MAINE TURNPIKE AUTHORITY

Portland, Maine

RECONSTRUCTION REPORT

OCTOBER 1970

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CONSULTING ENGINEERS | HNTB

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October 8, 1970

Maine Turnpike Authority
Post Office Box 839
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Gentlemen:

Presented herewith is a report on a special study relating to Section I of the Turnpike between York and Scarborough. The urgent need for reconstruction of Section I of the Turnpike is documented and described in the report. This section is fast becoming overcrowded, obsolete and unsafe and must be reconstructed into a facility which will provide the capacity to accommodate the heavy increase in the number of vehicles using this vital highway.

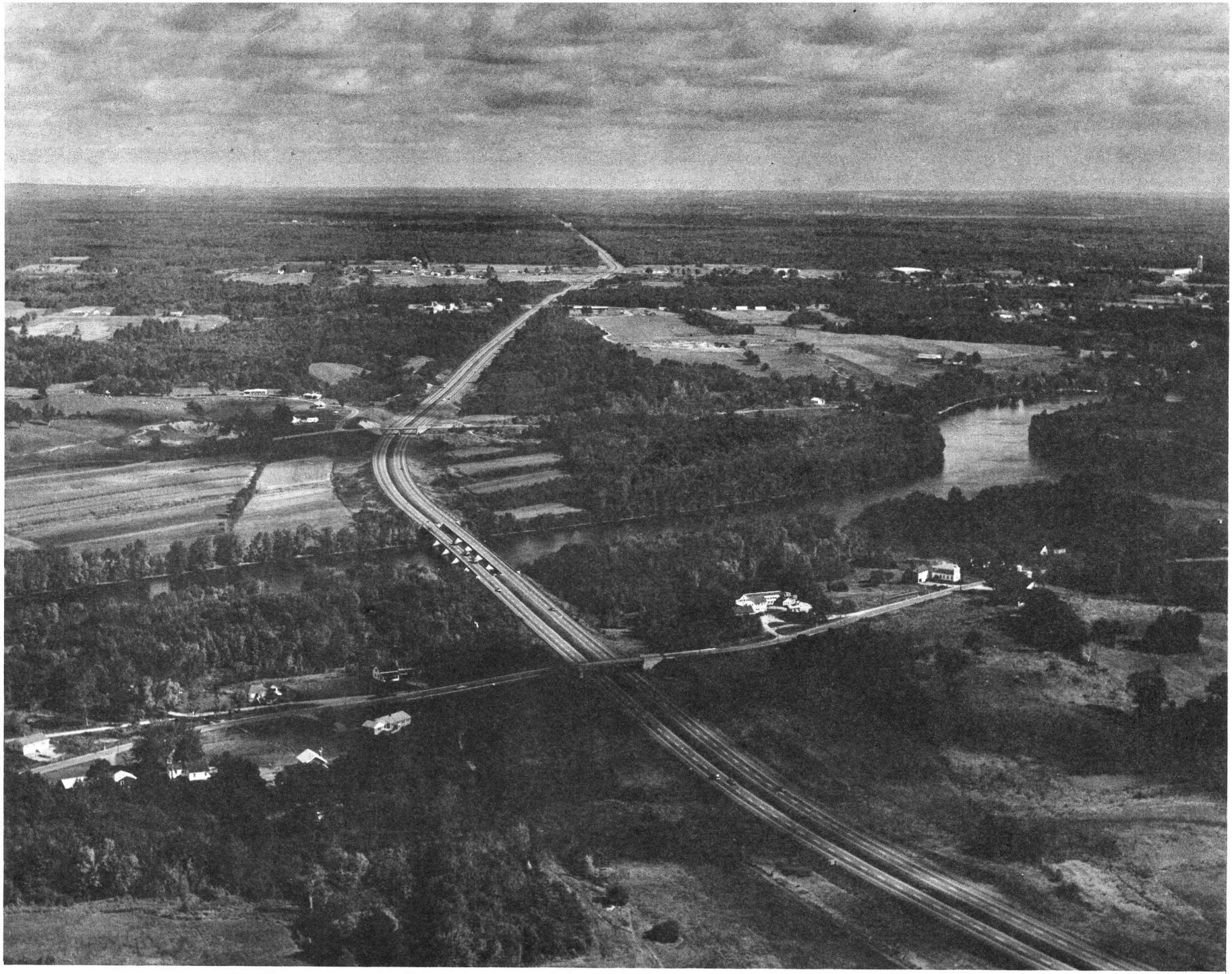
Also the report summarizes the results of our engineering investigation and indicates the reasons for our recommendations as to the most logical and feasible method for accomplishing the proposed reconstruction of Section I.

During the course of our studies, we met with several representatives of the Maine State Highway Commission and the Turnpike Authority who have provided valuable advice and reference material. In this regard, we express our appreciation to those with whom we have conferred.

Very truly yours,

Howard, Needles, Tammen & Bergendoff

W.M. Wachter



SECTION I - SACO RIVER BRIDGE

October, 1970

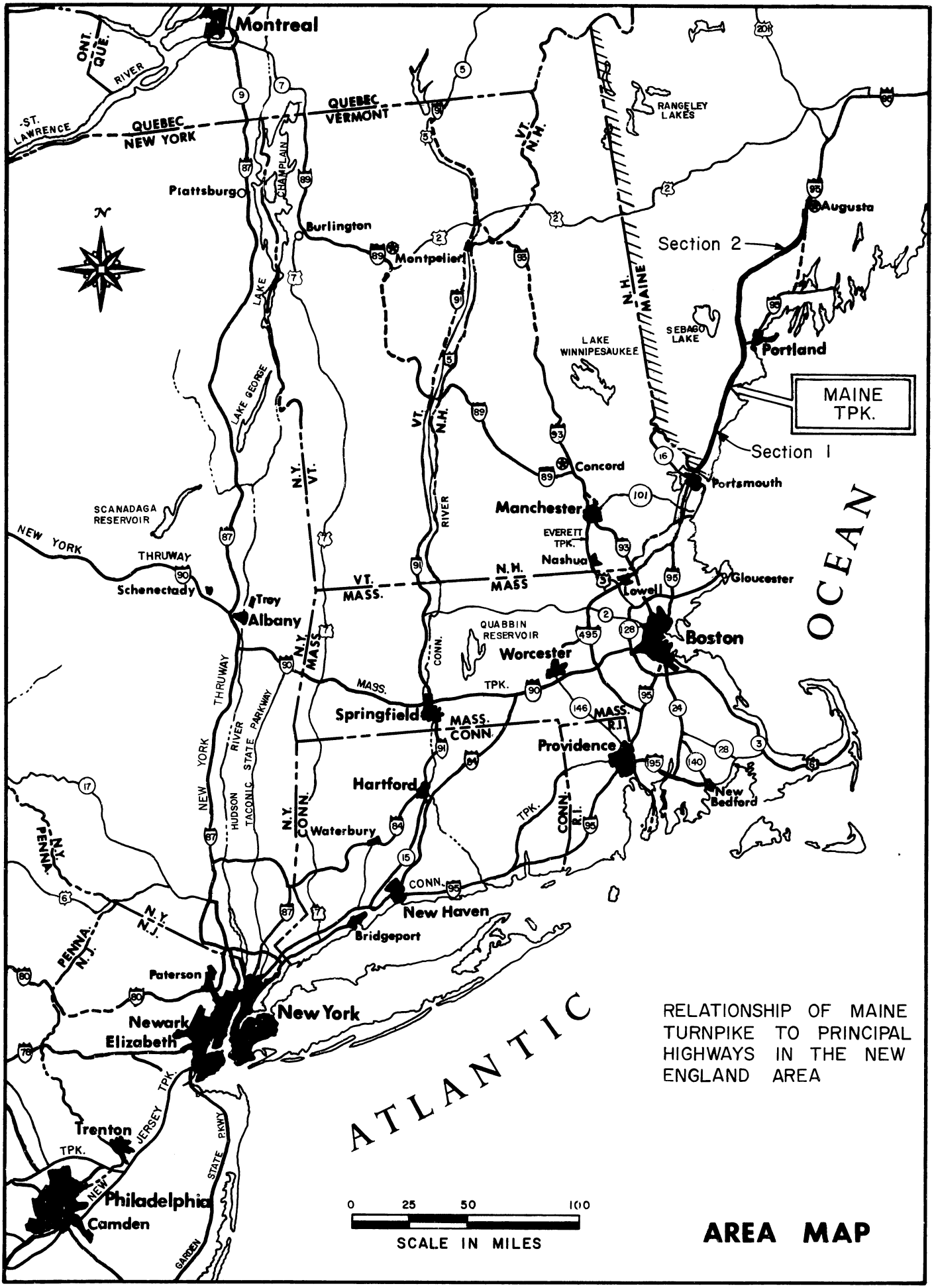
PROPOSED RECONSTRUCTION
MAINE TURNPIKE

Section I - York to Scarborough

PREPARED FOR

Maine Turnpike Authority
PORTLAND, MAINE

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
CONSULTING ENGINEERS | HNTB



RELATIONSHIP OF MAINE TURNPIKE TO PRINCIPAL HIGHWAYS IN THE NEW ENGLAND AREA

AREA MAP

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
CONSULTING ENGINEERS | HNTB

PROPOSED RECONSTRUCTION
MAINE TURNPIKE

Section I - York to Scarborough

Contents

INTRODUCTION

The Maine Turnpike is the major arterial highway into the State of Maine. It lies a few miles inland from the sea coast and extends from the Town of York to the City of Augusta. Subsequent to its completion, the Turnpike was made a part of the Interstate System and designated Interstate Route 95. Presently, the Maine State Highway Commission is undertaking the replacement of that portion of the original Turnpike from Kittery to York.

In recent years it has become increasingly apparent that the original traffic report of March 3, 1958, and the subsequent review of April 10, 1964, were both rather conservative in their predictions of traffic increases. Traffic on Section I (Kittery to South Portland), which was opened on December 13, 1947 as a four-lane limited access highway, has increased by almost 600 per cent from approximately 2,500 Average Daily Traffic in 1948 to 14,000 in 1970. Presently, Section I operates close to or above its practical capacity during peak travel periods. In addition, the Turnpike provides direct access to the coastal resort areas and beaches and its ability to accommodate the peak traffic flows in a safe and efficient manner during holidays and summer weekends is sorely taxed.

In view of the physical condition of the Turnpike, current traffic volumes and operating conditions and anticipation of future increases in traffic, the Maine Turnpike Authority engaged Howard, Needles, Tammen & Bergendoff to make a study on the need for reconstruction of the Turnpike and the development of a feasible method of carrying it out. This is the report on this study.

The report presents an analysis of projected traffic and revenues, a discussion of the various aspects of the required reconstruction and replacement work including estimates of costs and a revised bond debt retirement schedule which demonstrates that the required reconstruction project can be financed from Turnpike revenue without the interruption of bond retirements.

SUMMARY AND RECOMMENDATIONS

The traffic projections in this report (traffic volumes predicted for the year 1990 show increases of approximately 300 per cent over present traffic on the Turnpike), based upon the more recent traffic characteristics, clearly demonstrate that about 36 miles of Turnpike from York to Scarborough must be reconstructed in order to maintain a safe and smooth flow of traffic. These traffic projections also make evident the immediate necessity of replacing this section of the existing facility with a modern six-lane highway to provide the additional capacity to accommodate the anticipated heavier usage of the Turnpike in the years to come at a satisfactory level of service.

Section I, between the new toll plaza at York and the point in Scarborough where I-295 will interconnect with the Turnpike, is approaching 25 years of age. That section will be approaching 35 years of age by the time that any reasonable program of reconstruction can be brought to completion.

Although every effort was made to provide a safe and well designed facility when the Turnpike was built, the years since the Turnpike was opened to the public have seen many changes in both the vehicles which travel on the highway and the design standards which were considered to be sound practice when building such a facility. The automobiles which travelled on the Turnpike when it was opened were not capable of reaching the high speeds of today's powerful vehicles, a fact which was demonstrated by the 60 m.p.h. speed limit upon which the design was based. The large increase in traffic volume has also contributed greatly to the outdating of the safety standards which were used in the design of the Turnpike.

In February, 1967, a special AASHO traffic safety committee presented a report entitled "Highway Design and Operational Practices Related to Highway Safety". This report outlined several approaches to highway design which would help increase the safety of these vital facilities. The following are a few of the recommendations cited in their report:

1. "Embankment and cut slopes 6:1 or flatter can often be negotiated by a vehicle with some chance for recovery and these should therefore be provided where possible."
2. "To increase safety when vehicles leave pavement, a clear recovery area, free of physical obstruction, should be provided along the roadway 30 feet or more from the edge of the traveled way in rural areas."
3. "Median barriers of a suitable design should be considered where the median is 30 feet or less in width."

