WARREN TO BELFAST BYPASS FEASIBILITY STUDY

US ROUTE 1 CORRIDOR

Prepared for

MAINE DEPARTMENT OF TRANSPORTATION

By

EDWARDS AND KELCEY

ENGINEERING
PLANNING
ENVIRONMENTAL
SERVICES

EDWARDS AND KELCEY, INC.
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March 6, 1973

Mr. David H. Stevens, Commissioner
Maine Department of Transportation
State House
Augusta, Maine 04330

Attention: Mr. Roger L. Mallar, Deputy Commissioner
Planning and Administration

Dear Commissioner Stevens:

In accordance with our agreement of July 26, 1972, we are pleased to submit this report with our findings and recommendations on the need and feasibility of improving traffic flow in the U.S. Route 1 corridor beginning in the vicinity of the intersection of U.S. Route 1 and State Route 90 in the Town of Warren and extending to the City of Belfast. In addition to assessing the traffic demand of the study area, this study considers regional socioeconomic factors, land use and the natural environment and the impact that such a bypass would have on these factors.

We appreciate the opportunity to have conducted this study and acknowledge with thanks the assistance given us by many members of your Department, other State agencies, and the municipalities involved.

Very truly yours,

EDWARDS AND KELCEY, INC.

Gordon L. Kirjassoff
Executive Vice-President

GLK/md

WARREN TO BELFAST BYPASS FEASIBILITY STUDY

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Prepared for

THE MAINE DEPARTMENT OF TRANSPORTATION

AUGUSTA, MAINE

By

EDWARDS AND KELCEY, INC., CONSULTANTS

BOSTON, MASSACHUSETTS

MAINE DEPARTMENT OF TRANSPORTATION

COMMISSIONER

David H. Stevens

DEPUTY COMMISSIONERS

Planning and Administration	Operations
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DIRECTOR, BUREAU OF TRANSPORTATION PLANNING AND SERVICES

Roger L. Mallar

ASSISTANT DIRECTOR, BUREAU OF TRANSPORTATION PLANNING AND SERVICES

Gedeon G. Picher

C O N T E N T S

LIST OF ILLUSTRATIONS

I. INTRODUCTION

In 1971, the State of Maine Legislature approved an Act instructing the then Maine State Highway Commission to make a feasibility study of the need and cost of improving by construction, reconstruction or relocation that portion of U.S. Route 1 between Warren and Belfast. This legislation is reproduced below.

STATE OF MAINE

IN THE YEAR OF OUR LORD NINETEEN HUNDRED SEVENTY-ONE

H.P. 1295—L.D. 1696

AN ACT PROVIDING FOR A FEASIBILITY STUDY FOR FUTURE HIGHWAY IMPROVEMENTS IN THE U.S. ROUTE 1 CORRIDOR FROM WARREN TO BELFAST.

Be it enacted by the People of the State of Maine, as follows:

Feasibility Study. The State Highway Commission shall make a feasibility study of the need and cost of improving by construction, reconstruction or relocation of that portion of U.S. Route 1 beginning in the vicinity of the intersection of U.S. Route 1 and State Route 90 in the Town of Warren and extending to the City of Belfast and shall report the results of the study to the next regular session of the Legislature.

STUDY AREA LOCUS

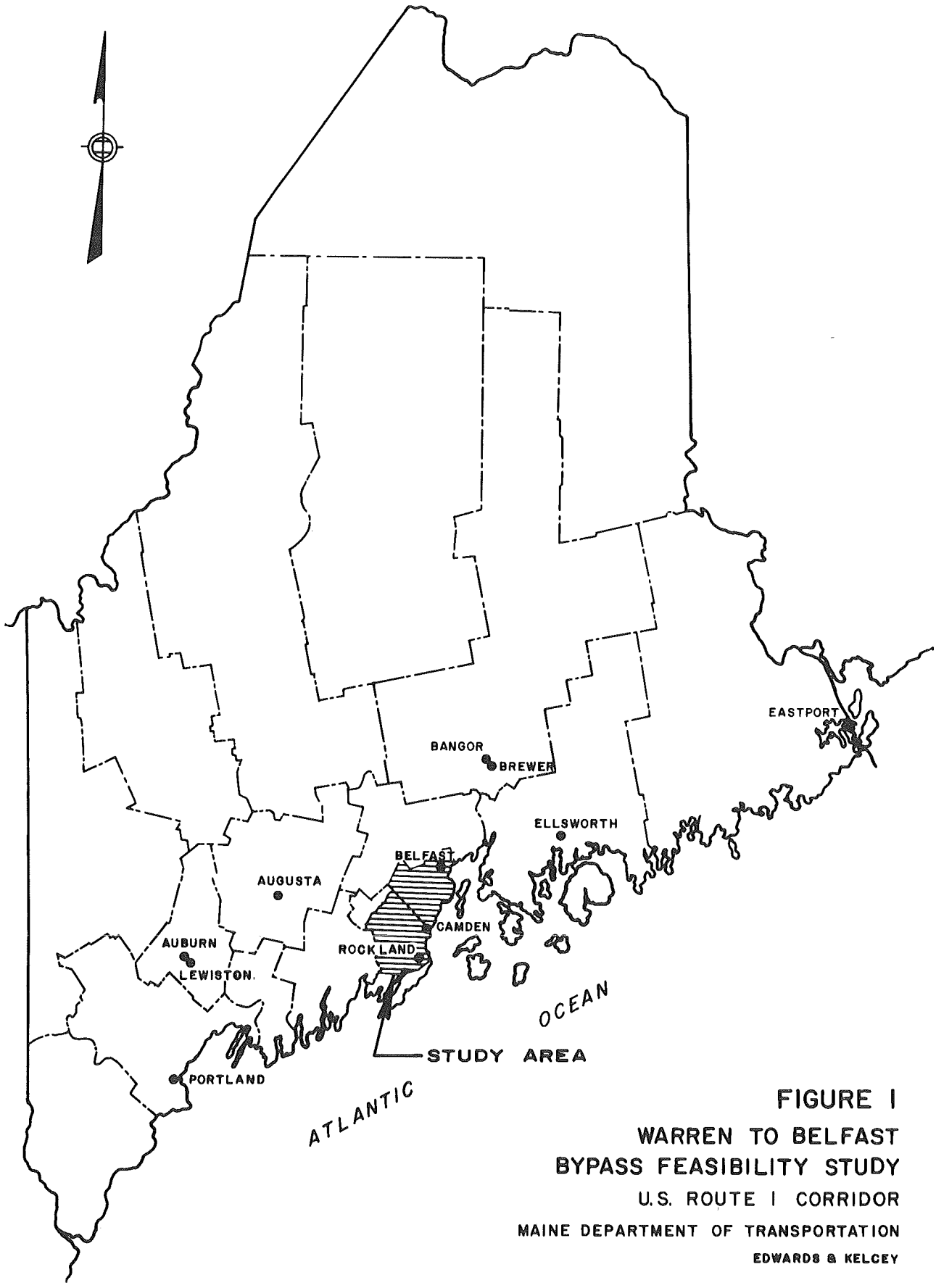

FIGURE I

WARREN TO BELFAST
BYPASS FEASIBILITY STUDY

U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

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This study directs itself to the determination of the feasibility of improving traffic flow in this corridor by the construction of a complete bypass of Route 1. Consideration was also given to reconstruction of existing routes and construction of short bypasses at selected locations.

Consideration was given to the effect that other transportation modes might have on highway travel through the Route 1 corridor, but no other modes are capable of economically serving the travel demands of the corridor to any significant extent.

Area economic and demographic factors, land use and environmental effects are carefully considered in addition to construction costs and user savings in developing a recommendation.

Figure 2, page 4, shows the study area and the bypass corridor selected for evaluation.

STUDY AREA AND BYPASS CORRIDOR

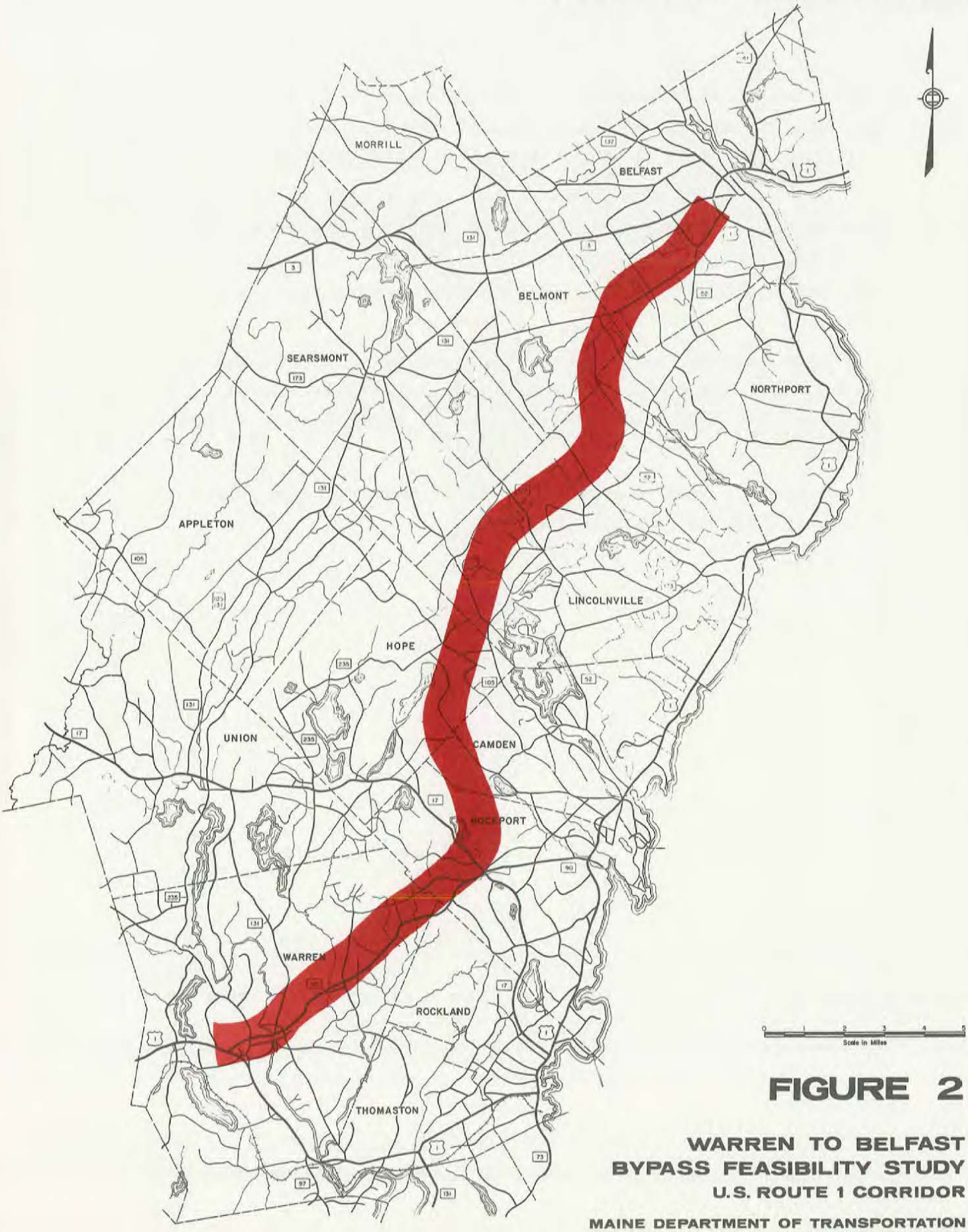

FIGURE 2

WARREN TO BELFAST BYPASS FEASIBILITY STUDY

U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

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SUMMARY OF CONCLUSIONS

The findings summarized below and detailed in the remainder of this report indicate:

(1) that an inland bypass if constructed in the immediate future would be underutilized and would not attract enough traffic from the existing Route 1 to relieve the congestion in Camden Village and at other locations,

(2) that operational improvements such as one-way street systems and parking adjustments are needed in Camden Village irrespective of other bypass considerations; these possibilities are receiving additional study,

(3) that Route 90 should be improved to modern secondary road standards and signed as Route 1 to indicate the most direct route for through traffic, thus providing Rockland and Thomaston the maximum possible relief from through traffic,

(4) that existing Route 1 should be signed as Business Route 1 to provide route continuity for travelers passing through Rockland and Thomaston to other destinations, and

(5) that further study of traffic flows resulting from the proposed changes to Route 90 should be conducted to determine with more confidence the future feasibility of an inland bypass.

It is generally concluded that: (1) failure to improve the highway facilities in the corridor will tend to have a stifling effect on the general economy of the area, (2) major highway construction or reconstruction in the narrow coastal

corridor between Camden and Lincolnville Beach could seriously impact this unique environment and can be expected to be unacceptable to a large segment of the community, and (3) an inland bypass of the coastal communities may be desirable within the next several years.

II. REGIONAL FACTORS AND DETERMINATION OF NEED

A. GENERAL

The study area shown on the Study Area Locus Map is located within the Midcoastal Planning and Development District (as defined by the Maine State Planning Office) and consists of thirteen communities—five in Knox County and eight in Waldo County. These communities, especially those which have frontage on the ocean, offer varied physical characteristics and scenic features of interest to tourists which have caused the study area to become one of Maine's prime vacation centers. The communities in the study area contain seventy-four (74) percent of the population of Knox County and thirty-seven (37) percent of Waldo County.

The area is primarily rural in character with the exception of the four coastal urban population and employment centers: the City of Belfast, the northernmost community in the study area; the Town of Camden at its approximate midpoint; the City of Rockland and the Town of Thomaston at its southerly end. Route 1 serves these centers and, together with the intervening coastal communities, is the economic focus of the study area. Communities in the interior section of the study area, many of which in 1970 had populations of under 1,000, are significantly dependent upon agriculture for the economic well-being of their residents.

Of primary importance to the area are the effects of improved traffic movement in the Route 1 Corridor on land use and socioeconomic considerations. Whatever solution is determined to be feasible from a traffic standpoint should also improve the quality of life of the residents, further the well-being of existing businesses and settlement patterns, and consider the overall growth philosophy of the

area as expressed through previous or current comprehensive planning efforts.

B. SOCIOECONOMIC

1. Regional Factors

As previously indicated, the study area includes the most populous portions of Knox and Waldo Counties. Over the 1950-1970 period, Knox County increased its population by only 3.2 percent. During this same period, its over-65 population has remained at 16 percent of its total population compared to the national ratio of 10 percent and the state ratio of 11 percent. This slow rate of growth coupled with the disportionate numbers of over-65 population indicates that Knox County is experiencing a significant outmigration of younger people and is consistent with the belief that the county is becoming one of the more popular retirement areas in Maine. Waldo County's population increased at a slightly greater rate of 7.6 percent over the twenty-year period and had a slight decline in the percentage of residents 65 and over.

Economic conditions in both counties are generally similar in that, even though the population has experienced a modest increase, very few job opportunities have become available. The manufacturing sector in Knox County, which is heavily dependent upon seafood processing, textiles, apparel and other small industries, has remained relatively unchanged while services and retail trade activities have grown. Waldo County has experienced industrial stagnation for a considerable period of time, but as with Knox County, non-manufacturing industries have assisted in offsetting somewhat this relative inactivity. Annual income and wages are low in both counties with about 40 percent of the households with annual incomes of less than $5,000 and, additionally in Waldo County, the effective buying power is about $1,500 below the state average. The number of retired

persons with adequate incomes and the popularity of Knox County and, to a lesser extent, Waldo County as vacation areas have provided seasonal employment and growth in retail sales which have helped to offset the lack of growth of the manufacturing sector.

2. Population

Table II-1 presents total population statistics for the communities in the study area and for Knox and Waldo Counties. The table shows that there were modest increases in population in most of the study area communities over the 1950 — 1960 decade with Belmont, Northport, Rockport and Warren exhibiting significant growth rates. Lincolnville, Rockland and Thomaston decreased slightly in population. In the 1960 — 1970 decade, however, over half of the communities decreased slightly in population while others gained slightly. The principal coastal cities of Belfast and Rockland decreased in population while the major coastal towns of Camden and Rockport increased. The decreased rate of growth in Camden compared to the previous decade may be the result of enforcement of community land use policy through zoning as well as a declining amount of available land. It should be noted that the decline in population in Rockland and Thomaston has been offset by the growth in neighboring Warren and Rockport. New growth areas appear to be emerging in the existing Route 1 corridor in those communities which have abundant vacant land, such as Lincolnville, Northport, Rockport and Warren. It is significant that estimates of peak seasonal population for 1970 in the study area communities show that most municipalities have the propensity to increase significantly during the peak tourist season and some, such as Appleton, Lincolnville and Northport, may increase by over 100 percent. Therefore, while the permanent population of the various study area communities has increased slightly, decreased slightly or remained essentially

Table II-1. POPULATION - WARREN/BELFAST STUDY AREA: 1950-1970

Community	1950	1960	Percent Change 1950-1960	1970	Percent Change 1960-1970	Est. 1970* Seasonal Population	Peak 1970* Seasonal Population
Knox County	28,121	28,575	1.6	29,013	1.5	17,234	46,247
Appleton	671	672	0.1	628	-6.6	879	1,507
Camden	3,670	3,988	8.7	4,115	3.2	3,462	7,577
Hope	504	525	4.2	500	-4.8	771	1,271
Rockland	9,234	8,769	-5.0	8,505	-3.0	1,330	9,835
Rockport	1,656	1,893	14.3	2,067	9.2	1,456	3,523
Thomaston	2,810	2,780	-1.1	2,646	-4.8	361	3,007
Union	1,085	1,196	10.2	1,189	-0.6	590	1,779
Warren	1,576	1,678	6.5	1,864	11.1	607	2,471
Subtotal	21,206	21,501	1.4	21,514	0.1	9,456	30,970
Waldo County	21,687	22,632	4.4	23,328	3.1	14,267	37,595
Belfast	5,960	6,140	3.0	5,957	-3.0	1,699	7,656
Belmont	258	295	14.3	349	18.3	55	404
Lincolnville	881	867	-1.6	955	10.2	2,029	2,984
Northport	574	648	12.9	744	14.8	1,821	2,565
Searsmont	558	628	12.5	624	-0.6	485	1,109
Subtotal	8,231	8,578	4.2	8,629	0.6	6,089	14,718
TOTAL	29,437	30,079	2.2	30,143	0.2	15,545	45,688

SOURCE: 1970 U.S. Census of Population

*Estimates of Peak Seasonal Population in Each Municipality in Maine, 1970. The Public Affairs Research Center of Bowdoin College, Brunswick, 1972.

unchanged over the twenty-year period, the seasonal influx of tourists and vacationers swells the study area's total population to the extent that it may increase by over 35 percent in the summer months. As a result, municipal services, retail establishments and other services catering to tourists exist in the study area in greater magnitude than the permanent population would require. The population changes, 1950-1970, are illustrated in Figure 3, page 12.

Age Structure. Table II-2 shows the percent age structure for Knox and Waldo Counties as it compares to the state.

Table II-2. PERCENT AGE STRUCTURE KNOX AND WALDO COUNTIES AND THE STATE—1960 AND 1970

	Knox County		Waldo County		Maine	
Age Group	1960	1970	1960	1970	1960	1970
Under 18	32.9	31.7	38.1	35.6	36.1	34.1
18 — 24	6.2	8.8	7.0	10.3	8.8	11.0
25 — 54	34.5	33.3	33.1	32.5	35.1	34.2
55 — 64	10.8	10.2	9.0	9.5	9.0	9.4
65 +	15.6	16.0	12.8	12.1	11.0	11.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: 1960 and 1970 U.S. Census of Population.

Knox County's under-18 population has remained less than that of the state both in 1960 and 1970. Waldo County, on the other hand, had a greater percentage of its population under 18 than did the state. The most significant factor, however, is that the percentage of the population between 18 and 24 and between 25 and 54 in both counties has remained consistently below the state in 1960 and 1970. Since it is this population which comprises the bulk of the labor force,

POPULATION CHANGE 1950–1970

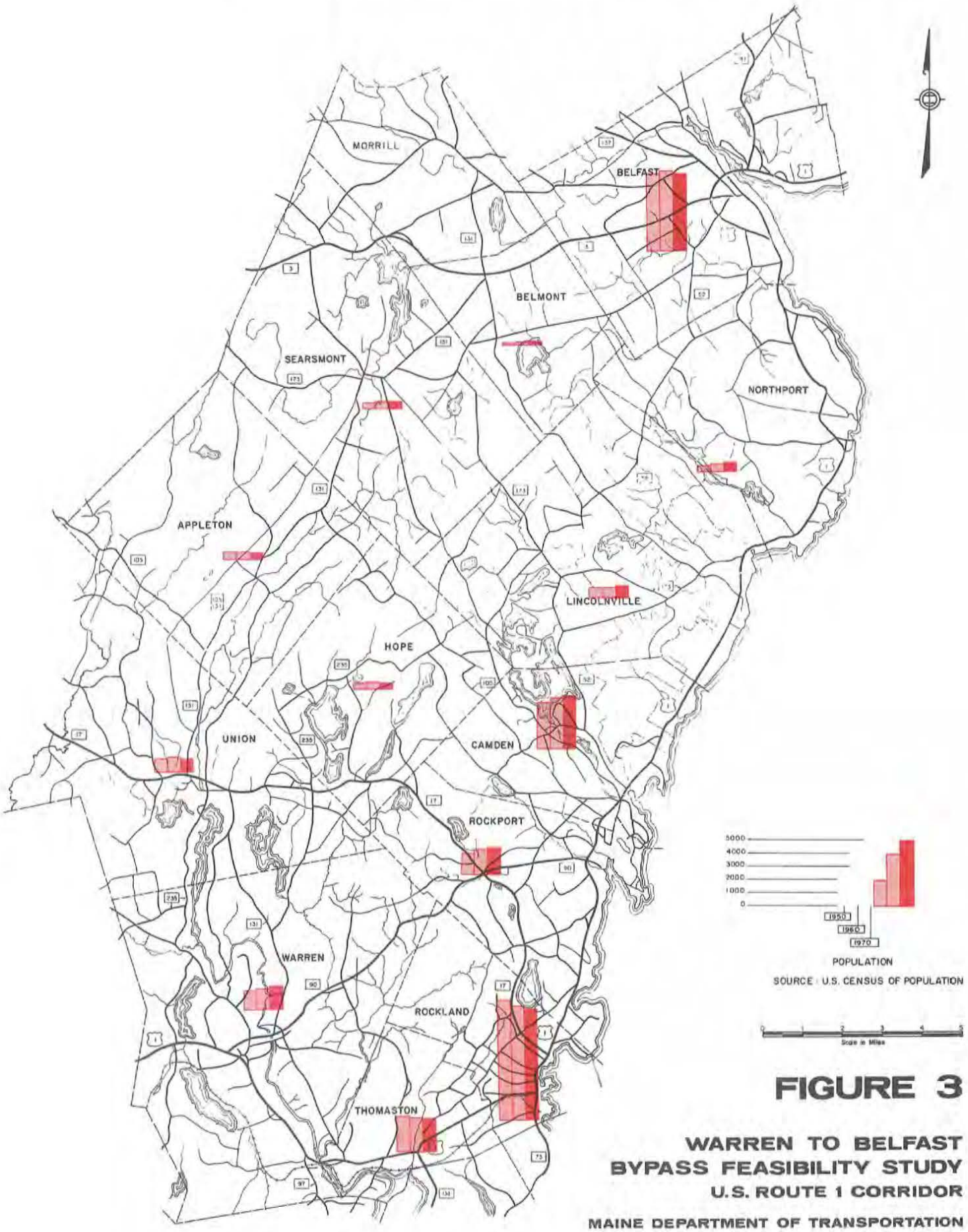

FIGURE 3

WARREN TO BELFAST BYPASS FEASIBILITY STUDY

U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

it seems apparent that outmigration to other areas in the state or out of state for employment is occurring and attests to the lack of economic growth in the counties previously discussed. At the same time, however, both counties had a greater percentage of their population 65 and over than did the state which is a further indication of the attractiveness of the counties for retirement, and the lower mobility of the older residents.

Population Projections. The Final Report of the Knox County Regional Comprehensive Plan estimated population to the year 2000 for Knox County and a preliminary report (Population Projections System for Maine, Public Affairs Research Center, Bowdoin College, June 1972) prepared for the Maine State Population Advisory Committee in 1972 projected population for all counties in the state. (Population projections for individual communities are currently being prepared by the Bowdoin College Public Affairs Research Center but are unavailable at this writing.) The following table presents a summary of population projections.

Table II-3. POPULATION PROJECTIONS

County	Actual 1970	Projected Population 1980	1990	2000
Knox	29,013	29,274* 29,348**	30,133* 29,813**	30,966* 29,860**
Waldo	23,328	23,705**	24,154**	24,009**

* 1969 Final Report of the Knox County Regional Comprehensive Plan.

** Public Affairs Research Center, Bowdoin College, 1972.

Although population projections for the communities in the study area (with the exception of Belfast, Camden and Rockland) are not available, it is assumed that, since both

counties are estimated to undergo only modest growth over the next three decades, the individual communities may be expected to contribute to their growth in a manner which reflects their previous growth trends. Slightly greater growth rates may be experienced in the coastal communities of Lincolnville, Northport, Rockport and Warren than in the more inland communities.

3. Economic Analysis

As previously implied, there is a parallel relationship between the economic and population characteristics in Knox and Waldo Counties. As economic emphasis has shifted away from manufacturing toward retail trade and services, a portion of the population has also shifted outward from the urban centers. Nonetheless, the people of the inland communities retain their ties to the economy of the principal employment centers of Belfast, Camden, Rockland and Thomaston since they serve as part of the labor force for economic activities in and around the centers. It should be recognized, however, that these communities also supply labor to some degree to the employment centers of Augusta, Bangor and Waterville. The rural, inner coastal areas also supply farm and timber products, which are the raw materials used by a number of manufacturing industries (e.g., lumber and wood products, food processing) in the coastal economic centers. These centers, together with their Route 1 link, are the economic foci of the study area for both employment and commercial activities as well as governmental services. The rural inland communities remain satellite to the centers supplying some raw materials and labor and are dependent upon them for goods and services.

Since Belfast, Camden, Rockland and Thomaston are the principal economic centers in the study area, as well as in Knox and Waldo Counties, a discussion of their respective

economic bases is appropriate. Belfast is the major employment center in Waldo County. Of the total product produced in Waldo County in 1970, over 80 percent of the dollar value is produced in Belfast, and over 76 percent of the county's manufacturing employees were employed there. Of the 572 workers in retail trade in Waldo County, about 68 percent are employed in Belfast and about 60 percent of the county's retail sales occur in Belfast. The three economic centers in Knox County collectively produced over 88 percent of the total product in Knox County and employed over 87 percent of the manufacturing employees. Rockland alone accounted for approximately 65 percent of the total product and employed over 58 percent of the manufacturing workers.[1] Retail trade has similar characteristics. Of the 1,190 workers in retail trade in Knox County, 57.7 percent were employed in Rockland and 21.4 percent in Camden (figures for Thomaston are not available). Rockland accounts for 54.4 percent and Camden 19.0 percent of the county's retail sales.[2] Although the previous figures were only available for 1967, discussions with and reports of the Rockland Area Chamber of Commerce indicate that in the "off-season" months Rockland accounts for 62 to 71 percent of the county's taxable retail sales. During the months of June through September, although its total sales nearly double, Rockland's share of the county total drops to about 56 percent. This is due to the seasonal operation of the many commercial uses along Route 1 outside of the city. Although statistics are not available to confirm it, it is suspected that Belfast may also experience a decline in its share of total sales during the summer tourist season.

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[1] Census of Maine Manufactures, Bulletin 480 (Augusta, Maine: Department of Labor and Industry, 1970).

[2] U.S. Department of Commerce, County Business Trends (Washington, D.C.: U.S. Government Printing Office, 1967).

The principal industries in the study area's economic centers are those which pay a lower wage scale as compared to other types of industries and as compared to the same industries found in other locations outside of the study area and the state. Belfast depends almost exclusively on the poultry industry, as demonstrated by the role of this industry in the city's tax base. In 1969, poultry processing plants accounted for 34.7 percent of the city's industrial valuation.[3] Also, supporting industries, such as feed and metal fabrication of poultry feeding equipment, all depend upon Belfast's emphasis on poultry production. Furthermore, other communities in Waldo County depend, in part, upon poultry farming and the processing facilities in Belfast for their economic viability.

Rockland's economy depends upon Knox County markets in retail and wholesale trade and, in addition, its manufacturing and fishing industries serve in the larger contexts of New England and national market influences.

Since tourism has traditionally been a significant factor in the economy of many of the study area communities, there follows a summary of points and observations contained in a recent report, The Economic Importance of Recreation Along the Maine Coast, February 1971. Although this report deals with the entire Maine coast, it does contain certain data relative to Knox and Waldo Counties which may be useful in estimating the role of tourism in the study area.

One of the most significant indicators of the economic role of tourism in a particular location is the portion of sales revenue paid out in payrolls, proprietor's income, property taxes and profits, since this money is most likely

[3]Environmental Consulting Group, Inc., Comprehensive Plan for the City of Belfast, Maine (Hanover, New Hampshire, 1971).

to benefit that community or area directly. Recreation-related establishments (e.g., antiques, sporting goods, liquor, restaurants, hotels and motels) account for most receipts of sales of tourist-oriented industries. The most significant general economic measures—residential facilities, recreational activities and commercial recreation sales as summarized by county in the report—indicate that the most active areas are York and Cumberland Counties. However, important to this analysis, the report indicates that within the last decade York and Knox Counties experienced the largest relative gains in retail sales and use of public parks and memorials.

In summary, the previously-mentioned study and taxable retail sales data of the Rockland Area Chamber of Commerce indicate that the economy of the study area is heavily reinforced by the retail sales associated with tourism and the supporting activities which relate to it. Route 1 and the population centers are the foci of this economic activity—Route 1 depending primarily upon the volume of tourist traffic, and the centers upon their attractiveness as places to visit or the diversity of goods and services found in them.

C. LAND USE

1. General

Figure 4 depicts the manner in which the land is currently being used in the study area. The uses are shown in a generalized way and represent the predominant, existing use in a given area so that it is possible to understand the functional relationships between geographical areas.

Land uses have been categorized using the following notation system: Residential, Seasonal Residential, Town Center, Employment Center, Highway Commercial, Recreation/Conservation, Public Land, Transportation and Agriculture. As

GENERALIZED LAND USE

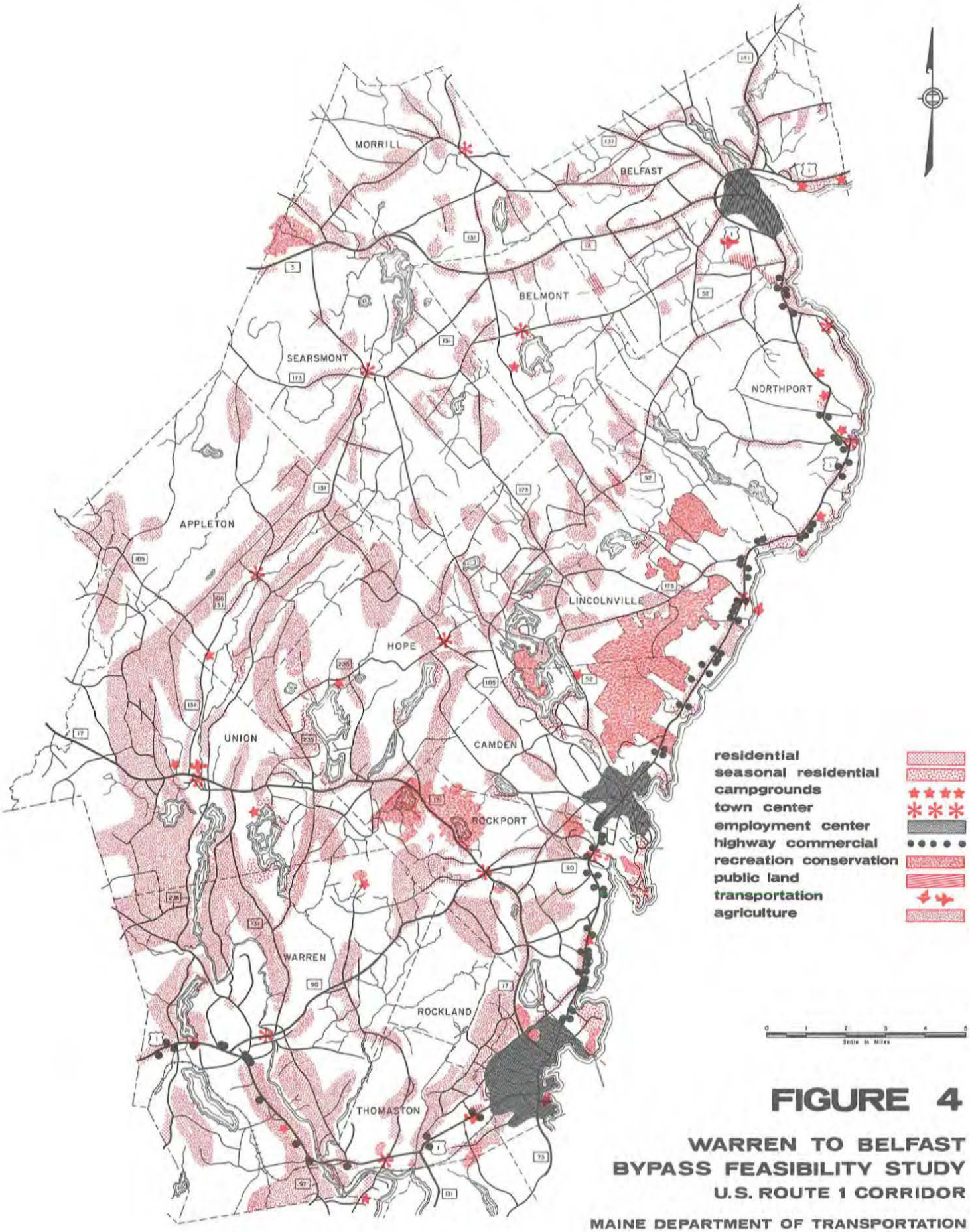

FIGURE 4

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

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previously indicated, the study area is primarily rural in character with the majority of the land being either forests of open fields. Agriculture is the predominant use in the rural inland areas, with other more intensive uses becoming more apparent along the coast.

2. Existing Land Use

Residential and Seasonal Residential. Residential density in the study area generally follows its overall development pattern. In the inland rural areas residences are almost exclusively single-family dwellings on large lots at a very low density scattered throughout the area. There are a small number of two- and three-family residences concentrated in the town centers. In the easterly section of the study area the density increases somewhat along the coast and becomes high in the immediate environs of the employment centers. Multi-family dwellings are numerous in Rockland and Belfast.

Seasonal dwellings are found in two areas: (1) in the inland communities primarily associated with the abundant fresh water lakes and ponds and (2) along the coast. The inland seasonal dwellings are primarily concentrated around the shorelines of Quantabacook Lake, Lake Megunticook, Sennebec Pond, Seven Tree Pond and Crawford Pond. Coastal, seasonal dwellings are found in significant numbers in Rockport, Camden, Lincolnville, Northport and Thomaston (as indicated in Table II-4). There are an estimated 1,500 seasonal housing units in the study area.

Campgrounds. Public and private campgrounds can be found in every community in the study area. According to the Estimates of Peak Seasonal Population in Maine, 1970, there are at least 680 camping sites in the study area with Appleton and Camden containing over 55 percent of the area's

Table II-4. SEASONAL RESIDENCES, COMMERCIAL LODGINGS CAMPGROUND SITES BY COMMUNITY—1970

Community	Seasonal and Migratory Housing Units	Commercial Lodging Rooms	Campground Sites
Appleton	33	0	200
Belfast	79	225	67
Belmont	13	0	0
Camden	192	725	183
Hope	143	5	40
Lincolnville	319	145	0
Northport	337	94	42
Rockland	26	147	0
Searsmont	93	41	0
Thomaston	7	2	50
Union	110	3	10
Warren	57	2	70
Rockport	91	155	25
TOTAL	1500	1544	687

SOURCE: Estimates of Peak Seasonal Population in Each Municipality in Maine, 1970. The Public Affairs Research Center of Bowdoin College, Brunswick, Maine, February 1972.

camp sites (see Table II- 4). The approximate locations of the major campgrounds are indicated in Figure 4.

• Town Center. Figure 4 identifies the principal town centers in the study area. These centers range in size and complexity of uses from the built-up center of Thomaston to the more "village" type center found in Union. These village centers contain clusters of residential uses, religious

institutions, some community facilities and small, neighborhood retail and service establishments primarily serving the contiguous population.

• Employment Center. Employment centers, as discussed previously, are Belfast, Camden, Rockland and Thomaston. It is these centers that form the economic framework of the study area and contain the majority of employment opportunities. All centers depend significantly upon Route 1 for transportation of raw materials, manufactured products and labor supply.

• Highway Commercial Uses. Highway commercial uses between the coastal employment centers (i.e., those along Route 1 which depend upon a highway exposure for their economic viability) are indicated on Figure 4, page 18.

The predominant tourist-oriented uses along the highway are motel and tourist lodging facilities, restaurants and gasoline stations. A recent survey conducted for this study indicated 46 motel/tourist court uses, 25 restaurant/diner facilities and 21 gasoline stations located along Route 1. The survey also identified a number of retail uses which depend upon a highway exposure. These uses totaled 28 establishments dealing primarily in arts and crafts, antiques and gift items. Obviously, the employment centers contain similar uses which probably depend in part upon tourist trade. However, since the centers contain a significant year-round population and are in and of themselves tourist attractions, it is felt that they do not depend heavily upon impulse stopping of the through traffic, but rather upon through traffic with an intent to stop and shop in a particular center. It is interesting to note that few of the establishments cater heavily to children.

• Recreation/Conservation. The principal public recreation/conservation use in the study area is Camden Hills State Park, immediately north of Camden Center on Route 1. The park

contains approximately 5,000 acres of land for recreational purposes as well as about 125 camp sites.

• Public Land. The public land holdings most significant to this study are the small parcels under ownership of the Belfast Water District located in the western section of the city, north of Halls Corner Road and west of Jesse Robins Road, a portion of the watershed around the Belfast Reservoir northeast of Woods Road and the Rockport/Camden Water District land in Rockport.

• Transportation. Figure 4 identifies the ferry slips in the study area: one at Rockland providing state operated service to Vinalhaven and North Haven Islands and the second at Lincolnville providing service to Isleboro. Private ferry service is provided to Matinicus Island from Rockland.

The study area is also served by two municipal airports and two privately-owned landing fields for public use. Belfast Municipal Airport is located off the Route 1 bypass and the Knox County Regional Airport is in Owl's Head. The private fields are located in Thomaston and Union.

There are two railroad facilities in the study area: Knox County (principally Rockland, Thomaston and Warren) is served by a spur connection of the Maine Central Railroad; Belfast has a municipally-owned railroad service. These are used exclusively for freight transportation.

• Agriculture. Agricultural uses occur primarily in the inland communities of Union, Warren, Appleton, Hope, Belmont and Searsmont. The cultivation of blueberries, raising of poultry, and dairy farming are the principal activities.

3. Community Goals

Although not officially adopted, expressions of community goals, objectives and policies relative to physical and social

ideals were presented in the Knox County Plan, 1970 (eight communities in the county are contained within the study area). The 1971 Comprehensive Plan for the City of Belfast, Maine also recommends a series of goals and objectives for that city. The balance of the study area (i.e., that portion contained in Waldo County with the exception of Belfast) has had no recent comprehensive planning, and, therefore, no published community goals are available.