The Maine Turnpike does not provide any of these safety features. The side slopes are presently 4:1, the clearance from the edge of traveled way to the face of the bridge abutments is only 12 foot 6 inches and although the median strip is a narrow 26 feet in width, there is no median guard rail. In addition, the latest AASHO design standards for interstate highways call for 16 foot 6 inch clearance at all underpasses as compared to the 13 foot 6 inch clearance which is provided on the Turnpike at the present time.

South of Section I the New Hampshire Turnpike is being reconstructed to eight lanes; a new high level Piscataqua River bridge to be opened in November, 1972, will funnel high volume traffic directly to the southerly entrance of the Turnpike; and the State Highway Commission is reconstructing to a full six lanes the 4.78 miles of former Turnpike between Kittery and the new York toll plaza. By 1974, I-295 at the north end of Section I, at Scarborough, will be interconnected with the Turnpike to provide another modern, high-traffic-volume highway feeding into the Turnpike. At that time Section I will become an overcrowded and potentially unsafe bottleneck in the corridor highway between the large population centers to the south and the great bulk of the State of Maine.

Section I already is operating close to its maximum practical capacity during peak travel periods. Particularly during holidays and summer weekends its ability to handle the traffic flows is sorely taxed. Turnpike usage has increased rapidly during the past six or seven years, and can be expected to continue to increase, especially in view of the much expanded and improved connectors at the south and north ends of Section I. The average number of vehicles using the Turnpike between Kittery and South Portland in 1960 was approximately 2,800,000; in 1969 the figure was 4,700,000. Conservative estimates for the future indicate that use of Section I, already at its capacity during peak travel periods, will approximately double in the decade 1970-1980 and will more than triple by 1990.

Analysis of the projected 1980 and 1990 peak hour traffic volumes was used to determine the number of lanes required by those years to provide acceptable operating levels of service on the Turnpike compatible with safety and reasonable operating speeds.

Traffic projection between Saco and Scarborough, for example, indicates that this segment will have the lowest traffic volumes of the section of the Turnpike between York and Scarborough. By 1980, the projected peak volume of 2,470 vehicles per hour in one direction on the existing two lanes will result in a traffic operating condition approaching "unstable flow". Under this condition, operating speeds fall from free flow at posted speeds to approximately 40 miles per hour. At this volume level, operation becomes highly affected by disruptive elements such as lane changing, commercial vehicles, entering and exiting traffic and maneuvers at interchanges. These merging and diverging areas begin to act as bottlenecks restricting the entire upstream roadway.

By 1990, the projected 3,890 vehicles per hour in one direction over the existing two-lane segment will cause "unstable" traffic flow conditions. Overall operating speeds in the range of 30 to 35 miles per hour will be experienced, with increasing periods of stop and go operation. Traffic flow will be completely regulated by the operations at interchange entrance and exit points. During peak periods, traffic build ups will cause periods of forced flow or complete stop and go operations.

The volumes of traffic projected for the rest of Section I range from 2,810 to 3,350 vehicles per hour in 1980 and from 4,590 to 5,260 vehicles per hour in 1990. Consequently, the other segments of Turnpike between York and Saco will experience even more critical operating conditions than those noted above.

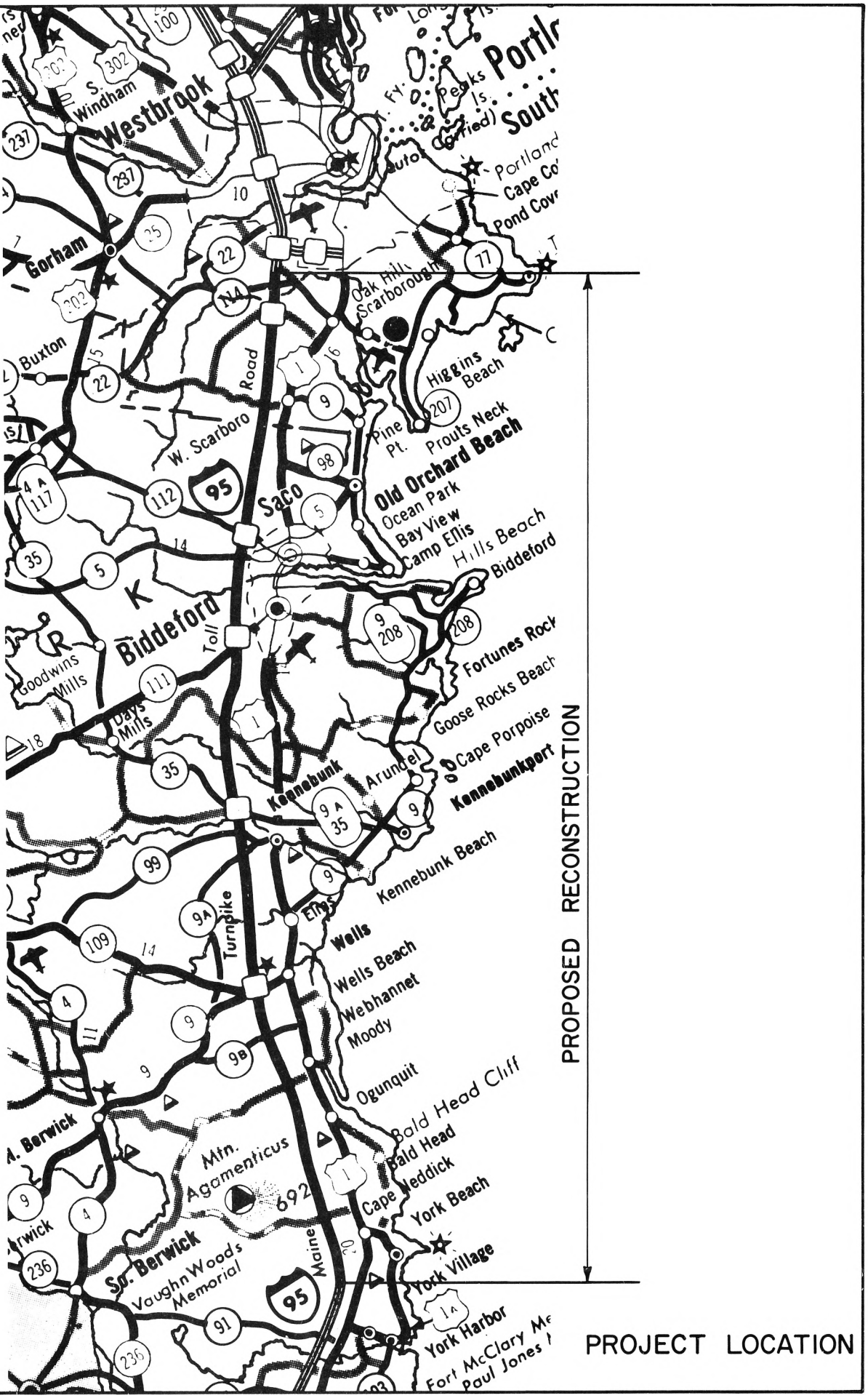
Because of its plain inability to handle such volumes of traffic, as indicated above, Section I is fast becoming obsolescent. By 1980, if not earlier, Section I, unless reconstructed, will be neither fast nor safe as was the highway which was designed in the 1940's and has been operated since 1947. The accident rate would inevitably increase; traffic congestion would slow and inconvenience Turnpike users; and revenues would be depressed by the resulting discouragement of travel on this vital highway.

Reconstruction of Section I is also necessitated or made highly desirable by a number of other considerations, most of which relate to the age of that Section and involve expenditures which would be unavoidable even without the reconstruction. The customary repaving program would be encompassed in the reconstruction program and no repaving would be required for five or ten years after completion of the program. The Turnpike underpasses are nearing the end of their useful lives and involve increasingly heavy maintenance and repair costs. Furthermore, greater vertical and horizontal clearances are required for the safety and convenience of the Turnpike users. Major repairs on the Turnpike overpasses, particularly on the Saco River bridge, will in any event be required during the Seventies. The reconstruction project will take the place of such major expenditures that would have to be incurred anyway.

The proposed reconstruction would be on the same alignment as the existing facility. It would include a resurfacing of the existing roadways, the addition of a travel lane in each direction, installation of a depressed median with double faced guard rail and the replacement of bridges with all of the reconstruction consistent with current design and safety standards and conforming to the reconstruction program now underway by the State Highway Commission on the 4.78 miles of former Turnpike south of the York toll plaza.

Because of the excess of material which would be available from excavation, it is also recommended that the fill sections be built to provide for an eight lane roadway. The cost of this additional earthwork would be nominal and the savings which would be realized at the time when the Turnpike must be expanded to eight lanes would be considerable. In replacing the bridges, this future expansion can also be provided for at little extra cost.

It is recommended that the reconstruction be undertaken in six separate contracts. Work on the first contract would begin in 1973 and the last contract would be completed in 1980. The proposed eight year schedule would allow the Maine Turnpike Authority to pay for the project from incoming revenue and still retire their outstanding bonds by their maturity date. The project should be undertaken as soon as possible to insure the continued safe and smooth movement of traffic on the Turnpike.


Westbrook
S. Windham
Gorham
Buxton
W. Scarboro
Saco
Old Orchard Beach
Ocean Park
Bay View
Camp Ellis
Hills Beach
Biddeford
Goodwins Mills
Days Mills
Kennebunk
Arundel
Kennebunkport
Kennebunk Beach
Fortunes Rock
Goose Rocks Beach
Cape Porpoise
Wells
Wells Beach
Webhannet
Moody
Ogunquit
Bald Head Cliff
Bald Head
Cape Neddick
York Beach
York Village
York Harbor
Fort McClary
Paul Jones
Sp. Berwick
Vaughn Woods Memorial
Mtn. Agamenticus
692
Oak Hill
Scarborough
Higgins Beach
Pine Pt.
Prouts Neck
Road
Toll
Turnpike
Maine
PROPOSED RECONSTRUCTION
PROJECT LOCATION

TRAFFIC PROJECTIONS

The following is a summary of the procedures and assumptions utilized in developing forecasts of annual, daily and design hourly traffic volumes on the Maine Turnpike for the period 1970-1990.

Past Trend Analysis and Forecast

Annual matrices of total traffic entering and exiting the Turnpike at each Interchange, for the years 1957 to 1969 were used as base data for the projections. The total annual entering traffic at each interchange was plotted by year, with annual percent increases next computed. These percentages were consistant for the period 1962 to 1969, and in most cases were approximately double the values for previous years. For each interchange, an annual average compound growth rate was computed based on the 1962-1969 period. These rates of growth were used for the initial 5 year period 1970-1975. For the next successive 5 year periods to 1990, the growth rates were decreased, with 4 percent used for the last five years (1985-1990) at each interchange. Table 1 summarizes these growth rates.

Table 1 - Forecast Annual Growth Rates (Percent)

Interchange	1970-1974	1975-1979	1980-1984	1985-1990
York	7	6	5	4
Wells-Sanford	7	6	5	4
Kennebunk	14	10	6	4
Biddeford	11	8	6	4
Saco	14	10	6	4
Scarborough Downs	2	2	2	2
S. Portland	12	8	6	4
Portland-Westbrook	13	9	6	4
Falmouth-Rte. 1	10	8	6	4
Portland North	11	8	6	4
Gray	10	8	6	4
Auburn	11	8	6	4
Lewiston	13	10	6	4
Gardiner	8	6	5	4
Augusta	10	8	6	4
AVERAGE	10	8	6	4

Distribution Pattern Analysis and Forecast

Annual traffic tabulated in the yearly origin-destination matrices were converted from actual numerical values to percentages representing the portion of vehicles entering an interchange which exited at each of the other interchanges. For each Turnpike entrance, the percentage of traffic leaving at a specific exit was plotted for each year from 1957-1969. A total of 210 "percentage distribution" trend curves were thus prepared. The trends were extrapolated to 1990, and tables were prepared for each forecast year listing the percentages thus estimated. These percentages were next applied to the forecast annual traffic entering each interchange to compute a final set of traffic distribution estimates for 1970-1990.

Traffic Assignment

For each section of the Turnpike, Annual, Average Daily and Directional Design Hourly Traffic were calculated as described below.

Traffic movements were categorized as follows:

a. Through traffic between Interchanges 1-8 (York to Portland-Westbrook) and Interchanges 9, 14 and 15 (Falmouth-Rte. 1, Gardiner and Augusta).

b. Local traffic between all other interchanges.

Two distinct time periods were considered:

a. 1970-1974-Prior to completion of I-295 through Portland and I-95 from Brunswick to Gardiner.

b. 1975-1990-Subsequent to the above.

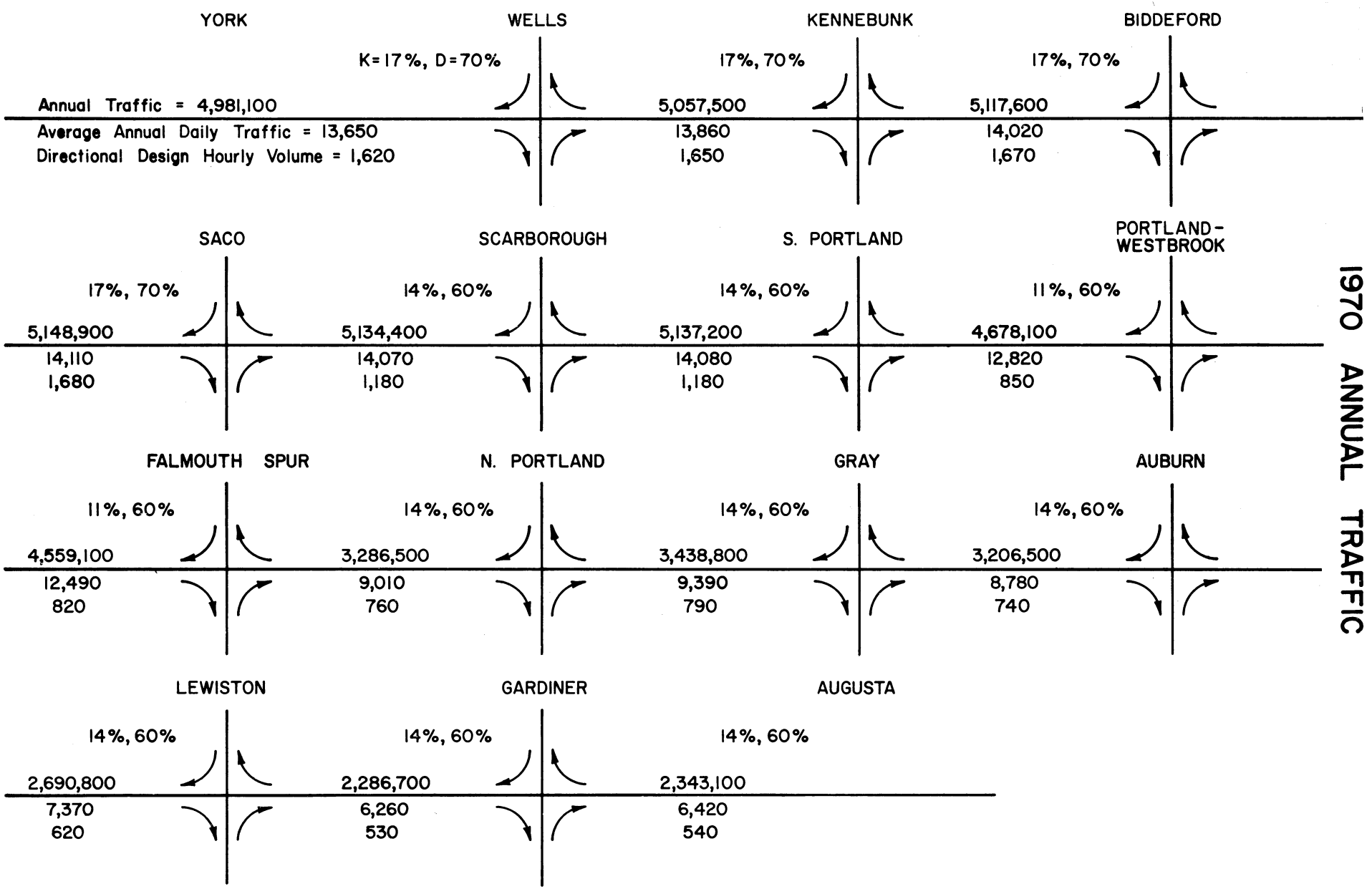
Using diversion curve procedures, an estimate of the percentage of through traffic which would divert from the Turnpike at Falmouth-Rte. 1 and use I-95 to Gardiner and Augusta was made. This estimate indicated that 83% of the through traffic would use this latter route, leaving 17% on the Turnpike subsequent to the completion of I-95 from Brunswick to Gardner.

Similar diversion procedures were used to determine the redistribution of through traffic between the Turnpike - Falmouth I-95 route and the alternative Rte. I-295 through Portland. It was estimated that of the 83% diverted traffic at Falmouth, 38% will route over I-295 using the S. Portland exit. The remaining 62% (of the 83%) will use the Turnpike between S. Portland and Falmouth subsequent to the completion of I-295 through Portland.

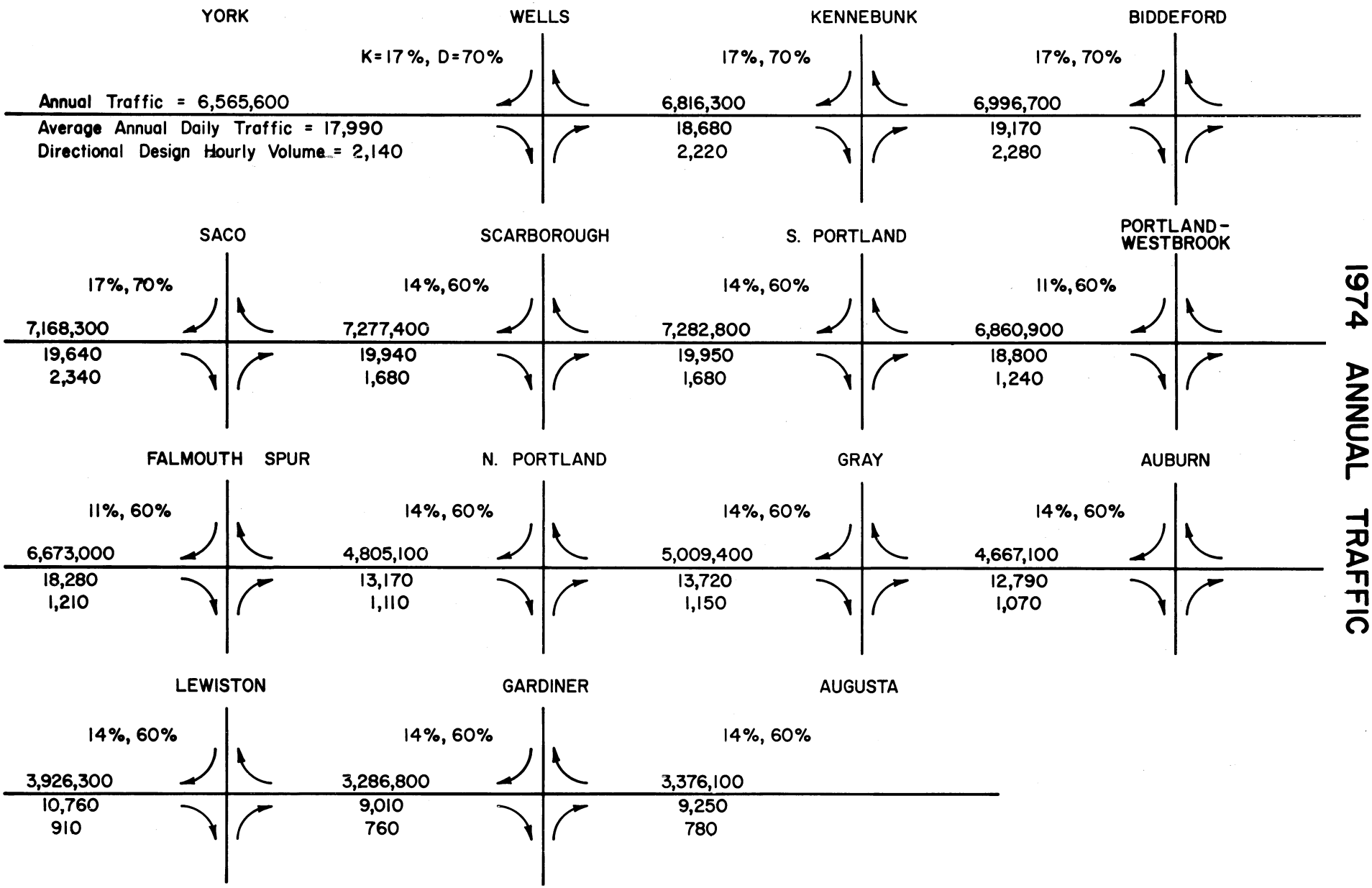
During the period 1975-1990 all local traffic was assumed to continue to use the Turnpike. While a small percentage of this local traffic might be diverted to I-295, the resulting amount of traffic was not considered to be significant.

Based on the above estimates, final assignments of annual traffic were made for the years 1970, 1974, 1975, 1980, 1985 and 1990. Annual values were converted to Average Annual Daily Traffic and factored to Directional Design Hourly Volumes, using k=17% from York to Saco, k=14% from Saco to South Portland, k=11% from South Portland to the Falmouth Spur and k=14% from the Falmouth Spur to Augusta. The directional distribution was 70% from York to Saco and 60% from Saco to Augusta.

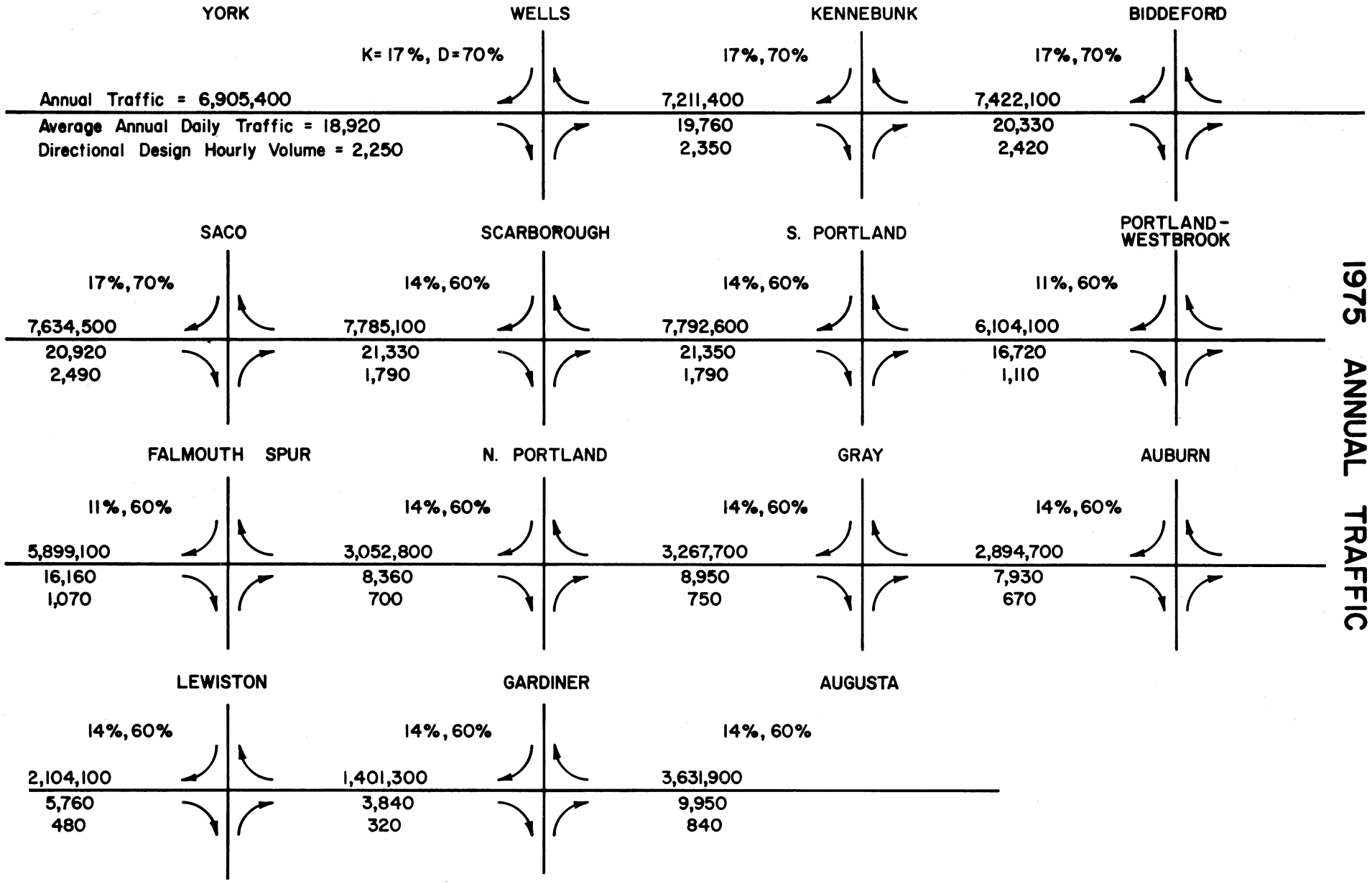
The charts on pages 9 to 14 show the projected traffic figures through 1990 between interchanges for the years 1970, 1974, 1975, 1980, 1985 and 1990. The chart on page 15 shows the projected traffic between interchanges in relation to the level of service for two lanes in each direction (present condition) and for three lanes in each direction. This chart clearly shows that unless the Turnpike is reconstructed the whole section from York to South Portland will be operating at or less than Level of Service D by 1983 with the various parts of the section between interchanges reaching this condition beginning as early as 1977. At Level of Service D traffic operation approaches instability with speeds reduced to 40 miles per hour or less.