The goals, objectives and policies expressed in the Knox County Plan, 1970 are designed to provide an optimum natural, social and economic environment for the county as a whole, as well as its individual communities and their residents. The emphasis is on balanced growth of the region for the well-being of Knox County residents. Specifically the plan recommends protection of coastal areas, conservation and use of natural resources related to the aims of Knox County residents, a land use plan reflecting the long-term growth pattern of Knox County including transportation and natural resources, and "economic viability with full employment and planning development."[4]

The plan for Belfast seeks to alleviate the shortage of a diversified economic base which exists in that study area. It suggests that a goal of greater employment opportunity could be realized through planned growth in industrial and commercial uses, accompanied by the necessary growth in transportation and utility facilities. The plan calls for the creation of Belfast as the focal point of the region with a balance attained among industrial, commercial, agricultural, residential and recreational activities.[5]

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[4]Environmental Consulting Group, Inc. Knox County Plan, 1970 (Hanover, New Hampshire, 1970), p. 8A.

[5]Environmental Consulting Group, Inc. Comprehensive Plan for City of Belfast, Maine (Hanover, New Hampshire, 1971) pp. 9—11.

The above-stated goals suggest a continuation and strengthening of the study area's principal economic centers with respect to their role in providing additional commercial and industrial growth and increased employment. Improved transportation facilities and convenient access within and through the study area is also considered to be necessary to this growth.

4. Proposed Land Use

Future land use proposals have been prepared for eight of the communities in the study area as part of the Knox County Regional Planning Commission's planning efforts in 1969 and 1970. In addition, the 1971 Belfast comprehensive plan contained land use proposals for that community. The balance of the study area (i.e., that portion contained in Waldo County) has had no comprehensive planning accomplished to date.

The future land use proposals of these plans are an interpretation of the goals, objectives and policies discussed in these reports. For the portion of the study area in Knox County, the proposals suggest a concept for future development with Rockland continuing as the major commercial and employment center, reinforced by Camden and Thomaston. These centers are also recommended for high density residential uses consistent with an "urban core" designation. The town centers of Appleton, Hope, Union and Warren are proposed to be strengthened so as to provide focal points and a sense of identity within the region. Residential densities around these centers are recommended to be medium in their immediate vicinity followed by rural density and agricultural uses. A considerable amount of the area is recommended for protection as a land reserve because of marginal physical conditions which would preclude economic development and servicing.

The Belfast future land use proposals include land to be

used for rural, residential purposes west and south of the existing Route 1 bypass with public acquisition and/or protection of the Little River Watershed.

D. NATURAL ENVIRONMENT ANALYSIS

1. General

This section presents a general discussion of the various natural characteristics of the study area—landforms and topography, vegetation, wildlife and water—which constitute the area's natural environment. Included is a discussion of the evolution of the topography and landforms, of the flora which make up a northern hardwood forest and marketable products therein, of the wildlife which occur in the study area and the water bodies and drainage patterns.

2. Landforms and Topography

As shown on Figure 5, the study area is characterized by generally rolling topography with intermittant steep hills. From the narrow coastal strip, the land rises steeply to the Camden Hills (Mt. Megunticook, 1385 feet msl) in Camden and Lincolnville, Beech and Bird Hills (above 500 feet msl), Brenner Hill (618 feet msl) and Dodge Mountain (663 feet msl) in Rockland. It descends to valleys dominated by lakes and ponds (Megunticook Lake and Pitcher Pond), then it ascends again in the central region which is dominated by hills and mountains (Philbrick Mountain, 896 feet msl; Meadow Mountain, 635 feet msl; Hatchet Mountain, 1103 feet msl; Moody Mountain, 942 feet msl; Levenseller Mountain, 1048 feet msl; and Ragged Mountain, 1100 feet msl). The land slopes down to the St. George River Valley and rises again to the Appleton Ridge, which extends from Union to Searsmont. Beyond this are bogs and swamps, principally Cedar Swamp and Witcher Swamp. The land in this region remains between 200 and 300 feet msl, with

scattered hills above this plain. In the southwest and south central regions the land is more rolling and better drained, contributing to the agricultural productivity in this area. The area around Belfast is predominantly rolling with the valley of the Passagassawakeag River the dominant landform.

The principal natural features of the study area are hills and water—swamps, bogs, lakes and ponds. Drainage is erratic and sometimes very poor, demonstrating the effects of glaciation on the region. Large bogs exist in the western and northwestern parts of the study area. Much of the subsoil is glacial till, an unsorted mix of broken rock, sand and clay. The type of rock varies considerably and much of the bedrock is smooth and fresh, showing few signs of decay and weathering. Because of the rocky layer of till which overlies the land, much of New England and particularly Maine is unsuited to intensive agricultural cultivation except in some comparitively small areas. The valleys of the few major rivers—St. George, Oyster and Passagassawakeag—are the major agricultural regions.

3. Vegetation

The type of vegetation found in the study area and the density of growth reflect the use in the past as well as the present. The land has been cleared time and again for agricultural and logging purposes. The forests found now are in some stage of recovery, the species found representing a step in the succession of the forests to a mature stand.

The forests here consist primarily of northern hardwoods with some spruce and fir and, as is the case throughout much of New England, lacks any "virgin forest" cover. The species found and growth attained in any given area varies according to the soil quality, the available light, the amount of moisture and pattern of drainage and the climate.

PHYSIOGRAPHIC FEATURES

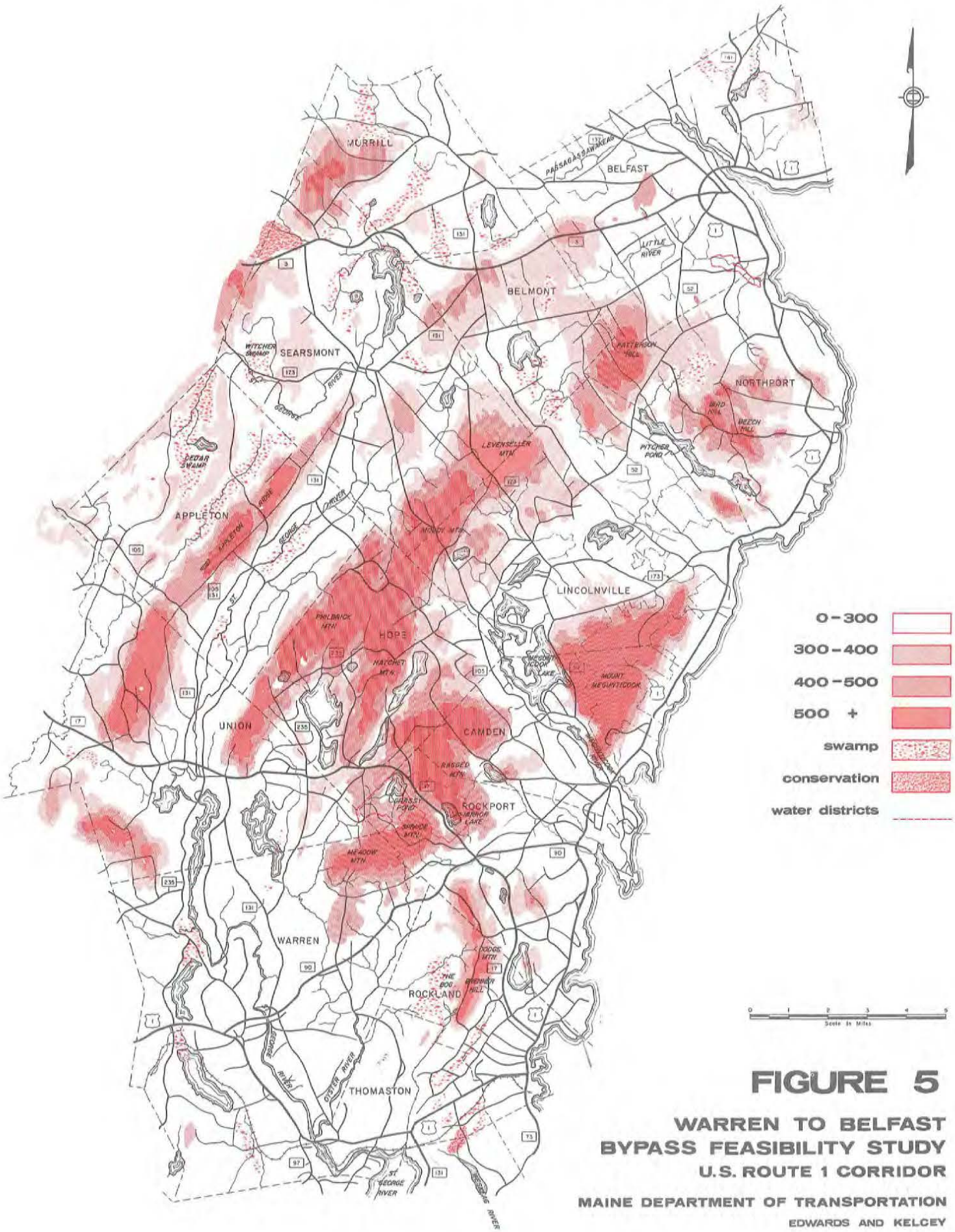


FIGURE 5

WARREN TO BELFAST BYPASS FEASIBILITY STUDY

U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

Spruce-fir stands are found on the higher mountain slopes, in cold boglands and along the cool, foggy coast. Often the forest floor is bare of dense vegetative cover due to inadequate light and the highly acidic soils caused by fallen needles. Roots do not extend deeply into the soil. This soil is highly erodable, especially after the forest cover has been cleared.

The lands beneath the spruce-fir stand are always infertile. The podzol soils develop in a cool, moist climate where the underlying glacial till is mostly granitic. The humus is acidic, and rainwater seeping through it becomes acidic also.

The study area is located in the zone of northern hardwood forests; thus birch, beech, maple—also spruce, hemlock, white pine—are the major vegetative covers. This type of growth is more open than the spruce-fir growth, allowing a variety of shrubs and plants to receive light to grow on the forest floor.

The woodland shrubs and herbs have an even more sporadic occurrence than the trees. Regional differences in climate (winter temperature and length of growing season) and local factors (light, moisture and soil acidity) determine the habitat.

The most important shrub in the study area is the blueberry. This plant grows in dry woodlands and is often found on the slopes of hills and mountains in acidic soil. Data found in the Knox County regional report, 1969 shows that in Knox County in 1964 there were 3,749 acres of land in blueberries, both wild and cultivated, which yielded 3,784,545 pounds at harvest.

The woodland boom which occurred in New England in the 1800's and man's disruption of the forest have had a profound

effect on the flora of the region. Widespread clearing for lumber or agricultural purposes wiped out whole populations of plants. Fires have also had a profound effect on the small, shallow-rooted shrubs and herbs.

The clearing of the land has in several cases allowed plants to thrive and move out of limited habitats into open land. As land has been abandoned and reverted again to forest, these are becoming rare again. The clearing has also contributed to the spread of pests—notably poison ivy. Man has also contributed to the flora of the region by importing, mostly from Europe, nearly one-fifth of the species found today. A few of these, such as devil's paintbrush, are pest weeds.

Specific tree species found in the study area in great quantity can be determined from data concerning logging practices. Principal trees planted include white pine, red pine, and Norway spruce. Christmas trees (balsam fir, scotch pine, spruce) are marketed in quantity. Softwood timber cut includes white pine, hemlock, spruce and cedar. Hardwood timber cut includes white birch, oak, hard maple, white ash, aspen poplar, beech and yellow birch.

At this writing the Maine State Planning Office is conducting inventories and analyses of Maine's coastal resources. Included in this report is an inventory of the vegetation of the coastal communities, both in cover and density. From this limited data, as now available in relation to the study area, it possible to make several statements concerning the vegetative cover of the area.

Many of the hills and steeper slopes are in blueberries, both wild and cultivated. The upper reaches of the hills are in hardwood, medium stocked and medium growth, or a combination of hard and softwood, young and medium growth both full and medium stocked. The predominant growth would appear to

be a combination of hard and softwood, with hardwood more abundant, medium growth and medium stocked. There are also a marked number of abandoned fields, some just fallow and some reverting to woodland.

4. Wildlife

The lakes, rivers, forests, open land and coast of the study area abound with wildlife, and most of the larger mammals found within this type of range could all conceivably occur here. White-tailed deer, fisher, fox, raccoon, beaver and muskrat all have ranges in this area. Sporadic appearances of moose, black bear and bobcat are also possible. Other mammals are porcupine, weasels, skunks, squirrels, rabbits, bats, shrews, moles and cricetid rats and mice. Common game birds include ring-necked pheasant, American woodcock, common snipe and 25 to 30 species of waterfowl, including Canada goose, ducks, common golden eye, teal, bufflehead, mergansers and common loon. In addition to these will be found the various species of non-game birds which can occur within this range.

There are about fifty different species of fish in the inland waters of Maine. The principal game fish include: landlocked and American salmon; brook and brown trout; American smelt; smallmouth and largemouth bass; white and yellow perch; chain pickerel; and brown bullhead. Not all of these occur within the study area, but habitats exist which would be suitable. Maine fisheries include the harvesting of shellfish such as lobster, shrimp, scallop, clam, crab and oyster. Ocean fish found off the coast of the study area include: cod, haddock, cusk, hake, pollack, ocean perch, whiting, flounder, herring, alewives, eel, mackerel, bluefin tuna, halibut and swordfish.

There are several nature conservancy areas and wildlife management areas in the study area which were established for

the preservation of unique vegetation and wildlife. Appleton Bog (84 acres) in Appleton, Fernald's Neck (270 acres) in Camden/Lincolnville, Meadow Mountain (281 acres) in Warren, the St. Clair Tract in Northport, and the Harkness Grant in Rockport are areas administered by the Nature Conservancy. Wildlife Management Areas administered by the Inland Fish and Game Department include Ruffingham Meadow State Game Management Area (610 acres) which projects into a portion of Searsmont and the Weskeag Marsh (180 acres) in Rockland.

5. Water

Water is the Maine coastal region's most important resource. Whether for marine harvesting, inland fish and game, or recreational purposes, both on the coast and on the lakes and ponds of the hinterland, the economy of the study area is closely tied to its water resources. The many lakes and ponds, and even more numerous swamps, reflect the glacial origin of the landforms of the region.

The largest swamps occur in the northwestern part of the study area in Appleton and Searsmont west of the Appleton Ridge. Cedar Swamp and Witcher Swamp both have streams which drain into the St. George River. Pettengill Stream has a large bog associated with it in this area which flows southwest out of the study area.

To the east and south of the Appleton Ridge, there are many small swamps and bogs, but none as extensive as those previously mentioned. Most of the small ones are associated with ponds, lakes, rivers and streams found in the study area.

The major rivers of the study area are listed below. The St. George River flows from Montville to Searsmont, turns south to the east of the Appleton Ridge and then flows in a southerly direction through Appleton, Union and Warren to the

tidal estuary in Thomaston. This is associated with the major agricultural regions of the study area. The St. George River broadens into a series of ponds in Union and Warren which have a great many seasonal residences, two campgrounds and numerous other recreational facilities.

The Oyster River originates in Mirror Lake in Rockport and flows in a southwesterly direction to join the St. George River in Thomaston. The Passagassawakeag River flows through the northern part of Belfast into Belfast Bay; Megunticook River flows into Camden Harbor; and Goose River flows into Rockport harbor.

The Camden and Rockland Water Company draws water from Grassy Pond and Mirror Lake to supply water to Camden, Rockland, Rockport and Thomaston. Union is also served by this company. Chickawaukie Pond also supplies some water to Rockland. The watersheds of Grassy Pond and Mirror Lake are protected, but the area around Chickawaukie Pond is not.

The only other urbanized area served by a public water utility is Belfast. Here there are two wells east of the city center and a reservoir fed by the Little River south of the city. The area immediately adjacent to the reservoir is protected, but the watershed of the Little River is not.

The rest of the communities in the study area are served by wells and septic tanks.

The many lakes and ponds found in the study area are, along with the seacoast, a major source of recreation for seasonal visitors to the region.

E. TRAFFIC

The traffic demand in Knox and Waldo Counties increases dramatically in the months of July and August—in many areas the demand is almost double that of the average month. Station No. 77 on Route 1 in Rockport is representative of traffic

conditions on Route 1 between Rockland and Camden. Figure 6, page 37, shows the monthly variation in traffic measured at that station in 1971. In July, the demand was 51.3 percent greater than the monthly average and in August, 63.3 percent greater than the monthly average. Approximately two-thirds of the daily traffic demand occurs between the hours of 10:00 A.M. and 6:00 P.M.—the peak demands occurring around noon and 4:30 and 5:30 P.M. The total vehicle trips for the average summer day using the existing highway network in 1971 are shown in Figure 8, page 39.

On the basis of July and August traffic interviews in the Route 1 corridor conducted by the State of Maine in 1971 at the six locations shown on the Highway Systems Map, Figure 7, page 38, traffic counts and related trip tables were developed to gain a better understanding of travel patterns within the study area. The trip tables were combined into thirteen districts or traffic zones shown in Figure 7 (page 38) for travel projections and traffic assignments. The trip tables do not include many local, intrazonal trips occurring in the area, but only those trips passing through the interview stations which were located to permit analysis primarily of Route 1 traffic which might bypass portions of the area if routes were available. The 1971 trip tables of interzonal trips are shown on page 34. These trip tables are displayed graphically as desire lines in Figures 9 and 10, pages 40 and 41.

Travel for 1995 was estimated by projecting the 1971 summer average weekday trips in accordance with historical traffic counts and socioeconomic trends. It was assumed that improvements necessary to increase capacity would be implemented along the roadways serving the study area; thus, no constraint was applied to the traffic growth developed for 1995. Figure 11, page 42 shows the projected 1995 average summer day vehicle trips on the existing network.

1971 TOTAL INTERZONAL TRIPS—AVERAGE SUMMER DAY														
Location	District	1	2	3	4	5	6	7	8	9	10	11	12	13
Belfast	1	--	--	--	200	--	24	172	10	5	--	25	20	152
Northport Lincolnville	2		--	4	821	27	98	243	21	4	21	13	102	466
North of Belfast	3			14	572	38	202	425	97	53	14	106	201	3046
Camden	4				164	75	911	2212	368	97	66	188	431	770
West of Northport	5					--	30	93	20	--	12	69	22	224
Rockport	6						170	988	154	11	18	62	105	359
Rockland	7							38	1324	720	611	2280	545	1798
So. Thomaston St. George	8								36	75	62	164	136	520
Warren	9									108	16	--	164	554
South of Warren	10										--	34	16	65
Thomaston	11											363	268	542
Northwest of Warren	12												21	203
Southwest of Warren	13						TOTAL 25,525							47

1995 Trip Table. Investigation of historical traffic counts along Route 1 within the study area and at selected count stations within the State of Maine indicated an average increase in traffic of approximately 6 percent per year. Population projections for the region, however, anticipate a very modest growth over the next three decades, as shown in Table II-3, page 13. This conflict led to the decision to develop

1995 TOTAL INTERZONAL TRIPS—AVERAGE SUMMER DAY														
Location	District	1	2	3	4	5	6	7	8	9	10	11	12	13
Belfast	1	--	--	--	296	--	36	255	22	7	--	37	68	517
Northport Lincolnville	2		--	6	1215	66	145	360	46	6	71	19	347	1584
North of Belfast	3			34	1258	93	444	935	237	117	48	233	683	10356
Camden	4				213	165	1348	3274	810	144	145	278	948	1694
West of Northport	5					--	66	205	49	--	29	152	54	547
Rockport	6						240	1462	339	16	40	92	231	790
Rockland	7							41	2913	1066	1344	3374	1199	3956
So. Thomaston St. George	8								83	165	151	361	332	1269
Warren	9									160	35	--	361	1219
South of Warren	10										--	75	39	159
Thomaston	11											537	590	1192
Northwest of Warren	12												27	495
Southwest of Warren	13							TOTAL 54,130						115

separate growth factors for each trip purpose or type of trip rather than apply one uniform factor to all trips.