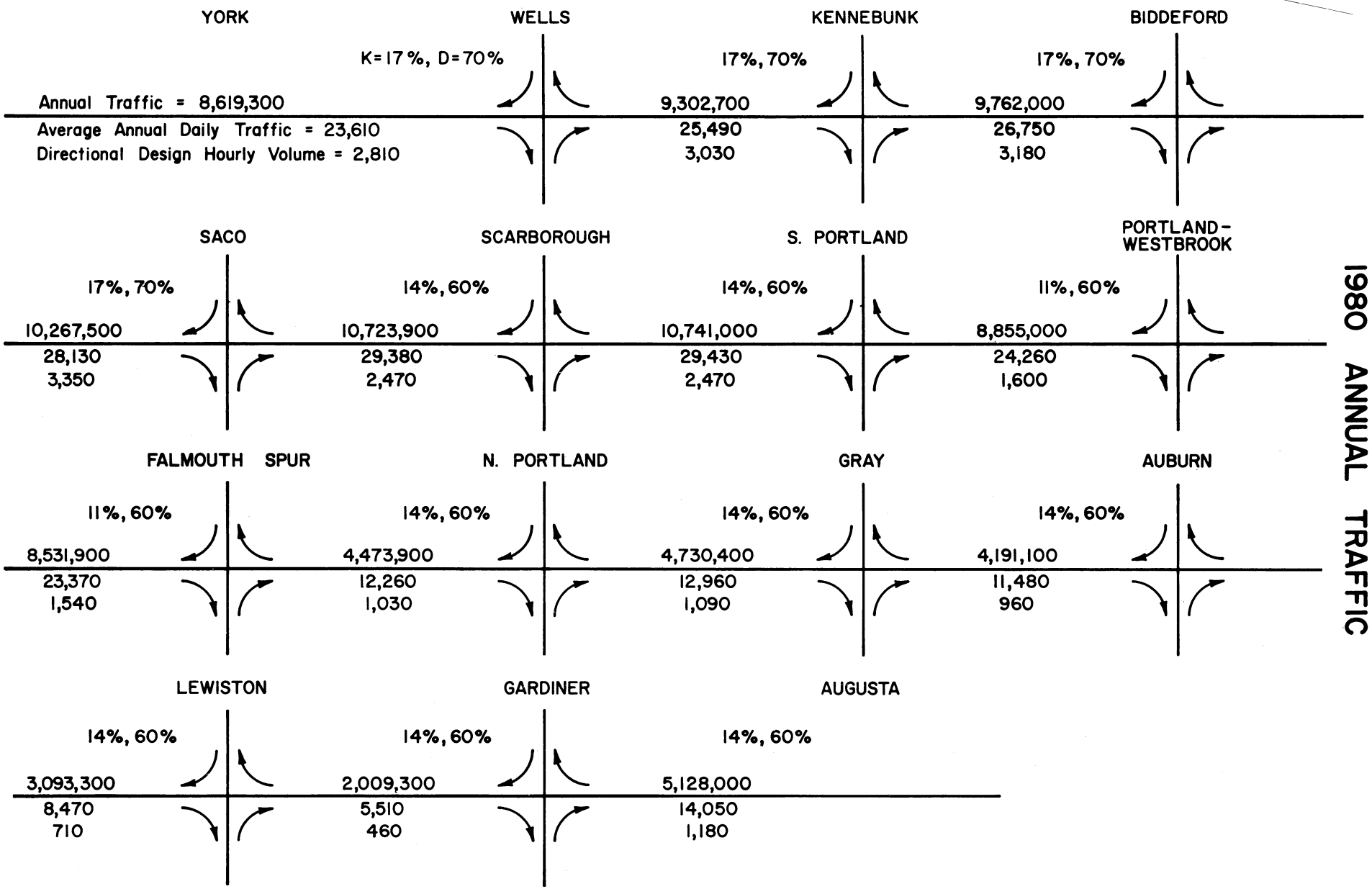
1970 ANNUAL TRAFFIC



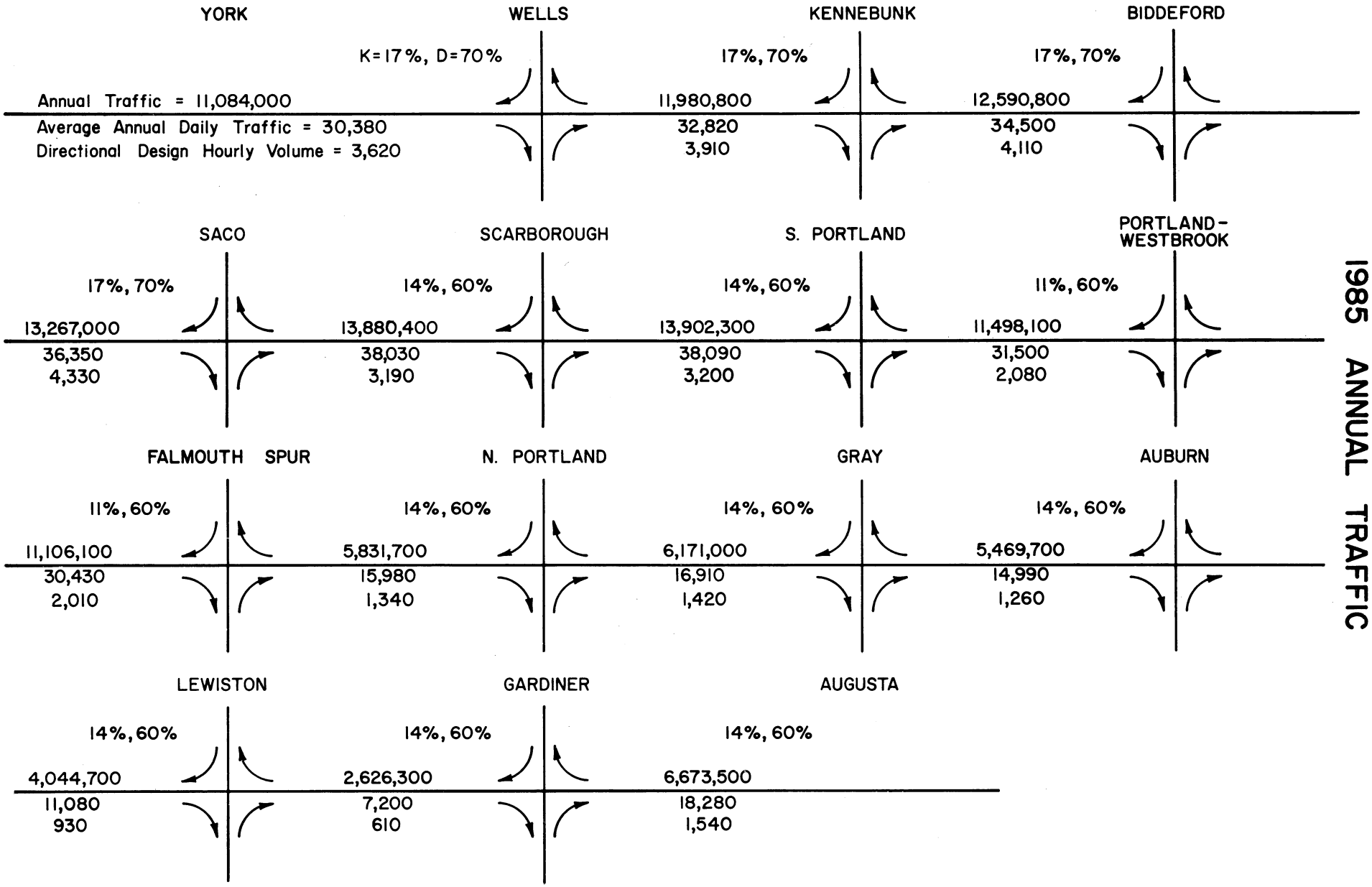
1974 ANNUAL TRAFFIC



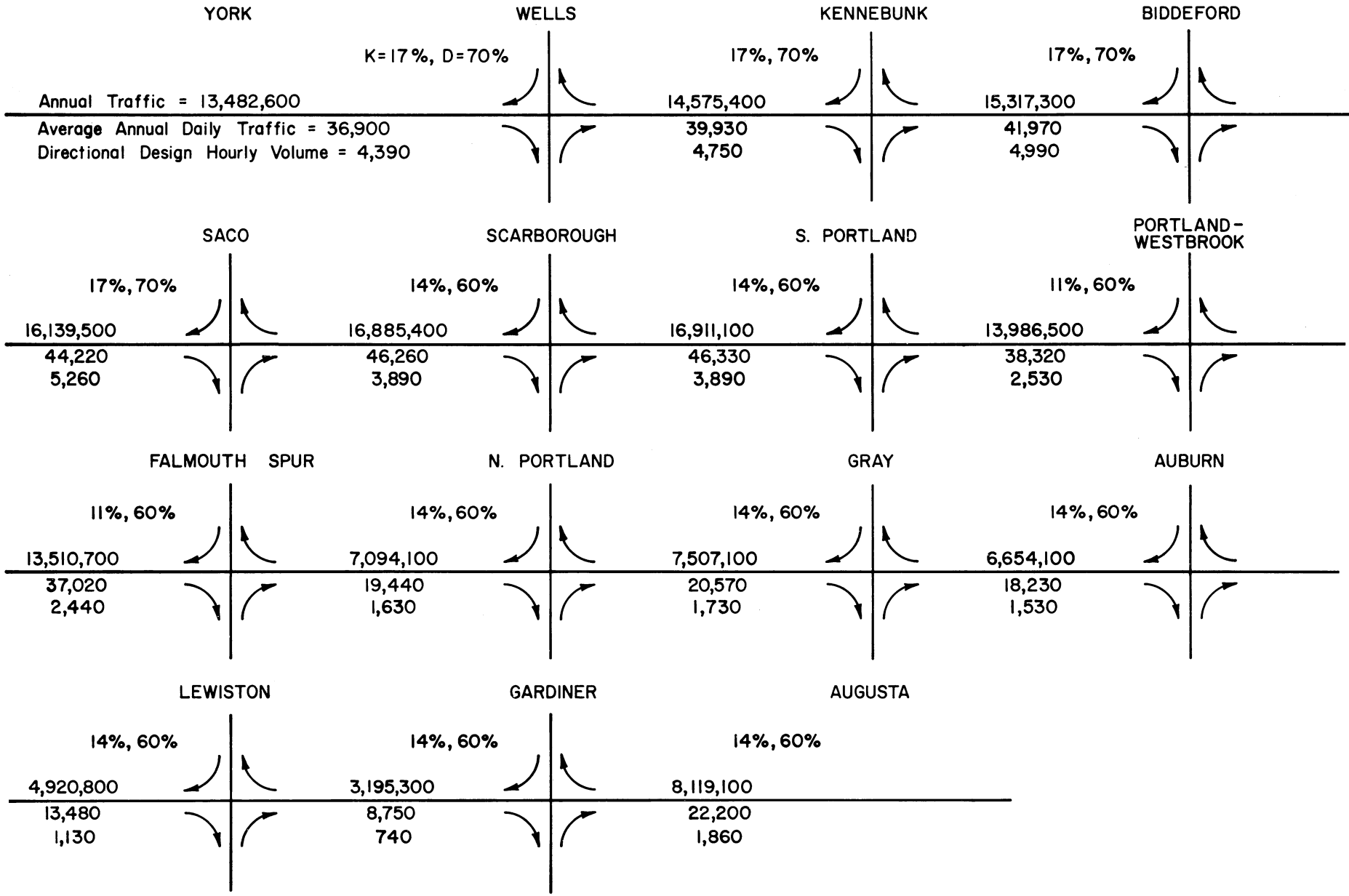
1975 ANNUAL TRAFFIC



1980 ANNUAL TRAFFIC

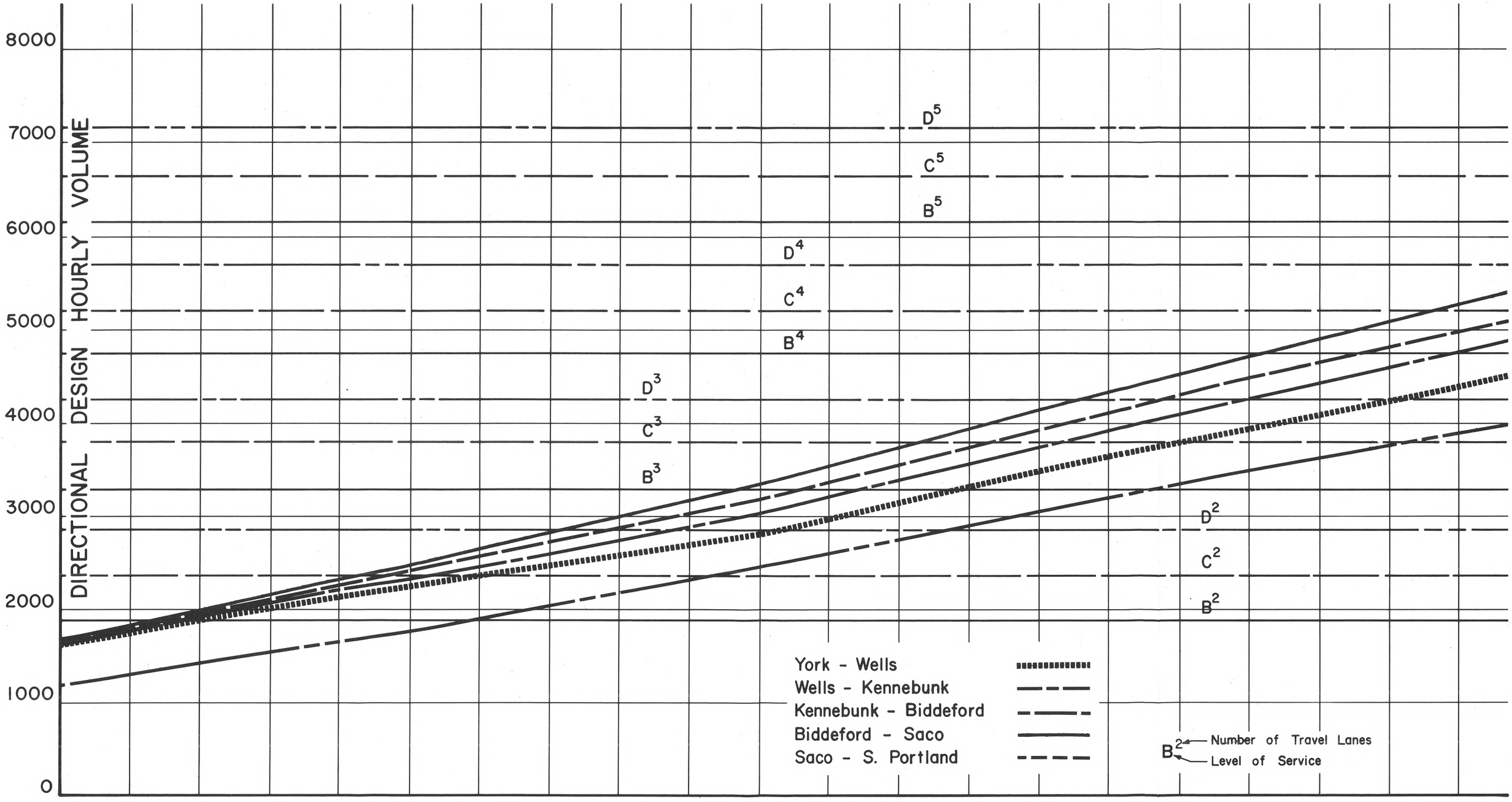


1985 ANNUAL TRAFFIC



1990 ANNUAL TRAFFIC

PROJECTED TRAFFIC AND LEVELS OF SERVICE BETWEEN INTERCHANGES



DESIGN AND PROJECT COSTS

The present facility would be replaced by a six lane highway. The existing four lanes would be retained and resurfaced with 3'' of Bituminous Concrete Pavement. The new section would consist of three 12' travel lanes with a 4' shoulder on the left side and a 10' shoulder on the right side. The roadway section and the various cut, fill and median treatments are shown on the typical sections on pages 20 and 21.

The existing median width of 26 feet, including shoulders, would be retained. The existing raised median would be depressed 5-1/2 inches and grassed or treated with bituminous material and stone chips in order to differentiate it from the travel lanes and shoulders. The median would have double faced steel beam guard rail.

The side slopes would be 6:1 in all cut sections and in shallow fill sections. The high fill sections would have a 2:1 side slope in conjunction with guard rail which would be placed 12 feet from the edge of traveled way. However, most of the existing high fill sections would be eliminated by flattening out the slopes wherever possible. This operation would be carried out by utilizing the excess material which would be available from excavation.

Since the Turnpike is likely to require four lanes in each direction in the future, it would be desirable to complete the required earthwork for the fourth lane at this time. This additional work (over and above placing the fill available in the course of reconstruction to 6 lanes) would increase the cost of the project by approximately $3,300,000. Even if the additional excavation is not done at this time, it would be desirable to construct the fill sections in such a manner that they would be readily adaptable to the eight lane section. This method is shown on the typical sections on page 21 . Except for the increased cost of extending the drainage structures, the additional expense incurred by building the expanded fill sections would be negiligible because of the excess material available from excavation.

Bridges

The Turnpike underpasses should be built with a 92 foot clear span over each roadway. This would allow for the Turnpike to be ultimately an eight lane facility and still provide a 30 foot horizontal clearance between the edge of traveled way and the face of abutment. The minimum vertical clearance would be 16'-6'' on all underpasses. The bridge widths would provide for two 11 foot lanes with 4 foot shoulders on each side for minor roadways over the Turnpike and for two 12 foot lanes with 10 foot shoulders for major roadways over the Turnpike. The bridge details are shown on page 22.

The six Turnpike overpasses should be built with a clear roadway width of 54 feet from curb to curb. This would allow for an ultimate four 12 foot lanes with 3 foot shoulders on each side.

All of the bridges in the project would be designed using an HS-20 loading and the latest AASHO specifications. The following charts on pages 18 and 19 give the basic design data for the bridges included in the project.

Subsurface Conditions