The different types of travel represent internal or local trips—entirely within the study area; external or semi-local trips—one end within the study area; major through trips—both ends outside of the study area oriented in a north-south direction and other through trips—both ends outside of the study area oriented in a westerly direction. As shown below,

the trip purpose, grouped by work or recreation, varied considerably by type of travel. Only 10 percent of the north-south through trips are work trips, whereas 42 percent of the internal trips are work trips.

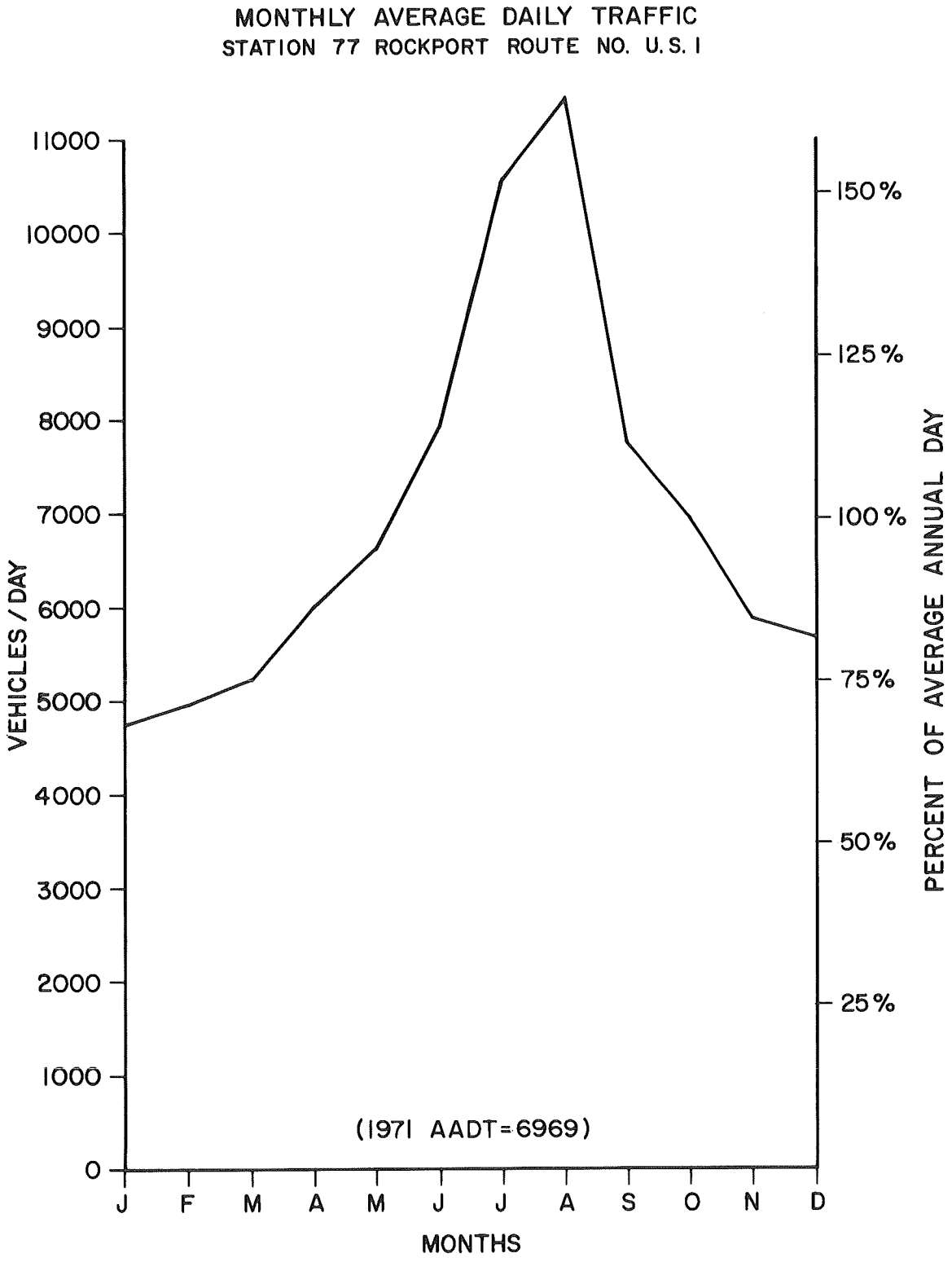
1971 TYPE OF TRIP BY TRIP PURPOSE					
Trip Purpose	Internal	External	N-S Thru	Other Thru	Total
Work	4211 (42%)	3580 (36%)	409 (10%)	336 (22%)	8536 (33%)
Recreational	5429 (54%)	5479 (55%)	3440 (86%)	1120 (72%)	15468 (61%)
Truck	392 (4 %)	864 (9 %)	173 (4 %)	92 (6 %)	1521 (6 %)
TOTAL TRIPS	10032 (100%)	9923 (100%)	4022 (100%)	1548 (100%)	25525 (100%)

Separate growth rates, increasing from 2 percent per year for internal trips to 10 percent per year for north-south through trips, were applied to the thirteen district 1971 trip table to estimate 1995 travel. A total of 54,130 trips are projected for 1995, representing an overall average trip growth of 4.7 percent per year.

The number of trips by trip purpose category for 1971 and 1995 are compared below, and the district interchanges projected for 1995 are shown in the following table.

NUMBER OF TRIPS BY TRIP PURPOSE CATEGORY		
Trip Purpose Category	1971 Trips	1995 Trips
Passenger Car—Work	8,536	16,322
Passenger Car—Non-Work	15,468	34,516
TOTAL PASSENGER CAR	24,004	50,838
Trucks	1,521	3,292
TOTAL VEHICLES	25,525	54,130

FIGURE 6


MONTHLY AVERAGE DAILY TRAFFIC
STATION 77 ROCKPORT ROUTE NO. U.S. I
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
VEHICLES / DAY
150%
125%
100%
75%
50%
25%
PERCENT OF AVERAGE ANNUAL DAY
(1971 AADT=6969)
J
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MONTHS