Except for several minor localized areas, the original Turnpike from York to Scarborough has encountered no adverse subsurface conditions. Therefore, since the project would involve reconstructing the Turnpike on its present alignment, no further problems concerning settlement are anticipated.

Right of Way

Reconstruction of the Turnpike will require additional takings in the following cases: (1) at the side road relocations, (2) at the revised ramp layouts for the Wells, Biddeford and Saco interchanges and (3) at the several large cut sections along the Turnpike. The work at the twenty-three side road relocations could be accomplished without affecting more than six residences.

If the design is based on providing the earth work for the ultimate eight lane facility, additional strip takings basically 50 feet wide would be required over approximately 20% of the length of the Turnpike.

Estimate of Project Costs

The project costs were based upon the assumptions that the depressed median would be installed, that the excavation would conform to the six lane section, that the fills would provide the earth work for an eight lane section and that the bridges would be built to allow for the ultimate reconstruction of the Turnpike to eight travel lanes.

The project costs were broken down into six separate contracts. These contracts and estimated project costs are as follows:

Contract	Sta. to Sta.	Length (Miles)	Cost
I	280+00 - 590+00	5.87	$ 6,218,000
II	590+00 - 905+00	5.97	6,335,000
III	905+00 - 1240+00	6.34	7,300,000
IV	1240+00 - 1555+00	5.97	5,863,000
V	1555+00 - 1730+00	3.31	6,020,000
VI	1730+00 - 2175+00	8.43	7,164,000
		TOTAL	$38,900,000

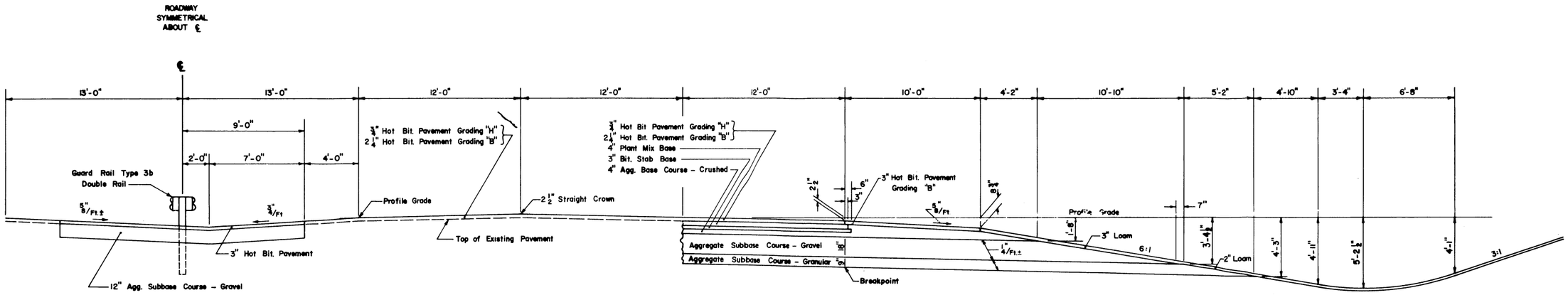
The unit prices used in determining the project costs were based upon 1969 State of Maine average prices for Interstate and Primary projects. These prices were adjusted for 1970 and take into account the additional costs of maintaining traffic during construction. Table 2 shows the State of Maine prices and the prices actually used in the estimate of the project costs.

SIDE ROADS CROSSING TURNPIKE

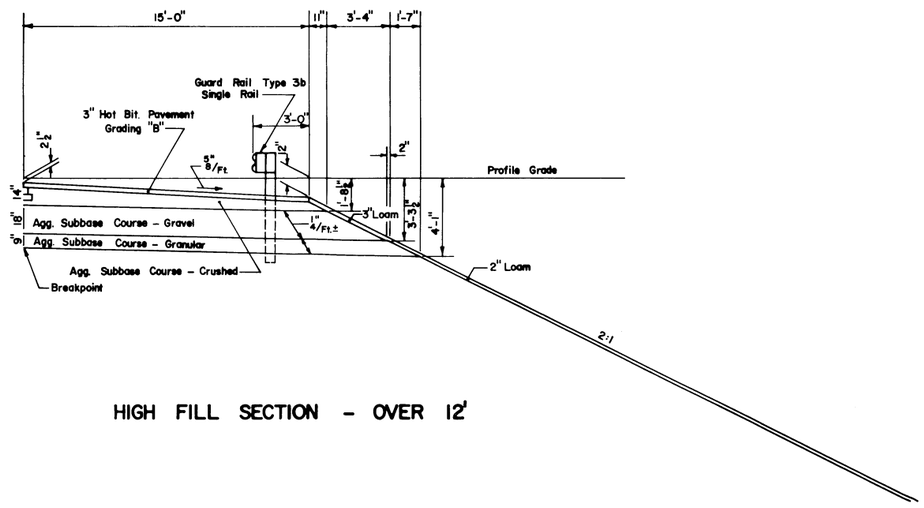
CONTR.	DESCRIPTION	SKEW ∢	DESIGN DATA				COST
			SPAN LENGTH	WIDTH	AREA	FOUNDATION	
1	Mountain Rd.	5°	92'-4"	33'-8"	6220	Spread Footing	$175,000
	Agamenticus Rd.	30°	106'-3"	33'-8"	7160	Spread Footing	200,000
2	North Berwick Rd.	5°	92'-4"	33'-8"	6220	Spread Footing	175,000
	Captain Thomas Rd.	10°	93'-5"	33'-8"	6290	Spread Footing	176,000
	Tatnic Rd.	0°	92'-0"	33'-8"	6190	Spread Footing	172,000
	Charles Chase Rd.	10°	93'-5"	33'-8"	6290	Spread Footing	176,000
3	Burnt Mills Rd.	25°	101'-6"	33'-8"	6840	Spread Footing	191,000
	Coles Hill Rd.	30°	106'-3"	33'-8"	7150	Spread Footing	201,000
	McGuire Rd.	15°	95'-3"	33'-8"	6410	Piles	183,000
	Cat Mousam Rd.	5°	92'-4"	33'-8"	6220	Spread Footing	174,000
	West Kennebunk Rd.	10°	93'-5"	33'-8"	6290	Piles	179,000
4	Limerick Rd.	45°	130'-1"	33'-8"	8760	Piles	251,000
	Old Alfred Rd.	25°	101'-6"	20'-8"	4200	Piles	121,000
	Biddeford - Alfred Rd.	45°	130'-1"	46'-8"	12140	Piles	309,000
	Biddeford Interchange	5°	92'-4"	46'-8"	8620	Piles	221,000
5	River Rd.	10°	93'-5"	33'-8"	6290	Piles	179,000
	Boon Rd.	15°	95'-3"	33'-8"	6410	Piles	183,000
	New County Rd.	5°	92'-4"	33'-8"	6220	Piles	178,000
	Saco Interchange	5°	92'-4"	46'-8"	8620	Piles	221,000
	Buxton Rd.	0°	92'-0"	33'-8"	6190	Piles	177,000
6	Flag Turn Rd.	30°	106'-3"	33'-8"	7150	Spread Footing	201,000
	Broad Turn Rd.	15°	95'-3"	33'-8"	6410	Piles	182,000
	Beech Ridge Rd.	15°	95'-3"	33'-8"	6410	Piles	182,000
	Two Rod Rd.	20°	97'-11"	33'-8"	6590	Piles	189,000
	Holmes Rd.	30°	106'-3"	33'-8"	7160	Piles	205,000

TURNPIKE OVER (Rivers, Roads and R.R.)

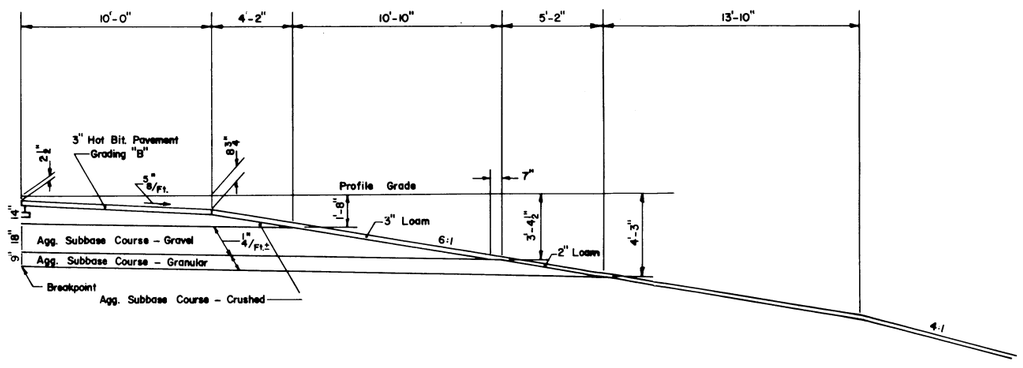
CONTRACT	DESCRIPTION	STRUCTURE TYPE	FOUNDATION	COST
1	Cape Neddick River	Culvert	Spread Footing	$45,000
	Josias River	Culvert	Spread Footing	45,000
2	Ogunquit River	Concrete Arch	Spread Footing	90,000
	Webhannet River	Culvert	Spread Footing	45,000
	Boston & Maine R.R.	3-Span (Steel Beams)	Ledge	213,000
	Wells - Sanford Road	1-Span (Steel Beams)	Spread Footing	131,000
	Wells Interchange	1-Span (Steel Beams)	Spread Footing	132,000
3	Merriland River	Arch Type Structure	Piles	81,000
	Mousam River	3-Span (Steel Beams)	Piles	468,000
4	Kennebunk River	1-Span (Steel Beams)	Piles	138,000
5	Saco River	6-Span (Steel Beams)	Piles	1,250,000
6	Nonesuch River	Arch Type Structure	Piles	50,000



NORTHBOUND ROADWAY - CUT SECTION



HIGH FILL SECTION - OVER 12'



SHALLOW FILL SECTION - 6' to 12'

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
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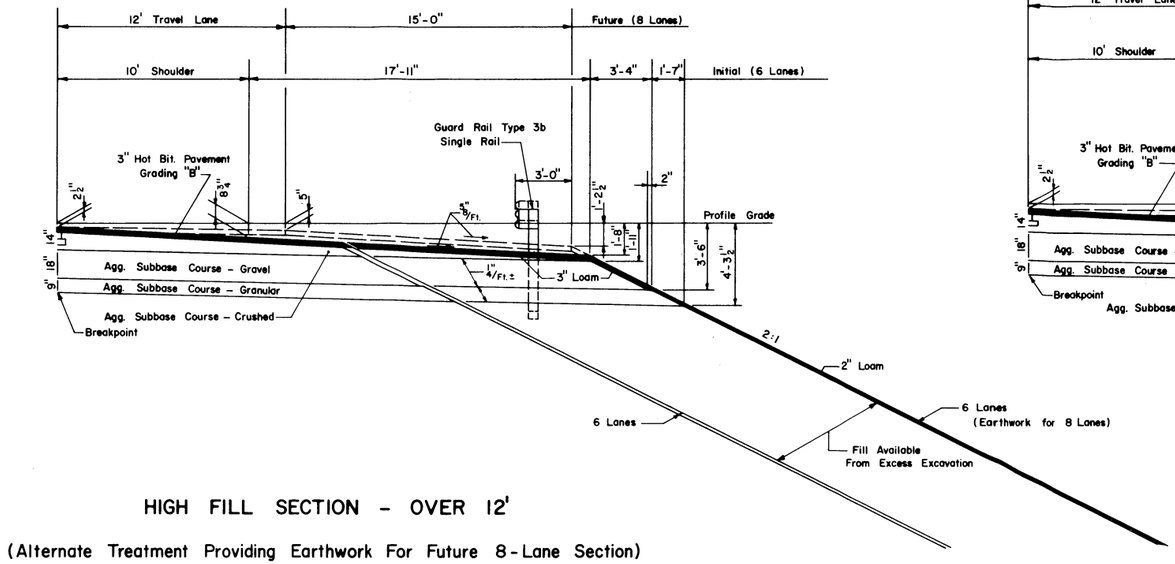
NEW YORK BOSTON KANSAS CITY

MAINE TURNPIKE AUTHORITY

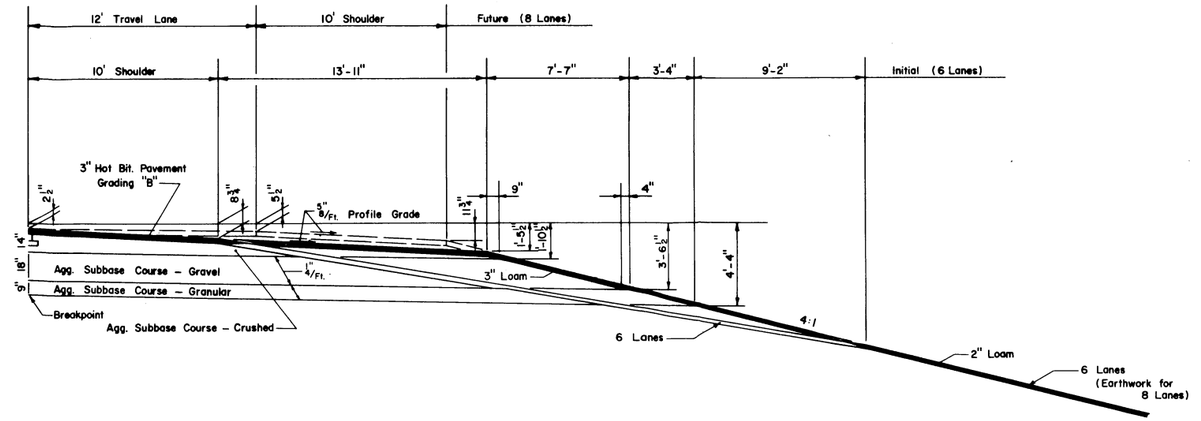
RECONSTRUCTION STUDY
YORK TO SOUTH PORTLAND

TYPICAL SECTIONS



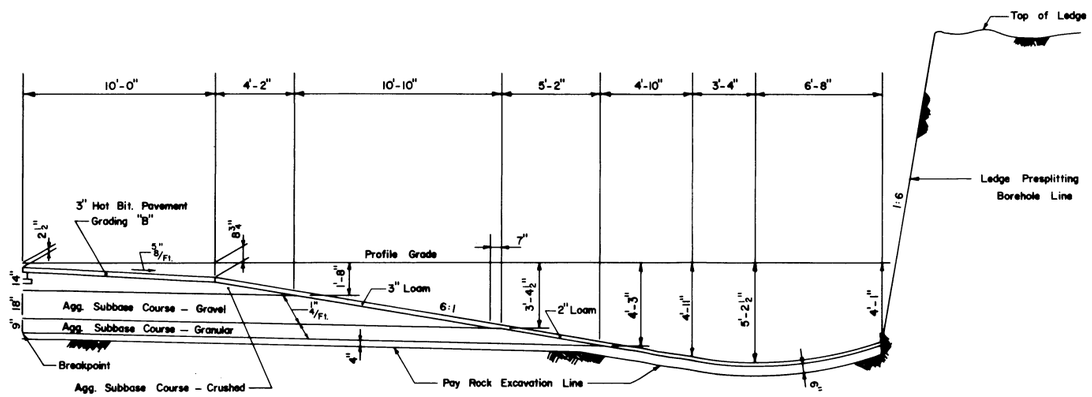
HIGH FILL SECTION - OVER 12'

(Alternate Treatment Providing Earthwork For Future 8-Lane Section)



SHALLOW FILL SECTION - 6' to 12'

(Alternate Treatment Providing Earthwork For Future 8-Lane Section)



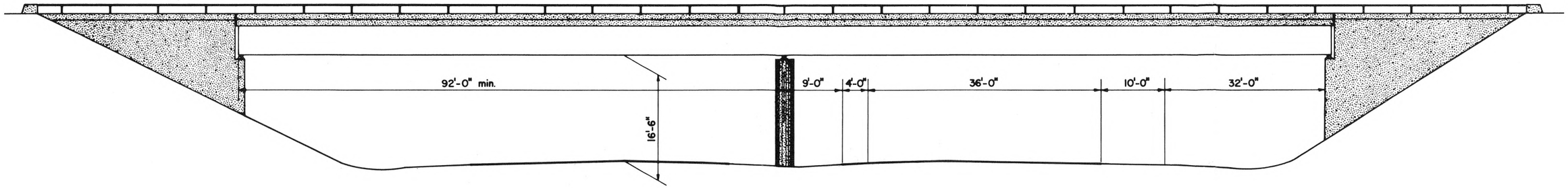
LEDGE CUT SECTION

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
CONSULTING ENGINEERS
BOSTON