HIGHWAY SYSTEM MAP AND TRAFFIC ZONES

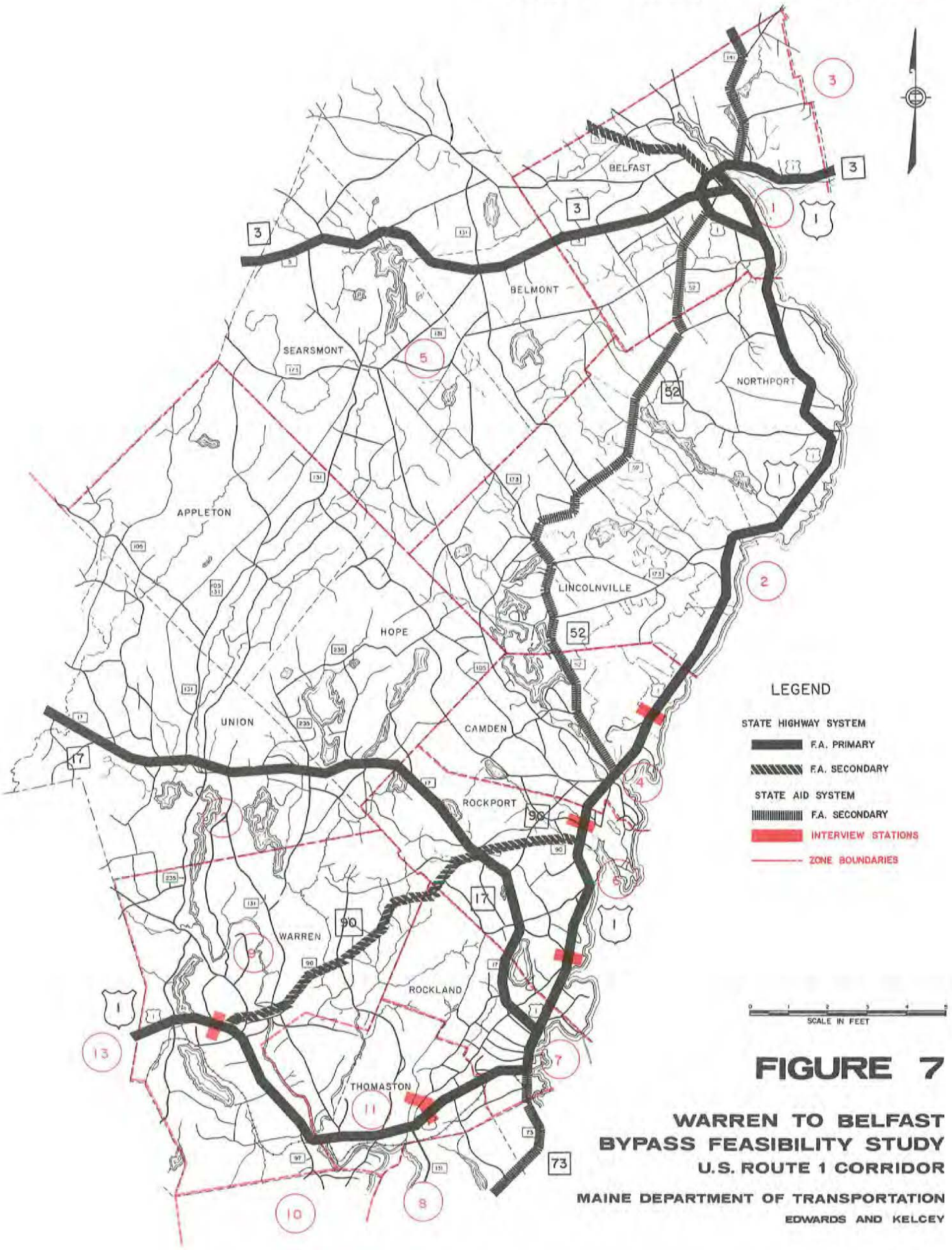

FIGURE 7

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

1971 AVERAGE SUMMER DAY VEHICLE TRIPS
EXISTING NETWORK

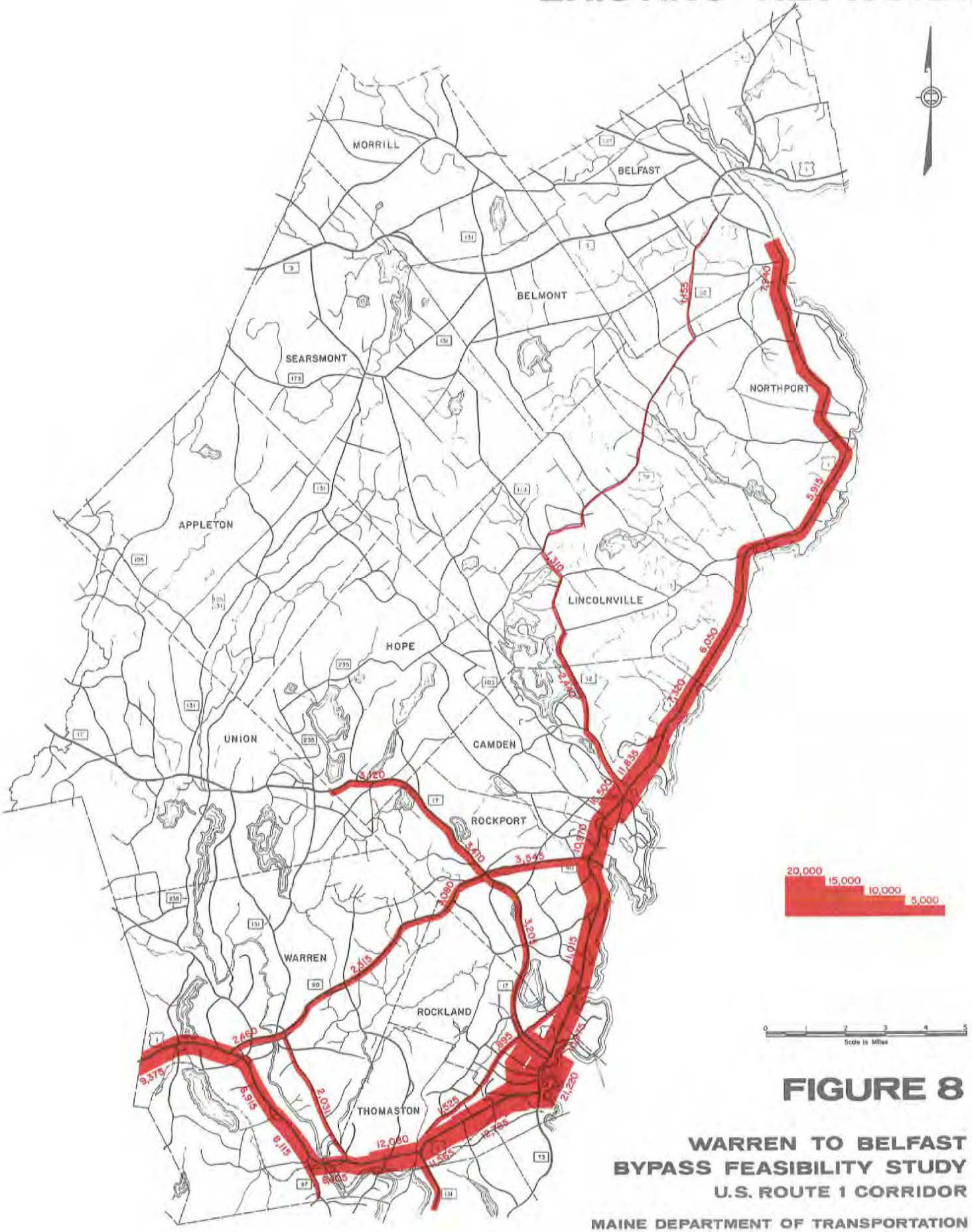

FIGURE 8

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

INTERNAL · EXTERNAL TRIPS
DESIRE LINES · 1971

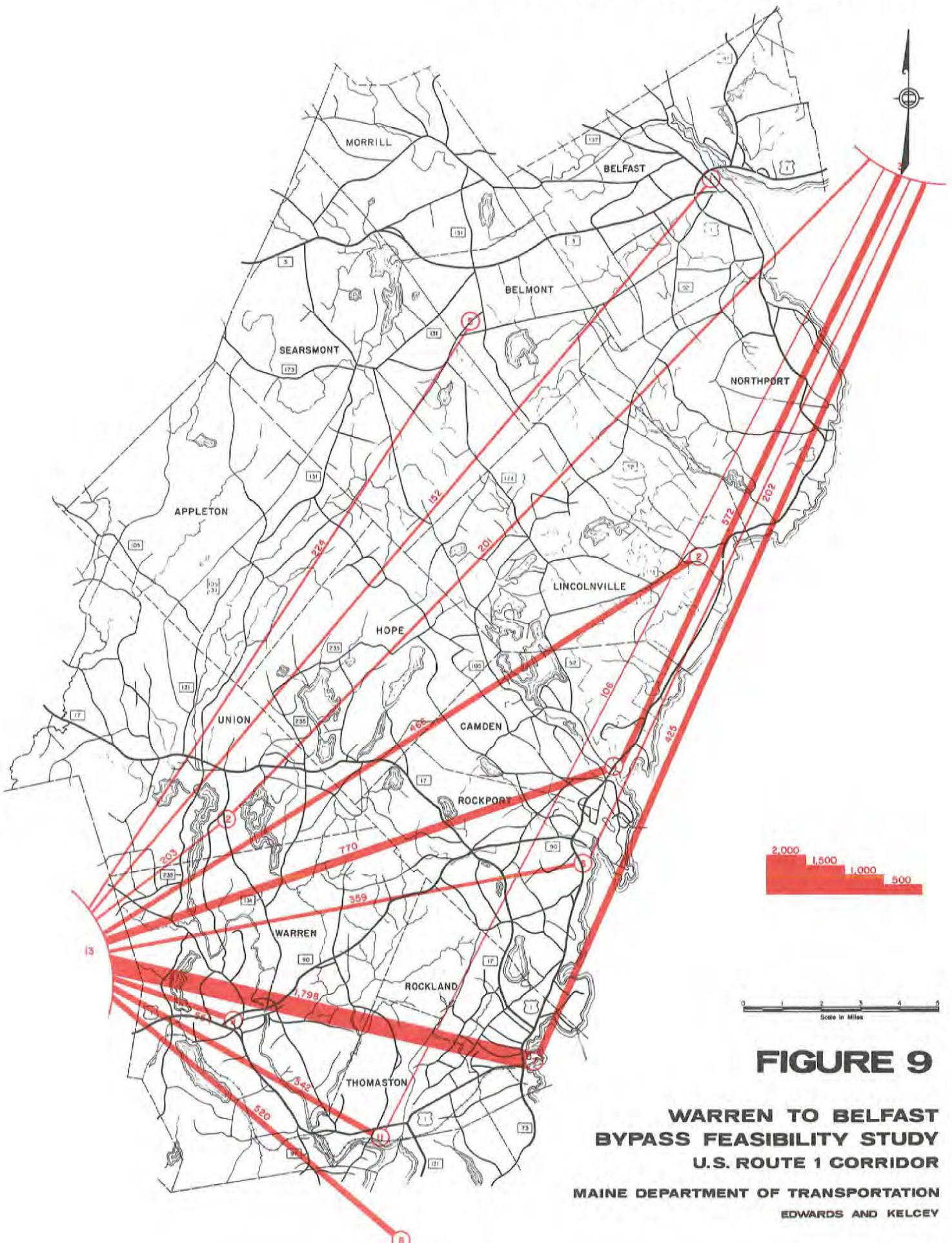

FIGURE 9

WARREN TO BELFAST
BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

INTERNAL · INTERZONAL TRIPS AND NORTH · SOUTH THROUGH TRIPS
DESIRE LINES · 1971

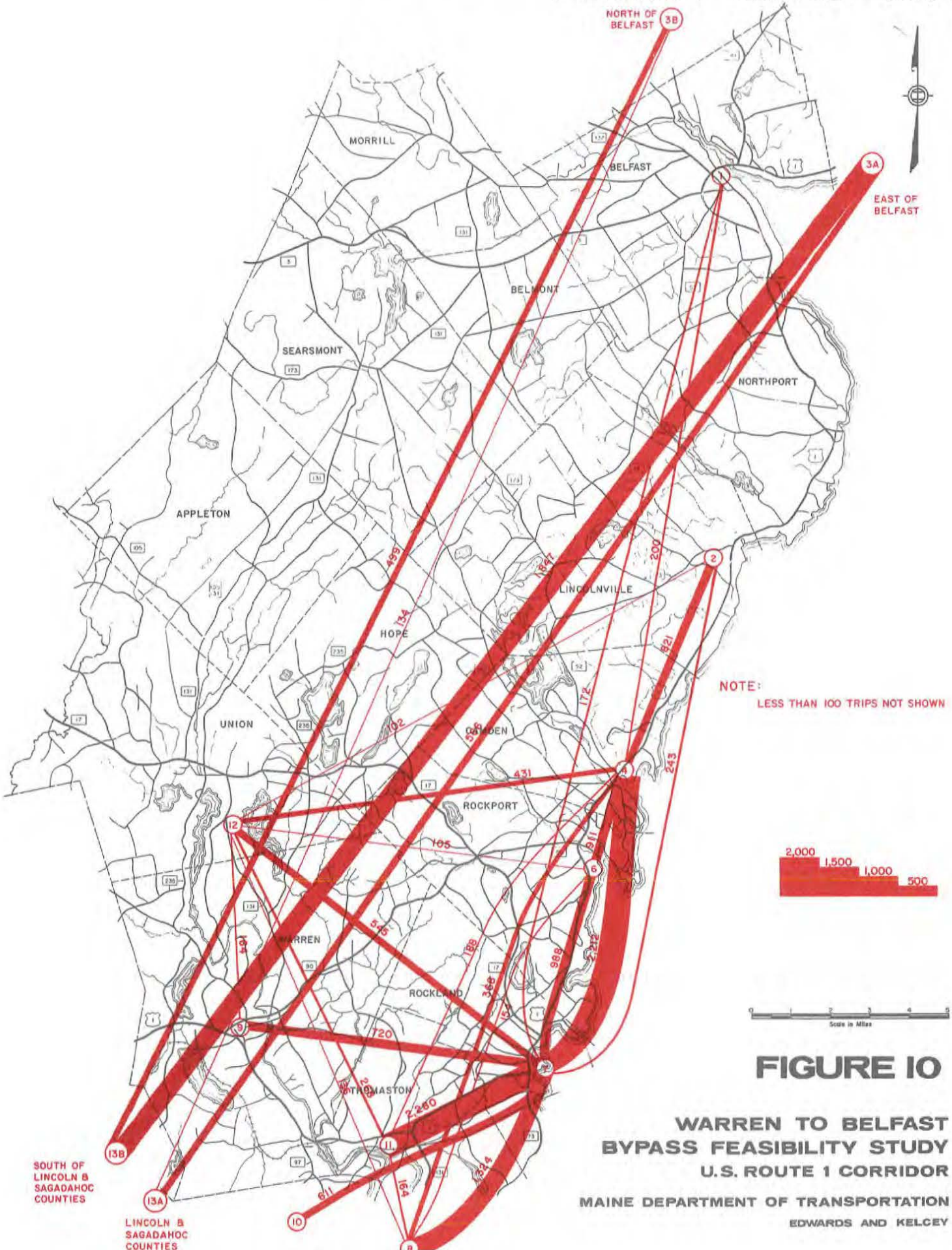

FIGURE 10

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

1995 AVERAGE SUMMER DAY VEHICLE TRIPS
EXISTING NETWORK

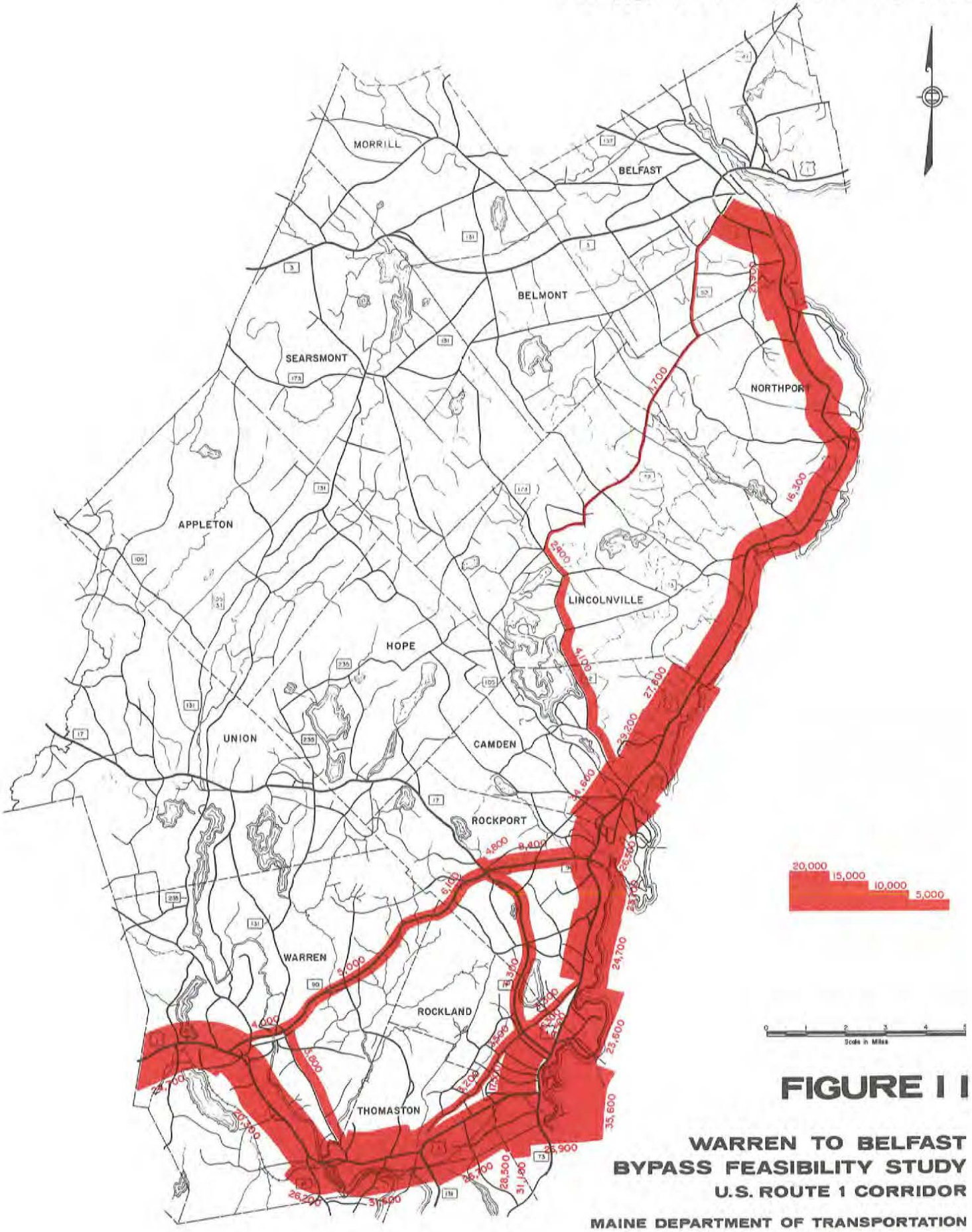

FIGURE I I

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

Figure 10, page 41, shows the projected average summer daily traffic including interzonal vehicle trips as assigned to the existing highway network for the year 1995. This assignment was made without regard for capacity restraints.

Existing Network. The network of roadways connecting Warren to Belfast and intermediate points, except in urban areas, carries two-way peak hour traffic volumes during summer months ranging from a low of approximately 150 vehicles per hour on Route 52 to a high of approximately 825 vehicles per hour between Rockport and Lincolnville. A "C" level of service (two-way volumes from 500—850 vph) defines the design capacities of roadways considered in this report.* A level of service in the upper "D" range (two-way volumes from 690—1,020 vph) is the point at which major improvements are generally required due to the occurrence of unacceptable periods of congestion.

It is evident that roadways outside of urban areas are now operating at volumes lower than capacity even in the summer season. Present roadway operating speeds range from a high of 56 mph on Route 90 to a low of 21 mph on Route 1 in the vicinity of the Camden-Rockport area. The average operating speed on Route 1 from Warren to Belfast is approximately 40 mph. Route 1 is the only major arterial roadway in the Warren to Belfast network that is nearing capacity. Large seasonal variations in traffic volumes are experienced on Route 1. There is up to an 80 percent increase in traffic volumes during the summer months. The effect of this heavy

*Stable flow is achieved at "C" level of service, but speeds and maneuverability are closely controlled by the traffic volume. Traffic operational freedom provided at a "D" level of service is restricted but generally flows smoothly. Selection of operating speed and passing opportunities are limited by increased volumes of traffic. Some congestion occurs at the design hour volume.

increase in traffic is especially evident on sections of Route 1 linking Belfast to Lincolnville and Lincolnville to Rockport.

The Belfast to Lincolnville link is approximately eleven miles in length, of which only about 35 percent provides sight distance sufficient for passing maneuvers. This section of Route 1 presently has the highest operating speed of any section on Route 1 between Warren and Belfast—yet, projecting the rate of summer volumes shown in Figures 9 and 10, pages 40 and 41, design capacity on this link will be reached by 1983.

The Lincolnville to Rockport link is approximately nine miles in length, of which only about 25 percent provides sight distances adequate for passing maneuvers. Operating speeds on this section vary from 21 mph for 2.2 miles to 44 mph for 6.8 miles. If volumes increase linearly to the projected 1995 summer values, capacity in the vicinity of Camden/Lincolnville town line will be reached by 1978. Traffic demand in Camden Village already exceeds capacity during the summer months.

Traffic in the Route 1 corridor has shown steady, continuous growth for over twenty years, and there is no reason to assume this would stop except for the limited capacity of Route 1 itself and the worsening of traffic congestion if additional capacity is not provided.

Considering the extent and intensity of commercial development along Route 1, any long-term, major improvements would be very expensive to construct, due to the necessity of acquiring right-of-way. Improvements within existing right-of-way would be less expensive but would not provide sufficient extra capacity in critical sections to meet the growing demands of summer traffic through the end of the decade.

Route 90 provides a viable bypass of the Thomaston-Rockland areas of the Route 1 corridor. For trips not destined for Rockland or Thomaston and vicinity, Route 90 provides a

nearly 30 percent shorter and 40 percent quicker route than Route 1. Route 90, however, has failed so far to attract the traffic which might be expected due to these savings.

Several factors help to account for this underutilization. Most of the traffic passing through the study area is recreational traffic on long trips[6]—i.e., over 100 miles—who are making the trip either for the first time or who make the trip very infrequently. These motorists are to a great extent dependent on road maps and advance signing for their route selection. On the Maine Official Transportation Map, Route 90 is not shown as a primary highway; on many gasoline company maps it is not shown as a principal through highway; and on many smaller scale United States road maps Route 90 is not even shown. Signing, while adequate for those looking for Route 90, does not provide enough advance information for many unfamiliar motorists to be diverted from Route 1 to the shorter bypass for their trips through the study area.

An analysis of interviewed trips for which Route 90 offered better service than Route 1 showed that more than half the trips between zones within the study area and between the study area and Sagadahoc and Lincoln Counties chose to use Route 90. Between areas further south and the study area only 26 percent of the traffic used Route 90. Only 10.6 percent of the longer north-south trips through the study area chose Route 90. This suggests that lack of familiarity with the area is one reason more traffic does not use Route 90.

However, examination of traffic volume trends in the vicinity of Route 90 indicates that the lack of familiarity is being overcome and that an increasing proportion of traffic is diverting from Route 1 to Route 90. Since 1965, average annual daily traffic volumes on Route 90 have increased

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[6] Camden-Rockport Traffic Assignment. Maine State Highway Commission, October 1966.

over 60 percent compared with a 27 percent increase on Route 17 and a 30 percent increase on Route 1 immediately west of the junction of Route 90 in Warren. Immediately east of the Route 90 junction on Route 1, traffic has grown only 5 percent—indicating that for the past six years a growing proportion of people have been choosing to take Route 90. As traffic and the associated congestion increase in the Rockland and Thomaston areas, this trend toward greater utilization of Route 90 is expected to continue.

To encourage greater use of Route 90 several measures could be taken:

(a) Improve the remaining portions of Route 90 to Federal-aid standards from Warren to Rockport to provide additional capacity.

(b) Sign Route 90 as Route 1 and existing Route 1 as Route 1 Business through Rockland and Thomaston to encourage through traffic use.

(c) On future Maine Official Transportation Maps show Route 90 in red as Route 1 to further encourage its use.

While the above improvements would reduce congestion due to through traffic in Rockland and Thomaston, all this traffic would still have to pass through Camden Village. Improvements in service through the constricted Camden area could be realized. Operational improvements, in conjunction with possible roadway construction of limited length, could bring about the optimum use of the existing roadway facilities. Studies to explore these possibilities are underway.

Building another highway facility to enable through traffic to bypass the Route 1 coastal corridor and thereby reduce congestion for those who wish to visit or conduct business in the coastal communities is a proposal which should be considered as a future planning goal.

F. SYNTHESIS

1. General

The previous inventory and analysis procedures conducted for the study area have provided a sound basis upon which certain decisions relative to the feasibility of a second transportation corridor can be made. These analyses have shown that, while the study area communities do not enjoy the level of economic viability found in other Maine communities to the south, the existing Route 1 corridor (i.e., the coastal communities traversed by Route 1 from Warren to Belfast) is the economic focus of the area. Route 1 functions as a transportation link between these communities for goods, services and labor as well as a "developmental" highway for tourist-oriented commercial uses. For this reason the comparatively stagnant economy is somewhat offset by the tourist-oriented and tourist-related commercial and industrial activities which have resulted in significant increases especially in retail sales over the past decade. It is the purpose of this section, therefore, to discuss the overall relationships which exist in the study area between the transportation function and various regional and community factors.

2. Regional and Town Relationships to the Transportation Function

The transportation function within the corridor is divided into two distinct types with respect to highways: (1) that which is related to the movement of goods and people through the corridor and (2) that which is related to the day-to-day needs and requirements of the residents of the study area.

The existing Route 1 corridor provides the major north-south link for the Warren-Belfast region between manufacturing and port facilities to the south in Portland and Bath and the entire coastal area. Additionally, the scenic qualities of the coast and the tourist-oriented developments associated

with it are significant economic factors in all coastal communities in the study area and beyond. Of importance to the study area in particular is the multi-purpose function of Route 1 in providing access between its major economic centers as well as its use by traffic which has its destination at some point outside the area and uses Route 1 for through trip purposes. This traffic, which is most heavy during the peak tourist season, when combined with local traffic has created difficult congestion conditions at a number of points. These points of congestion have, in all probability, contributed to the adverse economic conditions in the commercial centers, such as Rockland and Camden, to the extent that the Route 1 corridor is probably avoided by those who have alternate opportunities outside of the study area.

A bypass highway could relieve this congestion by the removal of through traffic from the commercial centers. In this way, the various scenic and historical coastal areas would not be cut off or go unnoticed by those who use the bypass, and traffic would be channelled into them in such a way as to minimize conflict with local traffic.

The various communities in the study area, on the other hand, have a close relationship to the transportation function within the corridor. The coastal communities especially depend upon Route 1 and its tourist-oriented development for tax revenue and its ability to carry tourist traffic to various points of interest within them, thereby stimulating their local economy. The more inland communities are less dependent upon Route 1 for north-south travel but are dependent upon the coastal economic and employment centers for goods, services and jobs. These centers have evolved to their current position of significance in the area because of their Route 1 linkage.

3. The Relationship of Through Traffic

As indicated by the socioeconomic analysis, the study area lacks a diversity in its employment base which is needed to sustain its labor force. Further, the existing industries do not provide as high a wage scale as is found in other more prosperous employment centers in the state. The development of Searsport as a major port facility and the encouragement of new industry in Rockland and Belfast which will capitalize upon available resources are thought to be needed to strengthen the area's economy and to provide a higher income level for its residents.

A major state and local commitment is needed to implement this policy, since the construction of a bypass alone will not create economic improvements. However, it can be assumed that economic promotion and planning will occur in concert with highway development.

It is difficult to speculate on the magnitude of additional employment potential in the region since it is closely tied to the particular type of industry involved and no growth trends are apparent. The types of industries outlined in the Knox County Regional Report and the Belfast Comprehensive Plan relate primarily to the Searsport harbor development and include various food processing plants, chemical plants, energy, textiles and fisheries, all of which could create a significant increase in employment. Once diverse employment opportunities are available, the historical trend of outmigration of young persons and families could reverse, thereby creating an increase in the demand for commercial and service uses and a more favorable climate within which the overall economic base and living standard could improve. A bypass facility, while not a panacea for the economic problems of the study area, could assist in its orderly economic and social growth. Of primary importance to the area's visual amenities and

environmental integrity, however, is to insure that this growth occurs consistent with sound land use practices in areas physically best suited for it and consistent with the Maine Coastal Development Plan currently being prepared by the Coastal Planning Unit of the Maine State Planning Office.

Of critical importance to the feasibility of a bypass is the impact that such a facility would have upon the existing commercial establishments located along Route 1. A study by the U.S. Chamber of Commerce has indicated a number of advantages to a bypass and generally concludes that, while a certain amount of tourist trade may be lost, a more favorable business climate in established business centers is generally created. Local streets with through traffic removed provide increased capacity for local traffic and results in an increase in local traffic. Further, the study indicates that real estate values tend to increase along the route and along the bypassed route as well, thereby stimulating the economic growth of the bypassed commercial centers. In general, the study indicates that the more stable businesses are benefited while those adversely affected are more marginal. According to this study, businessmen consider that the overall benefit to the community outweighs a loss in a certain amount of trade.

A bypass in the study area will certainly avoid urban areas where the removal of through traffic is likely to have a significant positive economic effect. Businesses along Route 1 between built-up areas, however, create a somewhat different situation. If Route 1 were to be upgraded and improved generally on its present location to a limited access facility to accommodate projected traffic volumes, access to the frontage commercial development would be restricted resulting in inconvenience to the businesses. A bypass outside of the immediate Route 1 corridor but with access points at

appropriate locations would enable traffic which desired to enter the existing Route 1 area to do so in a more organized manner, and its separation from through traffic would enable a much more orderly driving condition along Route 1 which would benefit the commercial uses. At the same time, some through traffic with spending propensity would be lost from Route 1 resulting in a potential loss to tourist-oriented businesses.

It must be remembered, however, that the study area is and will continue to be an attractive vacation area. Tourist traffic which uses Route 1 for its recreational qualities, scenic and otherwise, is likely to do so whether a bypass exists or not. Congestion is aggravated by the presence of traffic which has no desire to pass through the area or to make intermittant stops on its journey. The removal of this non-tourist through traffic by diverting it to a bypass would enable the amenities of the area to be appreciated in a more relaxed driving experience.

4. Relationship of the Transportation Corridor to Transportation Functions

Highways. The study area and other coastal communities north of Bath are served directly by Route 1. Links with Augusta to the west are provided by Route 17 and Route 3. Since Route 1 carries a significant amount of through traffic, traffic having its origin and/or destination between the extreme north-south points of the study area and local traffic between coastal focal points, it must function in a number of ways simultaneously.

The Maine Turnpike and Interstate 95 to the west provide convenient highway access from beyond Bath to Belfast and points north. However, the scenic qualities, and recreation and vacation facilities along the Maine coast and within the

study area are catalysts which draw traffic away from that corridor onto Route 1.

Except for the air, rail and ferry services described below, the area is dependent on the road system for transportation of persons and goods.

Airports. There are two municipal airports in the study area—Knox County Airport in Owl's Head about five-minute's drive south of Rockland center and Belfast Municipal Airport off the Route 1 Bypass west of the city's urban area. Knox County Airport is classified by the Federal Aviation Administration as a Secondary Feeder Airport and has scheduled passenger flights to Boston only. Belfast Municipal Airport has no scheduled passenger flights and is used for general aviation purposes only.

Knox County Airport is clearly the most important airport facility in the study area, although current studies indicate that within the airport's service area, which extends approximately from Belfast to Damariscotta and contains about 4.5 percent of Maine's population, only 2 percent of the state's passenger operations occur at Knox County Airport.*

It is concluded, therefore, that the development of a Route 1 bypass will have only secondary effects on the study area's principal airport. The highway and the airport may prove to be a stimulus to industrial growth. In any event, any likely bypass corridor has little relationship to the location of Knox County Airport and will have little effect on the Belfast Municipal Airport unless scheduled flights occur at that facility.

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*Airport Master Plan, Knox County Airport. Study in progress by Edwards and Kelcey.

Ferries. Two ferry operations exist in the study area—ferry service to Vinalhaven Island, North Haven and Matinicus Island out of Rockland harbor and service to Isleboro from Lincolnville. Since access to these ferries is provided via Route 1, a close relationship exists between Route 1 and this mode of transportation.

Railroads. Knox County is served by a spur connection with Brunswick by the Maine Central Railroad. Only Rockland, Thomaston and Warren are directly served for transport of cement, concrete products, feed, grain, fish meal and general merchandise. The volume of transported goods has not increased appreciably since growth has been restricted by a slow growth in permanent population and in the type of industry that generates a heavy amount of rail freight traffic. Passenger service has been totally discontinued, and there is no indication that it will be renewed.