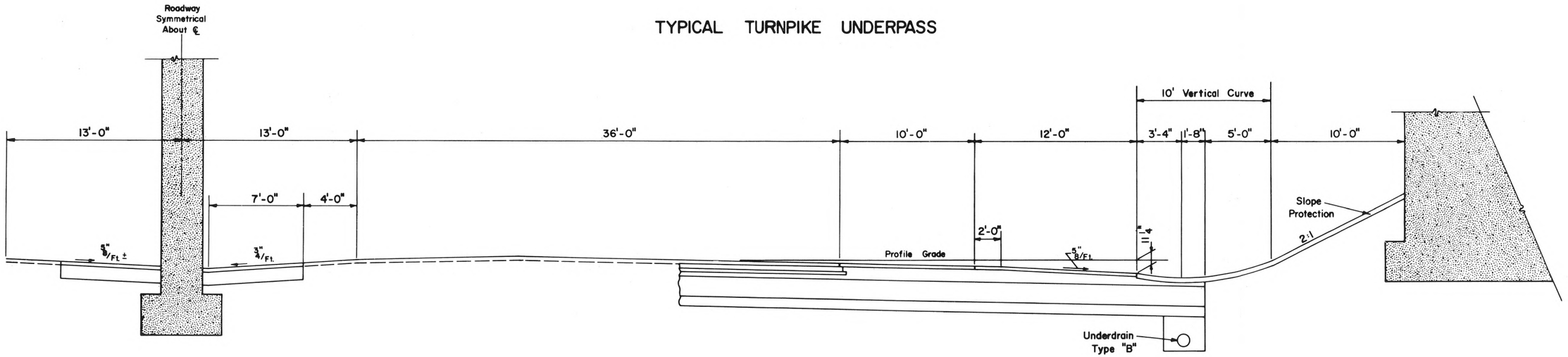
MAINE TURNPIKE AUTHORITY

RECONSTRUCTION STUDY
YORK TO SOUTH PORTLAND

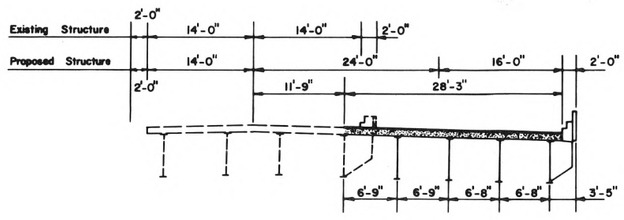
TYPICAL SECTIONS



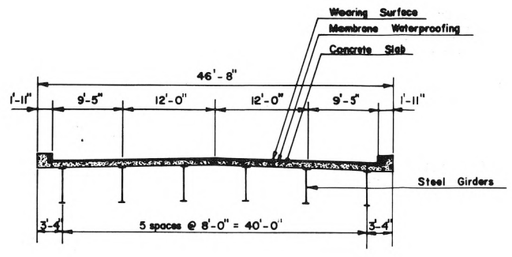
TYPICAL TURNPIKE UNDERPASS



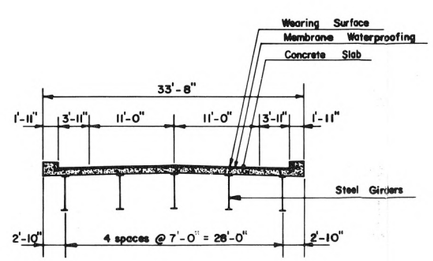
TURNPIKE UNDERPASS DETAILS



TURNPIKE OVERPASS
TYPICAL WIDENING



TURNPIKE UNDERPASS
MAJOR ROADWAY



TURNPIKE UNDERPASS MINOR ROADWAY

MAINE TURNPIKE AUTHORITY

RECONSTRUCTION STUDY

YORK TO SOUTH PORTLAND

BRIDGE DETAILS

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
CONSULTING ENGINEERS
NEW YORK BOSTON KANSAS CITY

Table 2 - Unit Prices

Item	1969 Interstate Projects Wt. Avg.	Exp. Low	Exp. Hi.	1969 FAP Wt. Avg.	Exp. Low	Exp. Hi.	1970 Use
Clearing	386.69	300.00	500.00	418.91	379.75	545.27	450.00
Common Excavation	1.32	0.80	2.50	0.86	0.72	1.38	1.75
Rock Excavation	3.50	3.50	3.50	4.17	3.12	5.15	6.00
Common Borrow	1.61	1.03	2.31	0.87	0.75	1.09	2.00
Plant Mix Bit. (B)							8.50
Agg. Base Crse. Crush	4.73	3.20	7.59	4.68	4.00	5.61	5.00
Agg. Subbase Crse. Gravel	2.55	2.00	5.00	2.17	1.70	4.00	3.00
Agg. Subbase Crse. Gran.	2.06	1.85	2.30				2.25
Bit. Stab. Base (3")	1.18	1.00	1.26	1.21	1.21	1.21	1.40
Hot. Bit. Pave. Gr. B	7.64	7.50	8.77	7.90	6.70	9.65	8.50
Hot. Bit. Pave. Gr. H	8.15	6.53	11.18				9.00
12" RCP Class III	4.44	4.00	5.27	4.96	4.09	5.61	4.75
18" RCP Class III	6.40	6.30	6.62	6.90	5.89	8.81	7.00
24" RCP Class III	10.05	9.00	11.00	9.64	8.05	11.80	11.00
30" RCP Class III	13.45	13.45	13.45	13.19	10.25	14.49	14.00
36" RCP Class III	15.00	15.00	15.00	17.12	13.42	17.86	17.00
42" RCP Class III	20.00	20.00	20.00	20.47	17.82	23.88	22.00
48" RCP Class III				26.42	21.62	28.90	29.00
54" RCP Class III	34.53	34.05	34.63	35.40	35.40	35.40	38.00
60" RCP Class III				35.10	31.19	43.76	42.00
72" RCP Class III				56.00	56.00	56.00	60.00
78" RCP Class III							70.00
Special Catch Basins							250.00
C.B. Abandoned							50.00
C.B. Renovated							100.00
6" Underdrain "B"	3.35	3.20	4.16	3.44	3.00	4.47	4.00
Guard Rail (3b) S.F.	4.49	4.49	4.50	4.29	3.34	4.75	5.00
Guard Rail (3b) D.F.							6.50
Terminal Ends-S.F.	7.24	7.00	7.57	9.43	6.17	21.26	8.00
Twisted End - 3b				175.95	157.09	225.00	200.00
Loam	3.75	3.44	5.00	3.57	3.15	4.36	4.00
Sodding	1.84	1.60	2.56	1.86	1.50	2.50	2.25
Erosion Cont. Mesh (H.D.)	0.78	0.70	1.15	0.90	0.72	1.14	1.00
Seeding, Method 2	9.30	8.00	12.00	8.94	7.44	11.00	10.00
Hay Mulch	94.28	90.00	100.00	88.39	75.46	110.00	100.00

In adjusting the project costs to the year in which they are actually incurred, an annual increase in costs of 10% was assumed. Therefore, a contract bid in 1977 would cost 1.7 times as much as it would have cost in 1970. Using traffic projections and the level of service data, a reconstruction schedule was established. The proposed schedule, projected costs for the different contracts and the estimated total cost of the program are as follows:

Contract	1970 Cost	Year	Estimated Cost
I	$ 6,218,000	1973	$ 8,084,000
II	6,335,000	1974	8,869,000
III	7,300,000	1975	10,950,000
IV	5,863,000	1976	9,381,000
V	6,020,000	1977	10,234,000
VI	7,164,000	1979	13,612,000
	$38,900,000		$61,130,000

Although the traffic projections would indicate that Contract V should be undertaken first, the reconstruction should proceed in a northerly direction beginning at the York toll plaza. The proposed project schedule would avoid the existence of any stretch of original four lane roadway between the widened I-95 south of the York toll plaza and the completed portion of the reconstructed Turnpike. This will result in a smoother and safer traffic flow and less inconvenience to the travelling public.

Maintenance and Operation Costs

In general, it would appear that maintenance costs would not increase significantly as a result of reconstruction. The following factors all contribute to this deduction.

1. The use of galvanized steel guard rail would eliminate any need of yearly painting.
2. The grass cutting required would be approximately the same as that for the existing roadway.
3. The increase in pavement area would result in additional snowplowing, sanding and salting, but the present maintenance work force should be able to handle the extra work load.
4. The trimming of brush from ditches and slopes would be eliminated.
5. No repaving on the reconstructed section between York and Scarborough would be required for five to ten years after the completion of the reconstruction program.

REVENUE PROJECTIONS

Using the yearly traffic summaries of entering and departing traffic, an analysis was made by applying the Class 1 fares (passenger cars) to the 210 movements. The total revenue derived from this analysis was then compared to the total toll revenue received and the resultant factor is the effect that commercial vehicles have to the total revenue received. Table 3 summarizes this analysis.

Table 3 - Fare Analysis for other than Class 1 Vehicles

Year	Total Vehicles	Revenue (all @ Class I)	Actual Revenue	Commercial Vehicle Factor
1965	5,976,041	$5,999,945	6,758,420	1.126
1966	6,494,353	6,468,376	7,322,869	1.132
1967	6,823,940	6,701,109	7,645,849	1.141
1968	7,556,764	7,322,504	8,415,319	1.149
1969	8,413,496	8,068,543	9,382,779	1.163

The projected revenue was computed in the same manner for the years 1970, 1974, 1975, 1980, 1985 and 1990. The remaining years were extrapolated from the above six years.

The commercial vehicle factor was then applied and the resultant answer gives the projected revenue from tolls. The resultant revenue projections were made somewhat conservative by varying the commercial factor from 1.14 for the year 1970 to 1.00 for the year 1990. Table 4 summarizes the toll revenue projections. This is shown on the graph on page 28 also.

Additional revenues are received from the six service areas on the Turnpike. The recent Kennebunk Service Area report analyzed this income and the figures used in that report have been used for the mile 24 service area revenue. The income to be derived from the remaining four concession areas was projected, using the traffic figures and income per passing vehicle as previously analyzed. Table 5 summarizes the gross revenues from tolls and concessions.

It is believed that the predicted revenue figures, which are based upon these traffic figures, are justified. The average fare per vehicle which was used to determine the revenue was downgraded by neglecting much of the truck traffic on the Turnpike. The assumption was also made that no toll increases would go into effect between the present time and 1988.

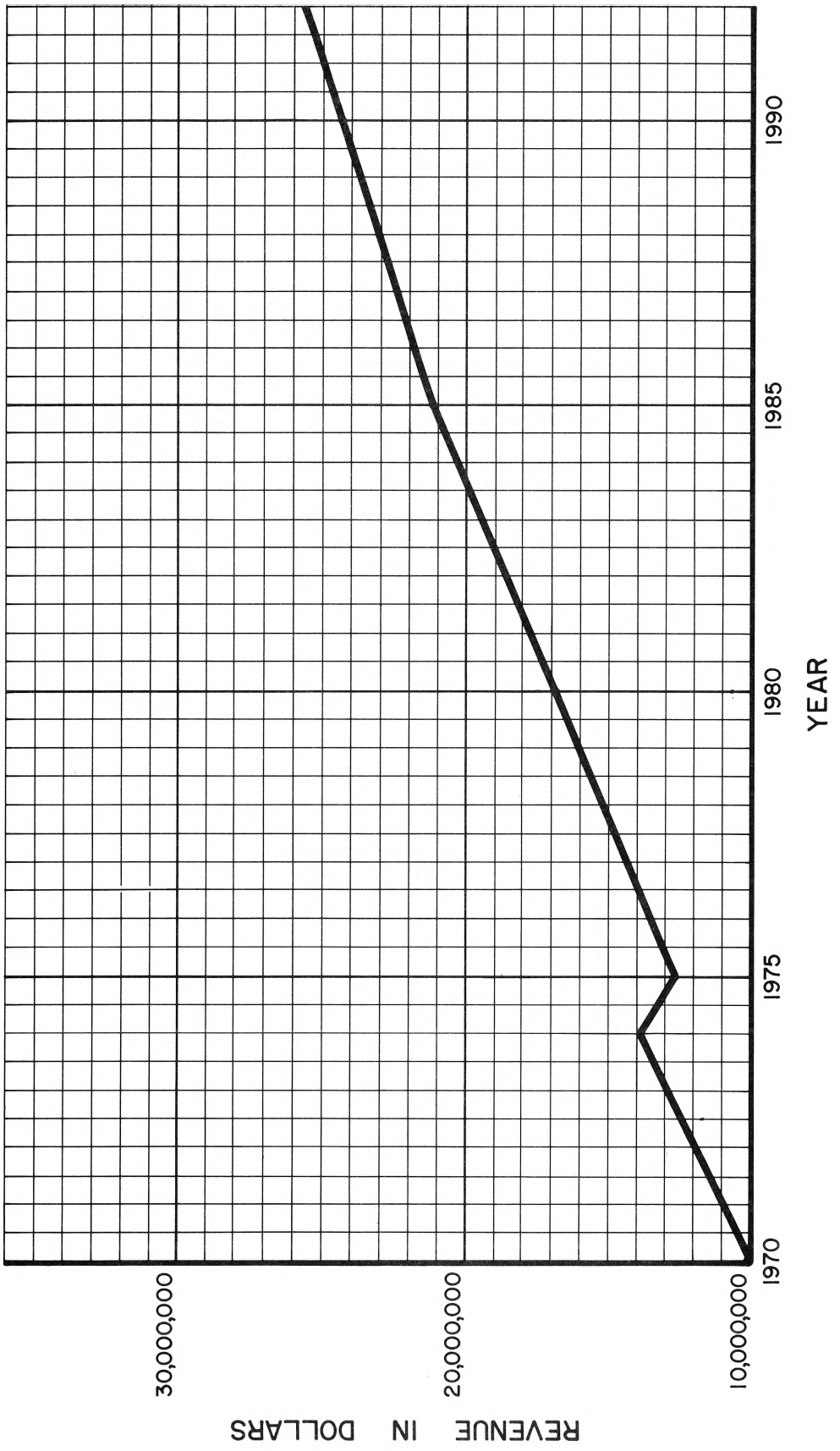
Table 4 - Toll Revenue Projections

Year	Revenue (all @ Class I)	Commercial Vehicle Factor	Toll Revenue
1970	8,810,200	1.14	10,044,000
1971	9,719,300	1.14	11,080,000
1972	10,628,400	1.13	12,010,000
1973	11,537,600	1.13	13,037,000
1974	12,446,700	1.12	13,940,000
1975	11,302,600	1.12	12,659,000
1976	12,145,100	1.11	13,481,000
1977	12,987,600	1.11	14,416,000
1978	13,830,000	1.10	15,213,000
1979	14,672,500	1.10	16,140,000
1980	15,515,000	1.09	16,911,000
1981	16,436,000	1.09	17,915,000
1982	17,356,900	1.08	18,745,000
1983	18,277,900	1.07	19,557,000
1984	19,198,800	1.06	20,351,000
1985	20,119,800	1.05	21,126,000
1986	20,957,200	1.04	21,795,000
1987	21,794,700	1.03	22,449,000
1988	22,632,100	1.02	23,085,000
1989	23,469,600	1.01	23,704,000
1990	24,307,000	1.00	24,307,000

Table 5 - Projected Gross Revenues

Year	Toll Revenue	Concession Revenue		Gross Revenue
		Section 1	Section 2	
1970	10,045,000	120,000	435,000	$10,600,000
1971	11,080,000	130,000	480,000	11,690,000
1972	12,010,000	140,000	530,000	12,680,000
1973	13,037,000	318,000	570,000	13,925,000
1974	13,940,000	336,000	620,000	14,896,000
1975	12,659,000	356,000	360,000	13,375,000
1976	13,481,000	375,000	385,000	14,241,000
1977	14,416,000	394,000	410,000	15,220,000
1978	15,213,000	413,000	435,000	16,061,000
1979	16,140,000	432,000	460,000	17,032,000
1980	16,911,000	452,000	490,000	17,853,000
1981	17,915,000	471,000	525,000	18,911,000
1982	18,745,000	490,000	560,000	19,795,000
1983	19,557,000	509,000	595,000	20,661,000
1984	20,351,000	529,000	630,000	21,510,000
1985	21,126,000	547,000	670,000	22,343,000
1986	21,795,000	566,000	700,000	23,061,000
1987	22,449,000	586,000	730,000	23,765,000
1988	23,085,000	604,000	760,000	24,449,000

PROJECTED ANNUAL INCOME FROM TOLLS



BOND REDEMPTION

The amortization chart on page 31 demonstrates how the reconstruction program could be undertaken without discontinuation of bond retirement. The funds needed to finance the project would be provided entirely by Turnpike revenue.

The column headed "Operation and Maintenance" on the chart was arrived at through an analysis of recent expenditures. The projected figures shown are the result of an approximate increase of 8% compounded annually.

The column headed "Reserve Maintenance" includes the cost of replacing the service areas at mile 24 (1971 and 1972) and the proposed Turnpike reconstruction project (1973 - 1980). This item also provides for the annual resurfacing of ten miles of Turnpike in both directions as shown in Table 6.

Table 6 - Estimate of Deposits to Reserve Maintenance Fund

Year	2 Lane Cost/Mile	Paving Costs	Misc.	Equip.	Replacing and Reconstruction	Total
1971	$ 52,000	1,040,000	150,000	110,000	1,700,000	3,000,000
1972	56,000	1,120,000	160,000	120,000	1,300,000	2,700,000
1973	60,000	1,200,000	170,000	130,000	8,084,000	9,584,000
1974	64,000	1,280,000	180,000	140,000	8,969,000	10,569,000
1975	68,000	1,360,000	190,000	150,000	6,600,000	8,300,000
1976	72,000	1,440,000	200,000	160,000	7,200,000	9,000,000
1977	76,000	1,520,000	210,000	170,000	8,000,000	9,900,000
1978	80,000	1,600,000	220,000	180,000	8,665,000	10,665,000
1979	84,000	1,680,000	230,000	190,000	6,000,000	8,100,000
1980	88,000	1,760,000	240,000	200,000	7,612,000	9,812,000
1981	92,000	1,840,000	250,000	210,000		2,300,000
1982	96,000	1,920,000	260,000	220,000		2,400,000
1983	100,000	2,000,000	270,000	230,000		2,500,000
1984	104,000	2,080,000	280,000	240,000		2,600,000
1985	108,000	2,160,000	290,000	250,000		2,700,000
1986	112,000	2,240,000	300,000	260,000		2,800,000
1987	116,000	2,320,000	310,000	270,000		2,900,000
1988	120,000	2,400,000	320,000	280,000		3,000,000

The column headed "Interest on Investments" takes into account the interest which the Turnpike Authority would receive from its various funds. Table 7 demonstrates how these figures were derived.

Table 7 - Estimate of Interest on Investments

Year	6% of Bond Interest*	6% of Reserve Fund Bal.	5.5% of Reserve Main.**	Total
1970	$70,084.80	280,339.20	55,000	405,424
1971	63,462.00	253,848.00	55,000 + 46,750	419,060
1972	57,572.40	230,289.60	55,000 + 35,750	378,612
1973	50,104.80	200,419.20	55,000 +222,310	527,834
1974	49,605.60	198,422.40	55,000 +246,648	549,676
1975	49,370.40	197,481.60	55,000 +181,500	483,352
1976	48,558.00	194,232.00	55,000 +198,000	495,790
1977	47,816.40	191,265.60	55,000 +220,000	514,082
1978	47,277.60	189,110.40	55,000 +238,288	529,676
1979	46,981.20	187,924.80	55,000 +165,000	454,906
1980	42,619.20	170,476.80	55,000 +209,330	477,426
1981	39,642.00	158,568.00	55,000	253,210
1982	26,257.20	105,028.80	55,000	186,286
1983	11,823.60	47,294.40	55,000	114,118

* Bond Interest Account = 1/2 of the account available for investment.

** Reserve Maintenance Account = $1,000,000 balance plus 1/2 of the reconstruction funds.

ESTIMATED RETIREMENT OF BOND DEBT

WITH PROVISIONS FOR REPLACEMENT OF MILE 24 SERVICE AREA AND TURNPIKE RECONSTRUCTION BETWEEN YORK & SCARBOROUGH

YEAR	GROSS REVENUE (2)	OPERATION & MAINTENANCE	RESERVE MAINTENANCE	INTEREST ON INVESTMENTS	NET REVENUE	INTEREST	SINKING FUND TRANSACTIONS		BOND REDEMPTIONS			
									PREMIUMS		RETIRED	BALANCE
							BALANCE	DRAFTS	PERCENT	AMOUNT		
1969	9,741,392.02	1,884,569.40	1,044,112.53	411,870.08	7,224,580.17	2,502,550.41	5,104,640	432,320	2.0	108,080	5,404,000	58,404,000
1970	10,600,000	2,181,500	1,300,000	405,424	7,523,924	2,336,160	4,672,320	441,520	2.0	110,380	5,519,000	52,885,000
1971	11,690,000	2,380,000	3,000,000	419,060	6,729,060	2,115,400	4,230,800	392,640	2.0	98,160	4,908,000	47,977,000
1972	12,680,000	2,590,000	2,700,000	378,612	7,768,612	1,919,080	3,838,160	497,840	2.0	124,460	6,223,000	41,754,000
1973	13,925,000	2,810,000	9,584,000	527,834	2,058,834	1,670,160	3,340,320	33,280	1.5	6,240	416,000	41,338,000
1974 (1)	14,896,000	3,040,000	10,569,000	549,676	1,836,676	1,653,520	3,307,040	15,680	1.5	2,940	196,000	41,142,000
1975	13,375,000	3,280,000	8,300,000	483,352	2,278,352	1,645,680	3,291,360	54,160	1.5	10,155	677,000	40,465,000
1976	14,241,000	3,540,000	9,000,000	495,790	2,196,790	1,618,600	3,237,200	49,440	1.5	9,270	618,000	39,847,000
1977	15,220,000	3,820,000	9,900,000	514,082	2,014,082	1,593,880	3,187,760	35,920	1.5	6,735	449,000	39,398,000
1978	16,061,000	4,120,000	10,665,000	529,676	1,805,676	1,575,920	3,151,840	19,760	1.0	2,470	247,000	39,151,000
1979	17,032,000	4,440,000	8,100,000	454,906	4,946,906	1,566,040	3,132,080	290,800	1.0	36,350	3,635,000	35,516,000
1980	17,853,000	4,790,000	9,812,000	477,426	3,728,426	1,420,640	2,841,280	198,480	1.0	24,810	2,481,000	33,035,000
1981	18,911,000	5,170,000	2,300,000	253,210	11,694,210	1,321,400	2,642,800	892,320	1.0	111,540	11,154,000	21,881,000
1982	19,795,000	5,580,000	2,400,000	186,286	12,001,286	875,240	1,750,480	962,240	0.5	60,140	12,028,000	9,853,000
1983	20,661,000	6,020,000	2,500,000	114,118	12,255,118	394,120	788,240	788,240	0.5	49,265	9,853,000	——
1984	21,510,000	6,500,000	2,600,000				+2,970,000					
1985	22,343,000	7,020,000	2,700,000									
1986	23,061,000	7,580,000	2,800,000									
1987	23,765,000	8,180,000	2,900,000									
1988	24,449,000	8,830,000	3,000,000									

(1) Assumed (I-295) Portland Loop and (I-95) Brunswick to Gardiner would be open to traffic Nov. 15, 1974
(2) Includes revenue from tolls and concessions

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
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1946 - 1969

December 8, 1970

Maine Turnpike Authority
Post Office Box 839
Portland, Maine 04104

Gentlemen:

Subsequent to submitting our Reconstruction Report on Section 1 of the Turnpike, we completed our studies on the Saco River Bridge and the installation of median guard rail on Section 2. These studies were presented to the Authority on November 5, 1970 at which time we were requested to prepare a revised amortization chart (Estimated Retirement of Bond Debt) showing the necessary deposits to the Reserve Maintenance Fund.

The revised maintenance fund deposits are based upon constructing one twelve mile section of median guard rail in 1971 and the remaining four thirteen mile sections in 1972 and 1973. There is a sufficient reserve in the 1971 Reserve Maintenance Fund to construct the initial contract without revising the reserve maintenance deposit that was approved on October 8, 1970. The total estimated cost of $2,100,000.00 for median guard rail will be deposited in 1972.

Reconstruction of the Saco River Bridge is scheduled for 1972, and the estimated cost of $2,500,000.00 will be deposited in 1972.

Because Section 1 will be repaved while being reconstructed, it was felt that the paving costs previously estimated in Table 6 of the Reconstruction Report could be reduced during the years' 1973 to 1978.

The enclosed amortization chart has been revised in order to show the revised reconstruction program. It is anticipated that this chart will be periodically revised as final year end figures are available and at other times during the program as may be appropriate.

Very truly yours,

Howard, Needles, Tammen & Bergendoff

W. M. Wachter

WMW/bb

Enclosure

ESTIMATED RETIREMENT OF BOND DEBT

WITH PROVISIONS FOR REPLACEMENT OF MILE 24 SERVICE AREA AND TURNPIKE RECONSTRUCTION BETWEEN YORK AND SCARBOROUGH

YEAR	GROSS REVENUE (2)	OPERATION AND MAINTENANCE	RESERVE MAINTENANCE	INTEREST ON INVESTMENTS	NET REVENUE	INTEREST	SINKING FUND TRANSACTIONS		BOND REDEMPTIONS			
									PREMIUMS		RETIRED	BALANCE
							BALANCE	DRAFTS	PERCENT	AMOUNT		
1969	9,741,392.02	1,884,569.40	1,044,112.53	411,870.08	7,224,580.17	2,502,550.41	5,104,640	432,320	2.0	108,080	5,404,000	58,404,000
1970	10,600,000	2,181,500	1,300,000	405,424	7,523,924	2,336,160	4,672,320	441,520	2.0	110,380	5,519,000	52,885,000
1971	11,690,000	2,380,000	3,000,000	419,060	6,729,060	2,115,400	4,230,800	392,640	2.0	98,160	4,908,000	47,977,000
1972	12,680,000	2,590,000	7,300,000	505,112	3,295,112	1,919,080	3,838,160	117,120	2.0	29,280	1,464,000	46,513,000
1973	13,925,000	2,810,000	9,084,000	556,388	2,587,388	1,860,520	3,721,040	62,160	1.5	11,655	777,000	45,736,000
1974(1)	14,896,000	3,040,000	9,569,000	576,064	2,863,064	1,829,440	3,658,880	88,400	1.5	16,575	1,105,000	44,631,000
1975	13,375,000	3,280,000	7,300,000	504,286	3,299,286	1,785,240	3,570,480	129,520	1.5	24,285	1,619,000	43,012,000
1976	14,241,000	3,540,000	8,000,000	511,072	3,212,072	1,720,480	3,440,960	127,600	1.5	23,925	1,595,000	41,417,000
1977	15,220,000	3,820,000	8,900,000	523,502	3,023,502	1,656,680	3,313,360	116,960	1.5	21,930	1,462,000	39,955,000
1978	16,061,000	4,120,000	9,665,000	533,018	2,809,018	1,598,200	3,196,400	104,160	1.0	13,020	1,302,000	38,653,000
1979	17,032,000	4,440,000	8,100,000	451,918	4,943,918	1,546,120	3,092,240	292,320	1.0	36,540	3,654,000	34,999,000
1980	17,853,000	4,790,000	7,312,000	405,574	6,156,574	1,399,960	2,799,920	409,200	1.0	51,150	5,115,000	29,884,000
1981	18,911,000	5,170,000	2,300,000	234,304	11,675,304	1,195,360	2,390,720	901,520	1.0	112,690	11,269,000	18,615,000
1982	19,795,000	5,580,000	2,400,000	166,690	11,981,690	744,600	1,489,200	971,840	0.5	60,740	12,148,000	6,467,000
1983	20,661,000	6,020,000	2,500,000	93,802	12,234,802	258,680	517,360	517,360	0.5	32,335	6,467,000	
1984	21,510,000	6,500,000	2,600,000				+6,480,000					
1985	22,343,000	7,020,000	2,700,000									
1986	23,061,000	7,580,000	2,800,000									
1987	23,765,000	8,180,000	2,900,000									
1988	24,449,000	8,830,000	3,000,000									December 1970

(1) Assumed (I-295) Portland Loop and (I-95) Brunswick to Gardiner would be open to traffic November 15, 1974

(2) Includes revenue from tolls and concessions