In Belfast, however, a somewhat different circumstance prevails. The city is one of the few municipalities which operates a municipally-owned railroad service. The Belfast and Moosehead Lake Railroad provides service to the farming areas to the west, and the Belfast Comprehensive Plan suggests expansion of the facility for industrial, agricultural and tourist purposes.

While the operation of this rail facility is not intimately tied to the existing Route 1 corridor, the expansion of Belfast's industrial base and increased processing of agricultural products could result in expansion of the railroad, and a bypass to the south would provide an improved means of transporting processed goods to market areas.

III. CORRIDOR SELECTION

A. INTRODUCTION

Building another highway facility to bypass the Route 1 coastal corridor is a proposal which should be considered. This section focuses on three alternative corridor locations for such a facility: (1) a western alternate which extends northerly from the vicinity of the Route 90/Route 1 intersection in Warren, along the easterly side of the St. George River through Union and Appleton and northeasterly from that point through Searsmont and Belmont to the Route 1 bypass in Belfast, (2) a central alternate which originates in the same area as the western alternate in Warren and extends north and east through Union and Hope, joining and becoming common with the western alternate in the Moody Mountain area, and (3) an eastern alternate which also originates in the same vicinity in Warren as the previous two and extends northeast to Rockport easterly of the Mirror Lake watershed, north through Hope, easterly of Hobbs Pond through western Lincolnville, southeastern Belmont, becoming coincident with the previous alternates in the vicinity of Patterson Hill and also terminating at the Route 1 bypass in Belfast. These alternate corridors were determined primarily by the design requirements of an expressway as they relate to topographic constraints and geometrics, as well as a preliminary evaluation of environmental and socioeconomic factors identified in Chapter II. This chapter analyzes the three alternate corridor locations in terms of their relationship to environmentally sensitive areas, socioeconomic and land use factors and traffic considerations.

B. NATURAL ENVIRONMENTAL CONSIDERATIONS

Figure 12, page 56, shows the relationship between the alternate corridor locations and the study area's physiographic features. In addition to the seacoast, some of the

PHYSIOGRAPHIC FEATURES
CORRIDOR ALTERNATES

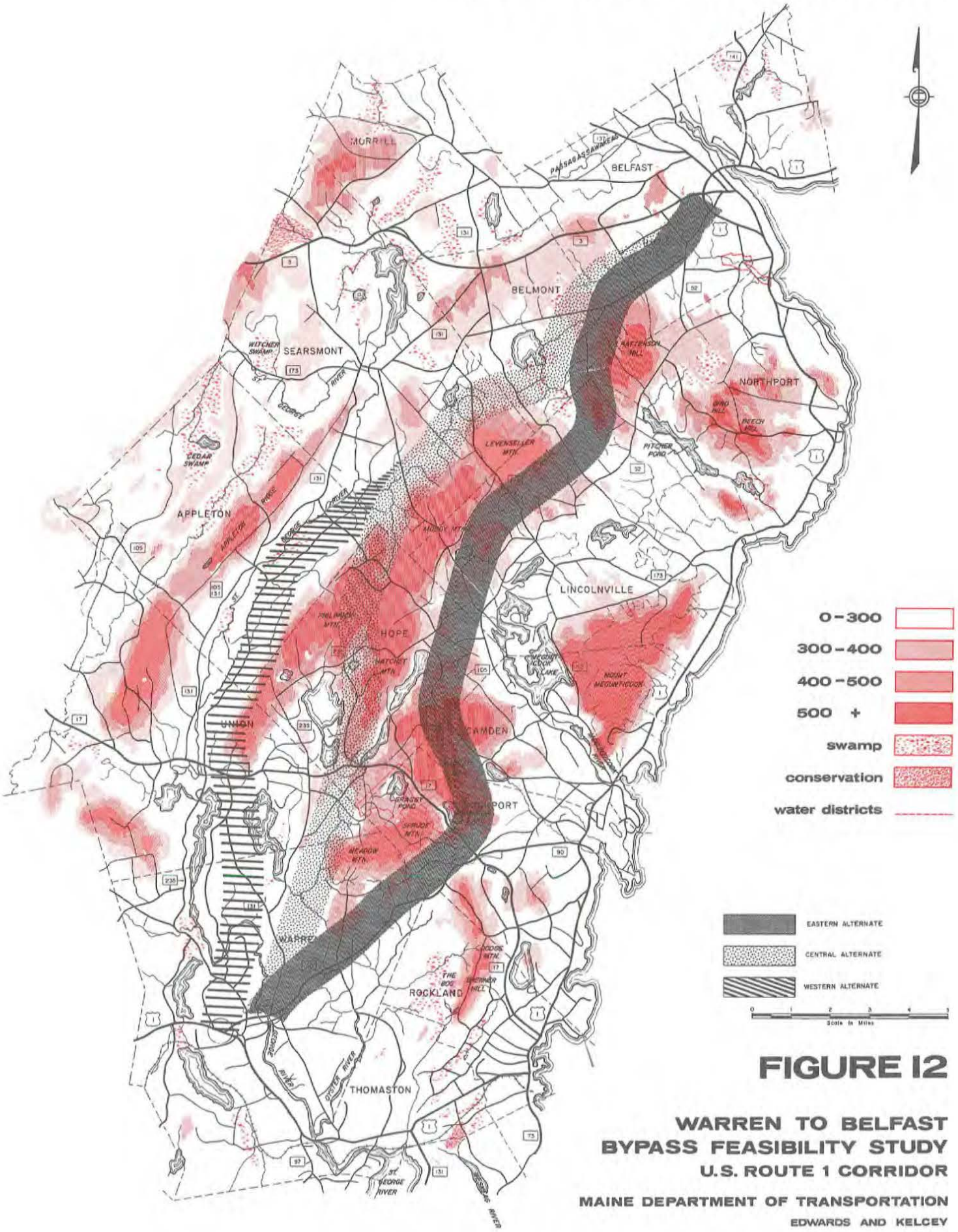

FIGURE 12

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

study area's most important natural features are its numerous inland water bodies and water courses consisting of many natural impoundments, river and stream networks and wetland areas. Many of these offer recreation, and a number of these natural storage areas are sources of municipal water supply for communities in the area. The coastal communities have a close physical and economic relationship with the ocean. For these reasons it could be said that water is the study area's most important resource in terms of its visual amenities, relationship to tourism, use for human consumption and indirect relationship to wildlife populations.

The western alternate traverses an area in the St. George River Valley which is relatively flat and is characterized by agricultural activities and forested land. As indicated previously, this corridor joins the central alternate about 15 miles northerly of its point of beginning at the Route 90/ Route 1 intersection in Warren. Along a northerly course it passes over the St. George River in Warren, between Seven Tree Pond and Crawford Pond in Union and along the easterly bank of the St. George River, joining the central alternate in southern Searsmont. While there appear to be no critically sensitive environmental areas associated with this alternate, the reach of the St. George River in Warren is an older, meandering section of the river and has a comparatively flat flood plain. The Georges River Canal, listed on the National Register of Historic Sites in Maine, follows the course of the St. George River through Knox and Waldo Counties. A highway crossing in this area should be accomplished so that the integrity of the river's flood plain is maintained and so as not to disrupt the geological characteristics of this mature reach of the river. Further north this alternate passes along the easterly side of Sennebec Pond through an area where the topography is more severe.

Since this corridor is located in the St. George watershed, which is characterized by many tributary streams and related ponds, highway construction should be accomplished so as to maintain the integrity of this drainage system. Although this corridor is characterized by open fields and some forested land which are upland game habitats, it is not felt that highway construction in this area would significantly affect wildlife populations or breeding habits.

The central alternate also crosses a mature reach of the St. George River southeast of the western alternate crossing. Appropriate construction methods should also be utilized here to maintain the integrity of the river and its watershed. Unlike the western alternate, this alternate traverses severe topography in central Hope in the vicinity of Philbrick and Hatchet Mountains and in Searsmont along the westerly slopes of Moody and Levenseller Mountains. While the visual qualities of the landscape could be appreciated from a highway in this location, it is essential that the complex system of drainage remain undisturbed and that highway runoff is appropriately carried off. Vegetation and wildlife populations would not be significantly affected by this corridor location.

An area of more environmental concern associated with this alternate is in the vicinity of the termination of the corridor at the Route 1 bypass in Belfast. Approximately four miles of the corridor is located within the watershed of the Belfast Reservoir and crosses the Little River drainage system in an area between Halls Corner Road and Tufts Road. The river flows directly into the reservoir and is formed by the confluence of a number of tributaries about a mile west of the reservoir and originating in the mountainous areas to the southwest. While highway construction in the headwater areas would not significantly affect the water quality of the reservoir because of the distance between it and the headwater

areas, the lowland areas in the vicinity of the tributary confluence point do not permit diversion of highway runoff away from the river. For this reason, additional care would be employed in the location of the route to insure that the water quality of the reservoir is not degraded.

The eastern alternate has its beginning at the same point on Route 1 in Warren as the previous alternates. It extends northeast northerly of and essentially parallel to Route 90 and follows the southeasterly slope of Meadow and Spruce Mountains to the vicinity east of the Mirror Lake watershed in Rockport. From this point it extends northerly through southwestern Camden into Hope easterly of Hobbs Pond. It then extends northeasterly into southwestern Lincolnville along the southeasterly slope of Moody and Levenseller Mountains, turns northerly west of Patterson Hill in Northport and joins the Route 1 bypass in Belfast at the same location as the previous alternates.

One of the more important environmental concerns associated with this alternate is the watershed around Mirror Lake and Grassy Pond, some of which is land under protection by the Camden and Rockland Water Company. Water is drawn from these reservoirs to supply portions of Camden, Rockland, Rockport and Thomaston. Although the entire watershed is not protected, there is substantial protected acreage south and east of Mirror Lake. The highway would be located outside of this watershed area. The only other sensitive environmental element associated with this alternate is the Belfast Reservoir and Little River area near the corridor terminus at the Route 1 bypass in Belfast. The same consideration should be given to highway construction in this corridor as is needed under the central alternate corridor.

In summary, therefore, there appear to be no significant environmental concerns associated with any of the three

alternates with respect to vegetation and wildlife. It should be noted, however, that standard engineering practices and design methods would be utilized to insure the proper handling of runoff.

The most significant environmental concern is related to the eastern alternate since two public water supply reservoir watersheds contain a portion of the corridor, whereas only one—the Little River watershed—is traversed by the other two alternates. There is sufficient latitude within the eastern alternate corridor to locate the highway outside the Mirror Lake surface watershed. Within the Belfast Reservoir watershed, however, highway runoff cannot be carried off outside of the watershed but would be handled to eliminate potential adverse harm from various roadway pollutants.

C. SOCIOECONOMIC AND LAND USE

Failure to do anything to facilitate the transportation needs of the expected traffic growth in the Route 1 corridor would soon result in intolerable traffic conditions and stifle the economies of the Route 1 communities. The traffic congestion would tend to destroy the very amenities which attract people to those communities.

The corridor between Camden Village and Lincolnville Beach is the most critical in the route between Warren and Belfast. Congestion here is the most severe, and solutions are the most complex, due to topographic, social and economic features of the area. Several methods of relieving traffic congestion in this area are considered below.

• Widening Route 1. Improvements to the existing Route 1 would require, as a minimum, widening to four lanes to provide a tolerable level of service for long-range traffic growth. Such a facility would facilitate expanded strip development which would be detrimental to the coastal environment.

To provide the same amount of capacity in Camden Village as the four-lane at-grade improvement on other sections of Route 1 would necessitate fairly major circulation improvements in, or a bypass of, the Village, since simple widening is not feasible in this area. The environment of this unique cultural area would be affected, and this proposal appears costly in property damages and relocation of families and businesses.[7] A bypass would especially affect the neighborhood to the west of Camden Village.

• Developing a Bypass Within One-Half Mile West of Route 1. This facility, which could have restricted access, would remove much of the through traffic from existing Route 1 without seriously disrupting property on Route 1. However, this proposal would have the disadvantage of requiring a bypass of Camden Village to be constructed through the neighborhood to the west. North of the village its location is severly restricted by rugged terrain for about ten miles through Camden and Lincolnville. Under such a proposal this narrow corridor would be devoted primarily to the transportation function. This road could be most scenic; however, the commitment of this area to highway use is inappropriate if a reasonable alternative exists, including corridors west of the Camden Hills, since deleterious effects upon land use, the environment and socioeconomic factors could be expected to outweigh the anticipated user benefits. Existing Route 1 presently affords the driver a scenic view—albeit somewhat diminished by the proliferation of roadside businesses—and a new road of adequate capacity for the anticipated traffic could dominate the area, aesthetically changing it for the worse.

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[7] Comprehensive Plan for the Town of Camden, Maine, 1962. (Old Town, Maine: James W. Sewall Company, 1962).

• Developing a Bypass West of Camden Hills. A preliminary traffic analysis indicated that a bypass to the west of the Camden Hills might be feasible. Any bypass that would attract sufficient traffic would leave Route 1 with adequate excess capacity outside the urban areas to service abutting properties through the 1980's. To be sure, traffic congestion would not be entirely eliminated; however, congestion would be largely abated, since the traffic remaining would be that which had a desire to be there, whether for shopping or sightseeing.

One such bypass envisions utilizing existing Routes 90, 105 and 52 alinements, improving these roads to accommodate projected traffic and constructing a connecting road between these routes in a new location in the westerly parts of Rockport and Camden. Existing Route 90 would appear to be adequate for an interim period. Routes 105 and 52 traverse highly desirable but sparsely developed recreational and residential countryside. Although this alternative appears to be quite attractive, it has detrimental side effects to recommend against its adoption if other options are feasible. A high percentage of the existing development lies along these routes; thus, local access would have to be maintained, or the relocation of a number of homes and some businesses would be required. The lack of access control would, with any substantial roadside development, result in future loss of highway capacity and safety. Further, the construction and right-of-way acquisition costs needed to raise the standards of Route 105 and sections of Routes 90 and 52 to adequate levels for high-speed through traffic would be significant and would approach the cost of construction on a new location in many areas.

Because of these disadvantages, it was decided that the feasibility of constructing an express highway entirely on a new location should be tested.

GENERALIZED LAND USE CORRIDOR ALTERNATES

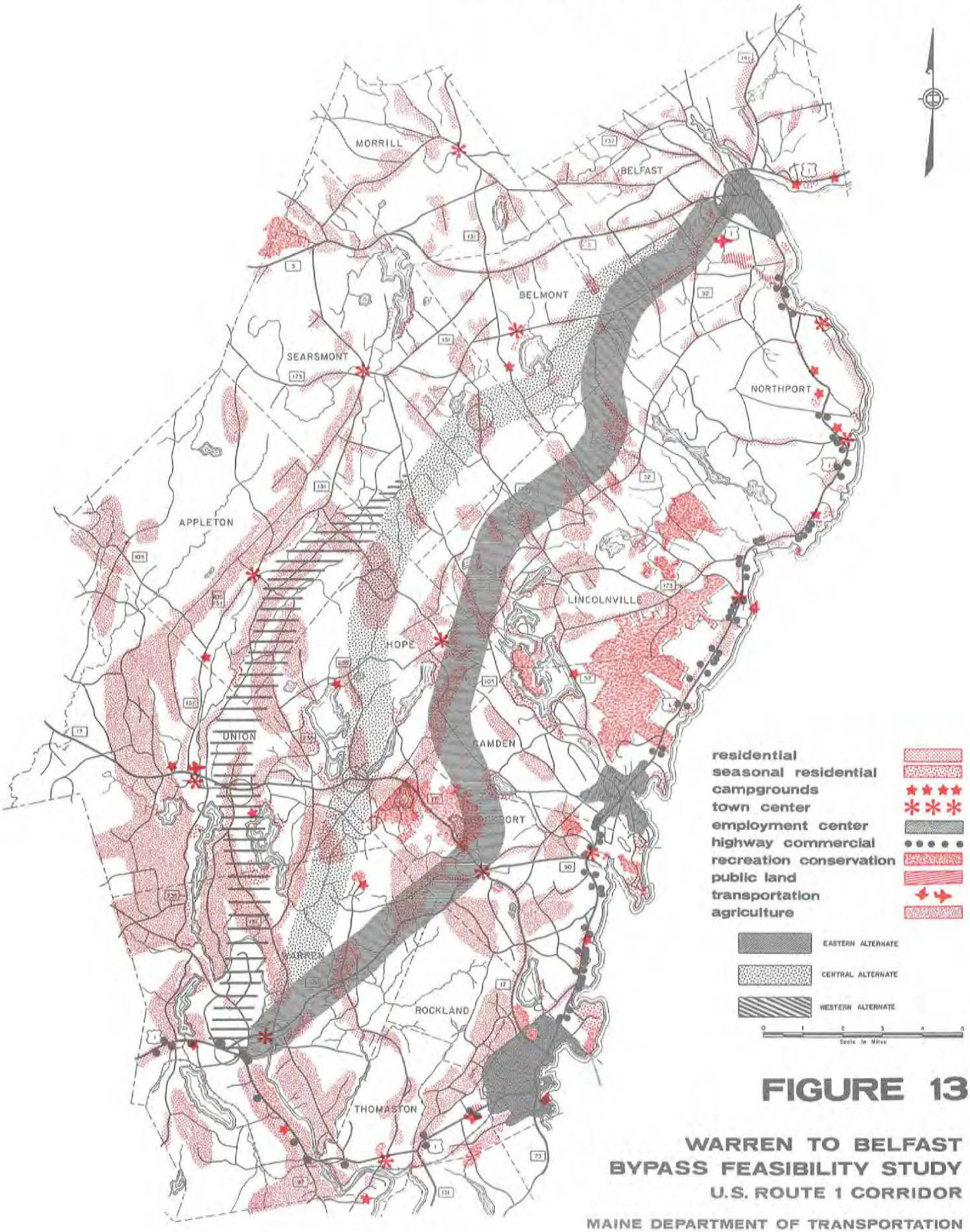

FIGURE 13

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

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EDWARDS AND KELCEY

Figure 13 shows three alternative express highway corridor locations as they relate to the study area's existing land use patterns. The western alternate would involve the least number of residential displacements and would not remove an extensive amount of agricultural land from production. However, it is possible that the visual quality of Union and Appleton centers may be adversely affected by the introduction of such a permanent cultural feature as an expressway.

The central alternate is more desirable than the western alternate since a route could be selected within it which would not displace as many residences. However, the fact that it is not physically as close to the existing Route 1 corridor makes it less desirable than a more easterly location.

The eastern alternate was selected for detailed evaluation as the most desirable, based upon the economic criterion of close relationship to existing Route 1 and acceptably low environmental effects. Certainly some residential displacements would result from highway construction in this corridor and, as indicated in the previous section, appropriate solutions must be developed in relation to the highway's orientation to reservoirs as well as to bodies of water and natural drainage systems. As an economic catalyst in the study area, however, this corridor optimizes the quick and efficient movement of traffic in and out of the coastal employment centers while, at the same time, carrying traffic through the study area with appreciable time and distance savings compared to the existing roads.

D. TRAFFIC

The western, central and eastern corridors would all provide shorter routes for traffic through the study area and relieve congestion in the Route 1 corridor. Of the three, only the eastern corridor, however, offers any direct service

to coastal communities in the study area in the form of shorter travel times between coastal communities and other communities in the study area (see Table III-1 below).

The central and western corridors would in 1975 serve less than 2,000 vehicles in the average summer day, whereas the eastern corridor might serve between 3,200 and 3,300, depending upon the type of facility built.

Since all three corridors are approximately the same with regard to environmental impact and the eastern corridor offers better possibilities for serving traffic needs, the western and central corridors can, from a traffic and socio-economic viewpoint, be rejected.

Table III-1. EFFECT OF EASTERN BYPASS ON TRAVEL TIME BETWEEN COMMUNITIES IN STUDY AREA*

	Current Trip Time on Existing Network (minutes)	Trip Time with Bypass (minutes)	Savings (percent)
Belfast to Warren	45	29	36
Belfast to Thomaston	47	40	15
Belfast to Rockland	42	30	29
Belfast to Rockport	31	26	16
Belfast to Camden	25	22	12
Warren to Rockport	15	13	13
Warren to Camden	21	19	10

*Where trip time comparisons are not shown, the bypass does not provide any time savings. Assuming operating speeds of 55 mph.

E. CORRIDOR SELECTION

The eastern corridor has the most to offer the study area. Being the closest to Route 1, it would offer the best traffic

service to the coastal communities and be most likely to promote desirable intensive development between the corridor and Route 1. While not having the least natural environmental effects, it has acceptably low environmental effects and, more than any other alternate, improves the accessibility of all regions with the study area.

IV. FEASIBILITY OF INLAND BYPASS

A. INTRODUCTION

This chapter analyzes the feasibility of constructing the major bypass highway postulated in the previous chapters. The three major aspects considered are:

(1) the comparison of direct road user benefits with construction and maintenance costs of the bypass facility;

(2) the regional socioeconomic effects; and

(3) the effects on the natural environment.

The road user benefit/cost relationship, while offering an objective quantitative criteria, is very sensitive to assumptions regarding traffic assignments and traffic growth. How these assumptions effect the benefit/cost relationship is explored. Due to data limitations, the environmental and socioeconomic effects are only treated qualitatively.

B. ROAD USER BENEFIT/COST ANALYSIS

1. General

The "benefits" considered here are only those accruing to the road user and do not include benefits to other elements of the economy as is sometimes done in benefit/cost analyses. The user benefits which are evaluated are also slightly understated since they do not include the value of the reduction in accidents which could be expected, due to the overall reduction in vehicle miles traveled with construction of any of the bypass alternates. Neither do the user benefits include savings to local traffic which would occur due to the reduction in congestion along Route 1.

The "costs" used in this analysis are the direct costs incurred by the general economy to provide the facility. The gasoline tax is the primary means of collecting these funds.

2. Traffic Assignments

The volume of traffic assigned to the bypass is highly dependent on the type of facility proposed. Three types of facilities were considered:

(1) A four-lane divided freeway, similar to Interstate Route 95, with grade separating structures at all intersections which could have free-running speeds[8] of 66 mph for passenger cars and 57.9 mph for trucks. This is called Alternate A.

(2) A two-lane rural highway on limited access right-of-way with climbing lanes and at grade intersections; this road would be designed for 70 mph which would provide average operating speeds[9] of 55 mph for passenger cars and 50 mph for trucks. This is called Alternate B.

(3) Alternate C would be a two-lane rural highway, similar to Alternate B, except that Route 90 from Route 17 to Route 1 would be used as the first section until 1980, after which time it is estimated the capacity of Route 90 could be approached. After 1980, Alternate C would be the same as Alternate B.

For the projected 1975 and 1995 interzonal traffic, trips originating and/or terminating in the study area and work trips through the study area were assigned to the bypass networks by use of the Bureau of Public Road's Time Ratio Diversion Curve. Based on existing experience on Route 90, 25 percent of the "non-work" trips through the study area were assigned to the bypass since it is probable that these motorists would, for the most part, continue to prefer the more interesting coastal route, with its opportunities for

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[8]Winfrey, p. 436.

[9]Ibid. p. 443.

intermediate meal and recreation stops, to the time savings of the inland bypass route. Traffic volumes for these diversion assumptions are shown for Alternate B in 1975 and 1995 in Figures 14 and 15, pages 70 and 71.

3. User Cost and Savings

Operating Costs. From speed and delay studies, field reconnaissance and topographic maps, each road in the network was classified as to average operating speed, grades, horizontal curvature and average number of stops required. Unit user costs for person hours by trip purpose and for vehicle miles by vehicle type have been estimated for the network conditions from authoritative sources, including Winfrey[10] and AASHO.[11]

Time Values. For work and business trips, the value of time saved was estimated to be equal to the average per capita wage rate prevailing in Maine projected to 1972 or $3.225 per hour per person.

The value selected for recreation or other non-work related time savings was $0.52 per hour per person based on the average rate at which people spend money.

The hourly value of truck and other commercial vehicle travel time used was $7.56 per hour saved.

The total annual network user costs for the existing network and the network with bypass Alternates A, B and C were computed for interzonal traffic both in 1975 and 1995.

4. Benefits

The savings accruing from 1975 through 1995 was calculated based on the assumption of a constant annual increase in user

[10] Ibid.

[11] Road User Benefit Analysis for Highway Improvements. Washington, D.C., 1960.

1975 AVERAGE SUMMER DAY VEHICLE TRIPS
NETWORK WITH BYPASS ALTERNATE B

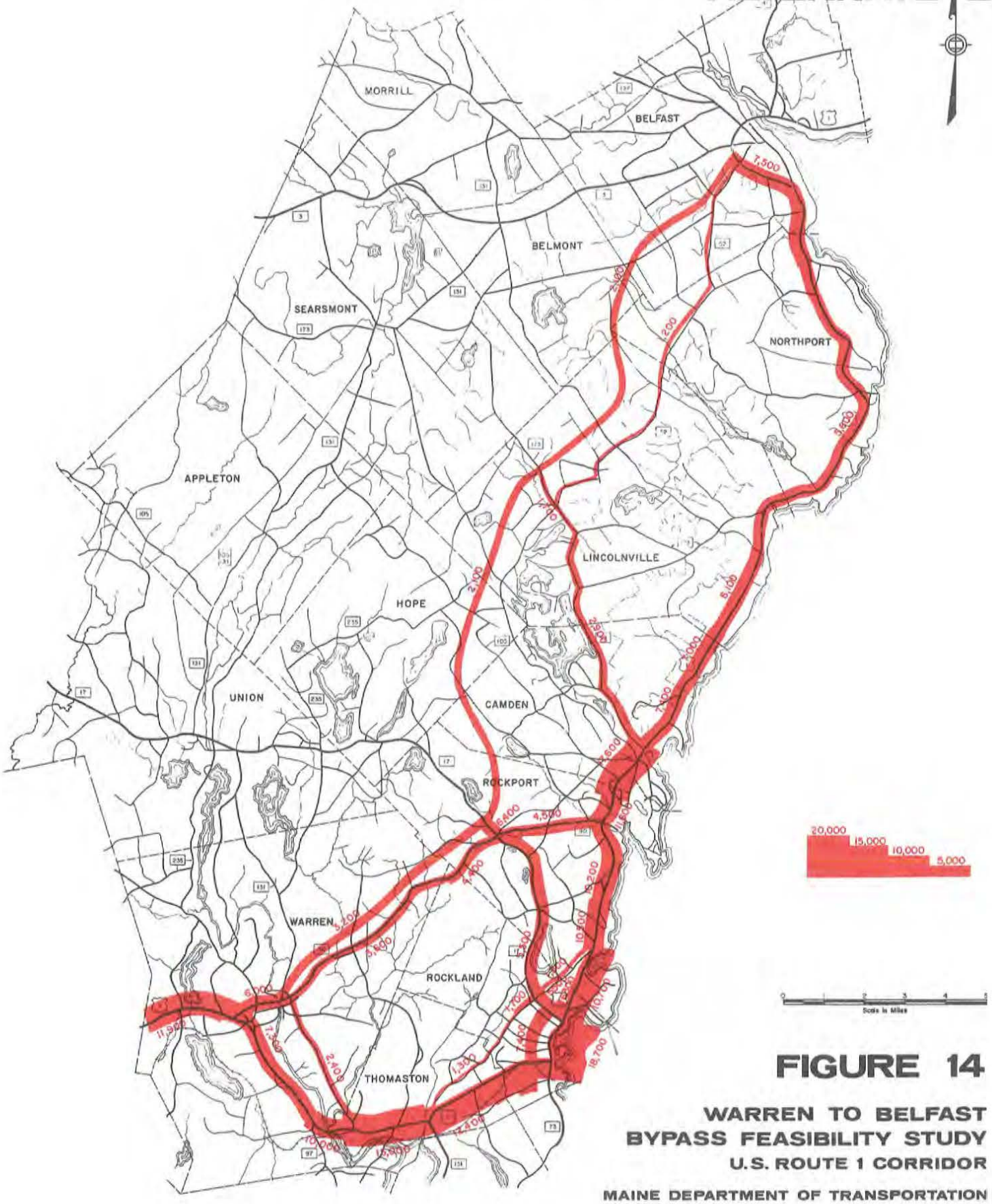

FIGURE 14

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

1995 AVERAGE SUMMER DAY VEHICLE TRIPS
NETWORK WITH BYPASS ALTERNATE B

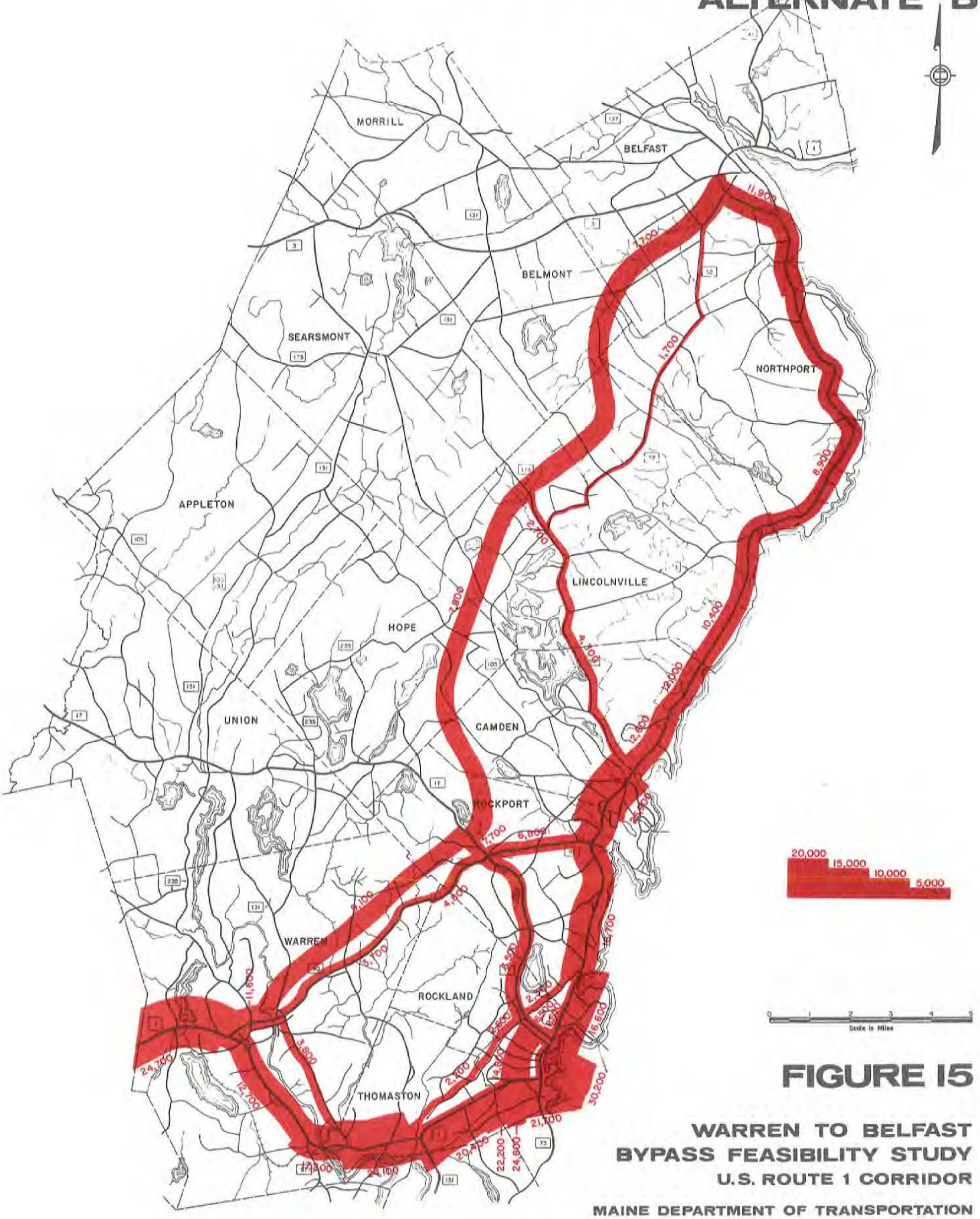

FIGURE 15

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

savings between 1975 and 1995 discounted at 8 percent to the present worth in 1972. A discount rate of 8 percent was selected as being representative of the current opportunity cost of capital, and it has been used as the basis of economic comparisons of the bypass alternates.

5. Construction Costs

Table IV-1, page 73, shows the construction costs associated with construction of a new facility in the Eastern Corridor.*

Residual values were calculated for the year 1995 on the basis of the following salvage rates:

Base and Surface	0 percent
Grading and Drainage	60 percent
Structures	60 percent
Right-of-Way	80 percent

The present worth of these salvage values was deducted from the construction costs as shown in the cost summary tables on page 74.

Maintenance costs were based on $3,000 per mile on a two-lane facility and $4,000 per mile on a four-lane facility. The present worth of these annual costs was calculated for the years 1975 through 1995 and added to the construction costs on page 74.

Tables IV-2a through IV-2c, page 74, show the calculation of the present worth of construction costs for the 8 percent discount rate for the three alternates postulated.

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*All costs include preliminary and construction engineering costs at current 1972 prices as prepared by the Maine Department of Transportation.

Table IV-1

STAGE 1: A two-lane facility with at grade intersections and acquisition of four-lane right-of-way, including future interchange right-of-way.

Base and Surface	Grading and Drainage	Structures	Right-of-Way	Total
SECTION 1:	ROUTE 1 IN WARREN TO ROUTE 17 (7.9 MILES)			
2,000,000	2,300,000	500,000	350,000	$ 5.1 million
SECTION 2:	ROUTE 17 TO ROUTE 173 (9.2 MILES)			
2,300,000	2,900,000	450,000	300,000	$5.95 million
SECTION 3:	ROUTE 173 TO ROUTE 1 IN BELFAST (9.5 MILES)			
2,400,000	2,800,000	400,000	300,000	$ 5.9 million
			STAGE 1 TOTAL =	$16.95 million

STAGE 2: Additional costs necessary to provide four-lane divided facilities (adding two more lanes to Stage 1) and four major interchanges at Routes 1, 17, 173 and 1.

Base and Surface	Grading and Drainage	Structures	Right-of-Way	Total
SECTION 1:				
2,300,000	2,600,000	1,300,000	——	$ 6.2 million
SECTION 2:				
2,500,000	3,100,000	1,000,000	——	$ 6.6 million
SECTION 3:				
2,600,000	3,000,000	1,200,000	——	$ 6.8 million
			STAGE 2 TOTAL	$19.6 million

Table IV-2a. COST SUMMARY ALTERNATE A		
1975 Construction Cost	$36,550,000	
• 1972 Present Worth of Construction Costs		$33,843,000
• Minus 1972 Present Worth of Salvage Year (1995)		2,320,000
		$31,523,000
• Plus 1972 Present Worth of Maintenance 1975—1995		829,000
		$32,352,000

Table IV-2b. COST SUMMARY ALTERNATE B		
1975 Construction Cost	$16,950,000	
• 1972 Present Worth of Construction Costs		$15,694,000
• Minus 1972 Present Worth of Salvage Year (1995)		1,076,000
		$14,618,000
• Plus 1972 Present Worth of Maintenance from 1975—1995		622,000
		$15,240,000

Table IV-2c. COST SUMMARY ALTERNATE C		
1975 Construction Cost	$11,850,000	
1980 Construction Cost	$ 5,100,000	
• 1972 Present Worth of Construction Costs*		$13,728,000
• Minus 1972 Present Worth of Salvage Year (1995)		1,076,000
		$12,652,000
• Plus 1972 Present Worth of Maintenance from 1975—1995		622,000
		$13,274,000

* Assuming the first $11,850,000 is allocated in 1973 and the remainder in 1980.

6. Benefit/Cost Ratios for Alternate Bypass Facilities

For an interest rate of 8 percent, deemed appropriate in today's economy, the benefit/cost ratios vary from a low of 0.24 to 0.43 as shown below:

Table IV-3

Facility Type	Present Worth Costs (millions)	Present Worth Benefits** (millions)	Benefit Cost
Discount Rate = 8 Percent			
A. Limited Access 4-Lane Expressway	$32.35*	$7.76	0.24
B. Limited Access 2-Lane At Grade Hwy.	15.24*	6.40	0.42
C. Stage Construction of B	13.27	5.71	0.43

* See Table IV-2a, IV-2b and IV-2c.

** Through traffic on the existing network is assumed to divide between Route 90 and Route 1 at the present rate (10.6 percent on Route 90) in 1975 and to divide equally between Route 1 and Route 90 in 1995. (This volume of traffic exceeds the design capacity of the existing Route 90 in 1980.)

The project is economically feasible if the ratio of the present worth of benefits to the present worth of costs exceeds 1.

It should be remembered that these benefit cost ratios are based only on savings accruing to interzonal traffic and do not include savings to local traffic due to reduced congestion. Neither do they include savings due to anticipated accident reduction, either of which could add slightly to the ratio. They do, however, describe the relationship of those measurable costs and benefits directly assignable to the inter-regional highway system and its major users.

C. SOCIOECONOMIC AND LAND USE

1. General

Section II of this report has discussed the socioeconomic characteristics of the study area, its existing land use pattern and future land use proposals. Section III has identified three alternative corridor locations and discussed the socioeconomic and land use considerations which ultimately resulted in selection of the Eastern Alternate. It is the purpose of this section to discuss the socioeconomic feasibility of this corridor location.

2. Socioeconomic

Of primary importance to the socioeconomic feasibility of the bypass highway is the extent to which the study area's economy will be favorably affected or stimulated. Specifically, will the bypass significantly affect tourist-oriented businesses along Route 1 ? Will the bypass generate economic diversification, thereby increasing employment and wage levels ? Will the bypass stimulate the tourist attractiveness of the area which would in turn further strengthen the area's economic posture by creating growth in tourist-related industries and retail trade ? Unfortunately, the answers to these questions are dependent on a number of factors which cannot be quantitatively estimated at this time. It is possible, however, to draw upon studies which have been made relative to bypass highways in other geographical areas and, together with data gathered for this report, give some qualitative indication as to the effect the bypass may have in the study area.

Effect on Tourist-Oriented Business. The tourist-oriented businesses most likely to be affected by the bypass are those located along the intervening areas of Route 1 between the town centers, since studies have shown that

established commercial centers experience either little change or an actual increase in economic viability once they have been bypassed.

The land use inventory conducted for this study revealed that there were 46 hotel/motel uses, 32 gift/antique shops, 25 restaurants and 21 service stations along Route 1. A recent comparison by the FHWA of 33 studies, covering 37 bypassed areas in 18 states indicated that, for communities with a population of between 3,000 and 5,000, there were losses in retail sales to service stations and no losses to restaurants (statistics for hotel/motel were not available).[12] Without specific information about the geographical areas where these studies were made, it is difficult to draw direct correlations. However, it would seem reasonable that there would be some loss in sales to service stations. Restaurants, especially those which have achieved some tourist popularity, would be sought by travelers even if a detour from the bypass were necessary. This same circumstance would probably exist for motels and hotels which do not depend exclusively on "impulse" stopping of traffic. Gift shops and other similar retail shops might experience some loss in sales, but in light of the study area's estimated peak seasonal population potential of some 46,600, it is conceivable that there would be sufficient population in the area to economically sustain these uses.

Effect on the Study Area's Economy and Employment. A direct limited access highway link between Warren and Belfast is not likely to immediately result in economic diversification or increased employment in the study area, since there must be appropriate land use policies and local interest to attract

[12] Economic and Social Effects of Highways, U.S. Department of Transportation, Federal Highway Administration (Washington, D.C., February 1971) p. 96.

new industry and commerce to the area's economic centers. Assuming that the policies and interest exist in some form and will be further strengthened in the study area, the process of business and plant location and site selection normally undertaken by large-scale industry is slow. Once new industry locates in the study area, its economic impact is not likely to be immediately apparent in terms of the area as a whole, but rather will be felt by the communities in which the new plants are located in the form of increased tax revenue.

The bypass highway should, however, have an almost immediate effect on existing industry and commerce whose markets are primarily limited to the immediate environs of the study area. For example, poultry processing and blueberry production would benefit by the savings in time that would result in transporting raw materials to processing facilities and shipping the processed products to market areas. The availability of good highways also enlarges the laborsheds which serve economic centers. The bypass would enable workers to conveniently commute from one end of the study area to the other to work in industry. This would be especially important to people who may wish to continue to live in the rural communities and engage in agricultural activities but, at the same time, find that they must supplement their income by other than agricultural employment on a part- or full-time basis.

Effect on Tourism. As indicated previously, the study area is one of Maine's prime tourist areas and has the potential of increasing its population by over 16,500 during the peak season. From 30 to 60 percent of the summer traffic volume on Route 1 is composed of traffic whose origins and destinations are outside the study area. Only slightly more than 10 percent of these vehicles make an intermediate stop on Route 1 for any purpose other than refueling. This traffic, while contributing little economic benefit to the

coastal communities, contributes a great deal to congestion, especially in the summer months. The attractiveness of this popular tourist area is likely to be enhanced by a bypass, since those who wish to pass through the study area without stopping can do so if they will without contributing to congestion on Route 1. Those who wish to visit the coastal communities could use the bypass and its interchanges to travel easterly to the coast without interfering with local coastal traffic.

The many ponds, lakes and streams in the study area, together with its rural character and unhurried way of life, are assets which have contributed to its tourist popularity. These amenities will be available to more people once more convenient and safe highway access is provided.

3. Land Use Implications

There are a number of implications relative to the bypass considered in this report which deserve comment. It is generally recognized that new highways in rural areas tend to stimulate increased development. This is especially true when the highway provides more efficient access to market areas and employment centers. Further, it is also a generally accepted fact that the greatest potential for commercial and industrial growth is around the access points of limited access highways.

The proposed bypass provides access at Route 17 in Rockport and with Route 173 in Lincolnville in rural sections of these towns. Although the proposed bypass may not stimulate development around these locations for a number of years, studies have shown that joint development of highways and other types of land uses is one method of insuring compatibility between the highway and the capability of the land to support new development and the ability of a community to

service it.[13] For this reason, it would be extremely important that Rockport and Lincolnville develop land use controls at access points as well as along feeder routes to insure that any new development is consistent with local land use policy.

In a larger perspective, as Route 1, the coastal route, is continuously improved the entire study area could be subject to increased pressure to grow and develop. Market and employment centers to the south would be within a convenient distance to the study area; its scenic qualities and availability of vacant land make the propensity for development that much greater. The current planning efforts of the Maine State Planning Office, Coastal Planning Unit will result in a sound land use and environmental policy for all of the coastal communities. This policy translated into action will protect the basic natural integrity of the area while stimulating its economic growth.

D. ENVIRONMENTAL EFFECTS

Previous sections of this report have discussed the environmental considerations which exist in the study area and have identified areas of environmental concern as they relate to each of the alternate corridor locations. It is the purpose of this section to discuss environmental considerations relative to the Eastern Alternate which has been selected as the most feasible of the bypass alternates studied.

As indicated in Chapter II of this report, the study area is characterized by a number of water bodies, related water courses and wetlands, all of which sustain wildlife of some type and contribute to the visual amenities which abound in

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[13] Economic and Social Effects of Highways, U.S. Department of Transportation, (Washington, D.C., February 1971).

the area. The possible contamination of the several freshwater bodies and streams and of private wells is therefore of concern. In the interest of human safety, it is assumed that the bypass will be salted in winter storms (until such time as a feasible alternative method is found) and, consequently, additional salt—primarily sodium chloride—will be added to the area's ecosystems. Experience to date in Maine has not shown this to be a major problem any significant distance from the roadway with the exception of private water supplies close to the highway facility and so situated as to receive highway runoff.

In the long range, the presence of an additional pollution generating facility within the corridor, whether some form of land development or an improved highway facility, could lead to a gradual degradation of surface and groundwater quality over a period of time. Subsequent development, both residential and industrial, dependent upon an adequate water supply may therefore be adversely affected. Beneficial environmental effects may be gained, however, by appropriate design of the proposed facility sympathetic to these problems. The location of the corridor and its access was developed in so far as possible to minimize those impacts to the environment caused by location alone, such as caused by changes in development patterns associated with access point locations.

A further long-range consideration of the effect of the bypass relates to the presumption that subsequent residential and non-residential development will occur along the existing local roads and not along the proposed limited access facility. Because of the great quantity of water features within the corridor, some adverse impact to surface waters, the biota within them, and the recreational uses made of them could be anticipated, without proper land use controls and sympathetic site selection and design. Growth in the corridor

is not likely to be as rapid without the catalytic effect of the bypass.

Wildlife resources within the corridor are a function of many elements—not the least among them are the vegetative types, which in turn are for the most part controlled by the historical activities of man. In response to these elements, the most productive wildlife resources lie westerly of the corridor in areas generally unaffected by the corridor.

The scenic qualities of the study area's landforms should also be sustained by appropriate highway design. A location should be selected to enhance these qualities and provide the users with an optimum opportunity to appreciate them. In this way the highway would not only function as a safe and efficient means to transport people and goods but would also be a scenic route, thereby adding to the study area's tourist

V. CONCLUSIONS

An inland bypass would be a highly desirable improvement to the area's transportation system and would benefit the area's general economy and enhance its overall economic growth potential through improved accessibility.

Whether or not this bypass is built, the roadside business segment of the economy could be expected to expand and remain healthy, making Route 1 more commercially oriented. Further commercial development could occur, however, at the expense of the natural, scenic attractions of Route 1. An inland bypass for through traffic would reduce this tendency.

Traffic growth on Route 1 will eventually require construction of additional highway capacity which most desirably should be provided by a limited access inland bypass. At this time, however, such a bypass is not expected to divert enough traffic from Route 1 to produce direct user benefits sufficient to offset the expenditures of public funds or to relieve the congestion in Camden Village.

To provide sufficient capacity to accommodate the amount of traffic expected to remain on Route 1 in Camden Village will require operational improvements to relieve this congestion.

Before the large amounts of money necessary to build a major bypass are committed, steps should be taken to better determine the amount of through traffic which would use an inland bypass. It is recommended, therefore, that the following steps be taken:

(a) Improve the remaining portions of existing Route 90 to Federal-aid standards from Route 1 in Warren to Route 1 in Rockport. Sign this portion of Route 90 as Route 1 and the existing Route 1 as Route 1 Business through

Rockland and Thomaston. These changes should also be reflected on the Maine Official Transportation Map and oil company maps by showing existing Route 90 in red as Route 1. The cost of this improvement is estimated to be $1,600,000. Figures 16 and 17, pages 85 and 86, show an estimate of the amount of traffic to be carried on improved Route 90 in 1975 and 1995, respectively.

(b) Study the traffic flows resulting from the proposed changes to Route 90 to determine when an inland bypass would be feasible.

Immediate relief of the congestion in Camden Village should be accomplished by some type of operational improvement, several of which are currently under consideration. These and the improvements to Route 90 discussed above should provide relief of the congestion in the coastal communities until an inland bypass is economically justified.

1975 AVERAGE SUMMER DAY VEHICLE TRIPS
IMPROVED EXISTING NETWORK

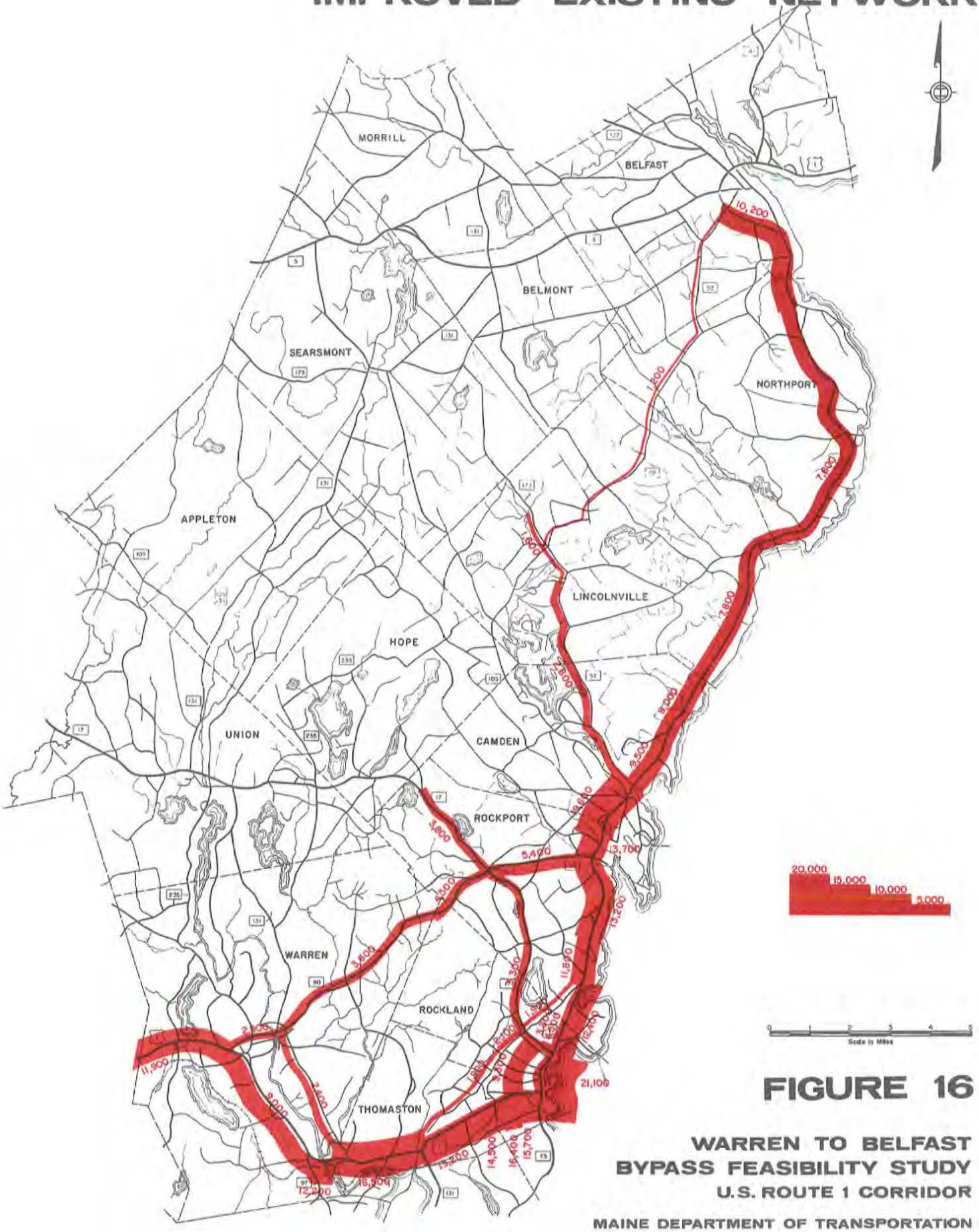

FIGURE 16

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION
EDWARDS AND KELCEY

1995 AVERAGE SUMMER DAY VEHICLE TRIPS
IMPROVED EXISTING NETWORK

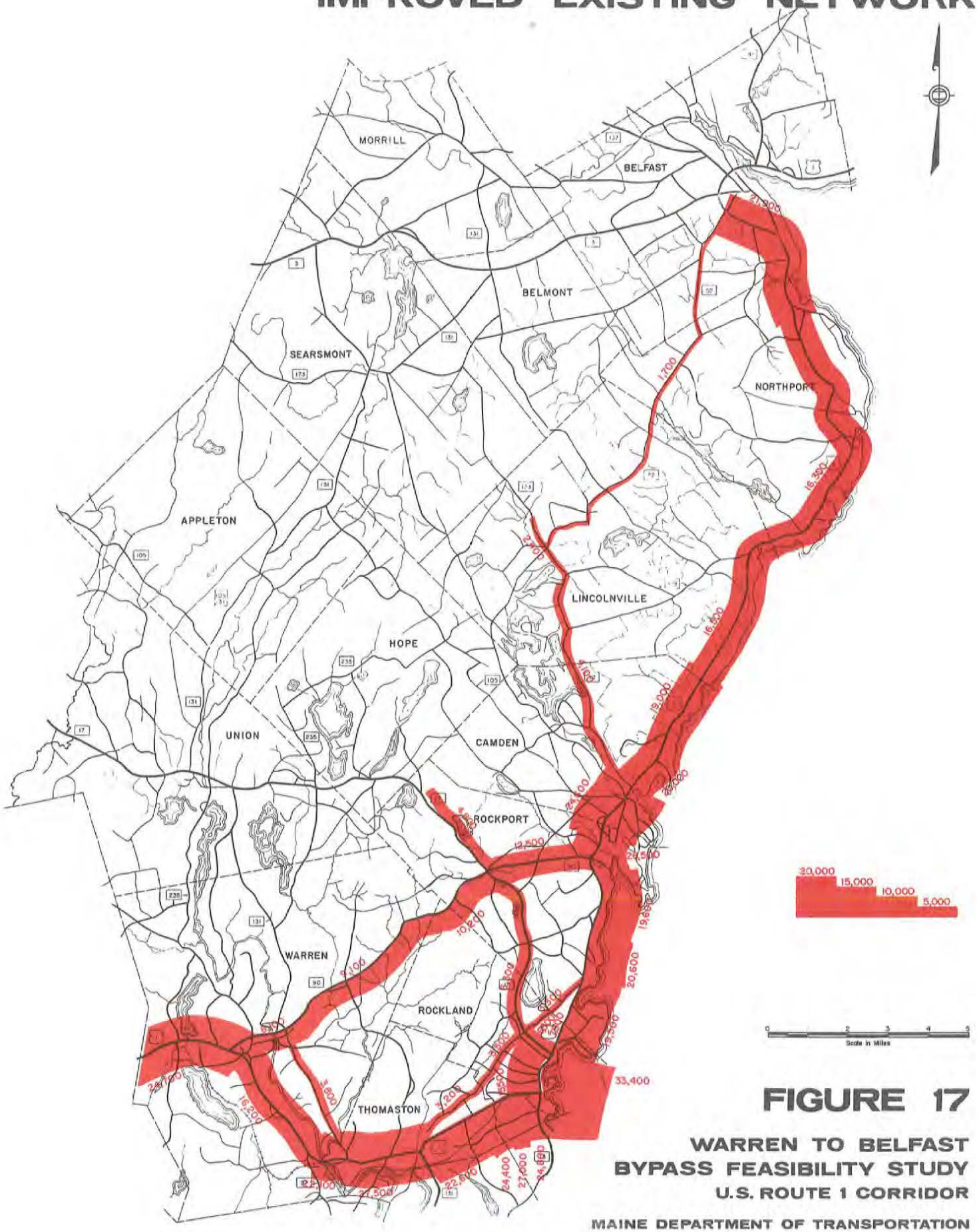

FIGURE 17

WARREN TO BELFAST BYPASS FEASIBILITY STUDY
U.S. ROUTE 1 CORRIDOR

MAINE DEPARTMENT OF TRANSPORTATION

EDWARDS AND KELCEY

BIBLIOGRAPHY

American Association of State Highway Officials. A Policy on Geometric Design of Rural Highways, 1965. Washington, D.C.: Association General Offices, 1966.

An Economic Study on the Feasibility of an East-West Development Highway in Northern New England. Prepared for the New England Regional Commission by the Development Economics Group, a division of Louis Berger, Inc., September 1971.

Bruce Campbell and Associates. Rockland, Maine Master Plan Report, September 1962.

Camden-Rockport Traffic Assignment, October 1966. Augusta: Maine State Highway Commission, 1966.

Census of Maine Manufactures, 1970. Augusta, Maine: Department of Labor and Industry Bulletin 480, 1970.

Comprehensive Plan for the Town of Camden, Maine, 1962. Old Town, Maine: James W. Sewall Company, 1962.

Employment, Wages and Contributions Under the Employment Security Program, 1971. Augusta, Maine: Economic Analysis and Research Division, Maine Employment Security Commission, 1971.

Environmental Consulting Group, Inc. Comprehensive Plan for City of Belfast, Maine. Hanover, New Hampshire, 1971.

_____. Knox County Plan, 1970. Hanover, New Hampshire, 1970.

Estimates of Peak Seasonal Population in Each Municipality in Maine, 1970. Brunswick, Maine: Public Affairs Research Center of Bowdoin College, February 1972.

Farb, Peter. Face of North America. Harper Colophon Books. New York: Harper and Row, 1962.

Final Report of the Knox County Regional Comprehensive Plan. Rockland, Maine: Knox County Regional Planning Commission, 1969.

Hanis, Edward H. Demand Analysis of State Park Utilization and Other Outdoor Recreation Activities in Maine. Brunswick, Maine: Public Affairs Research Center of Bowdoin College, June 1970.

Highway Capacity Manual, 1965. Highway Research Board Special Report 87. Washington, D.C.: Division of Engineering and Industrial Research, National Academy of Sciences, National Research Council, 1965.

Jorgensen, Neil. A Guide to New England's Landscape. Barre, Massachusetts: Barre Publishers, 1971.

Maine Coastal Development Plan, Phase I Report. Augusta, Maine: Maine State Planning Office, June 1970.

Maine Comprehensive Outdoor Recreation Plan. 3 vols. Augusta, Maine: prepared through Park and Recreation Department by the Planning and Research Division, January 1972.

Maine Pocket Data Book, 1971, An Economic Analysis. Augusta, Maine: Maine Department of Economic Development, 1971.

Outdoor Recreation Study Team of the University of Maine. Outdoor Recreation in Maine. Orono: Maine: University of Maine, December 1965.

Road User Benefit Analysis for Highway Improvements. Prepared by the Committee on Planning and Design Policies. Washington, D.C.: American Association of State Highway Officials, 1960.

Third Preliminary Report: Population Projection System for Maine. Brunswick: Public Affairs Research Center of Bowdoin College, June 1972.

Traffic Assignment Manual. Department of Commerce. Washington, D.C.: U.S. Government Printing Office,

U.S. Bureau of the Census. Census of Population, 1960, Vol. 1, Characteristics of the Population, Part 21, Maine. Washington, D.C.: U.S. Government Printing Office, 1961.

U.S. Bureau of the Census. Census of Population, 1970, Advance Report PC (V1)-21, Maine. Washington, D.C.: U.S. Government Printing Office, 1971.

U.S. Bureau of the Census. General Social and Economic Characteristics--Maine, 1970. Department of Commerce. Washington, D.C.: U.S. Government Printing Office, 1970.

U.S. Department of Commerce. County Business Trends. Washington, D.C.: U.S. Government Printing Office, 1967.

U.S. Department of Transportation. Economic and Social Effects of Highways. Washington, D.C.: U.S. Government Printing Office, 1971.

Veazie, Carl E. Economic Importance of Recreation Along the Maine Coast. Brunswick, Maine: Public Affairs Research Center of Bowdoin College, February 1971.

_____. Supply of Outdoor Recreation Facilities in Maine. Brunswick, Maine: Public Affairs Research Center of Bowdoin College, June 1970.

William Dickson Associates, Inc. Rockport, Maine Town Plan. Scarborough, Maine, August 1971.

Winfrey, Robley. Economic Analysis for Highways. Scranton, Pennsylvania: International Textbook Company, 1969.