

12-15-1964

Highway Needs and Finance in Maine: a Report on the 1965 Highway-user Tax Study

Maine State Highway Commission

Roy Jorgensen and Associates

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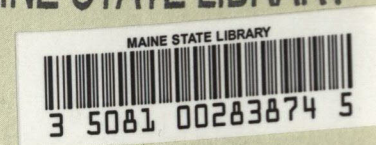
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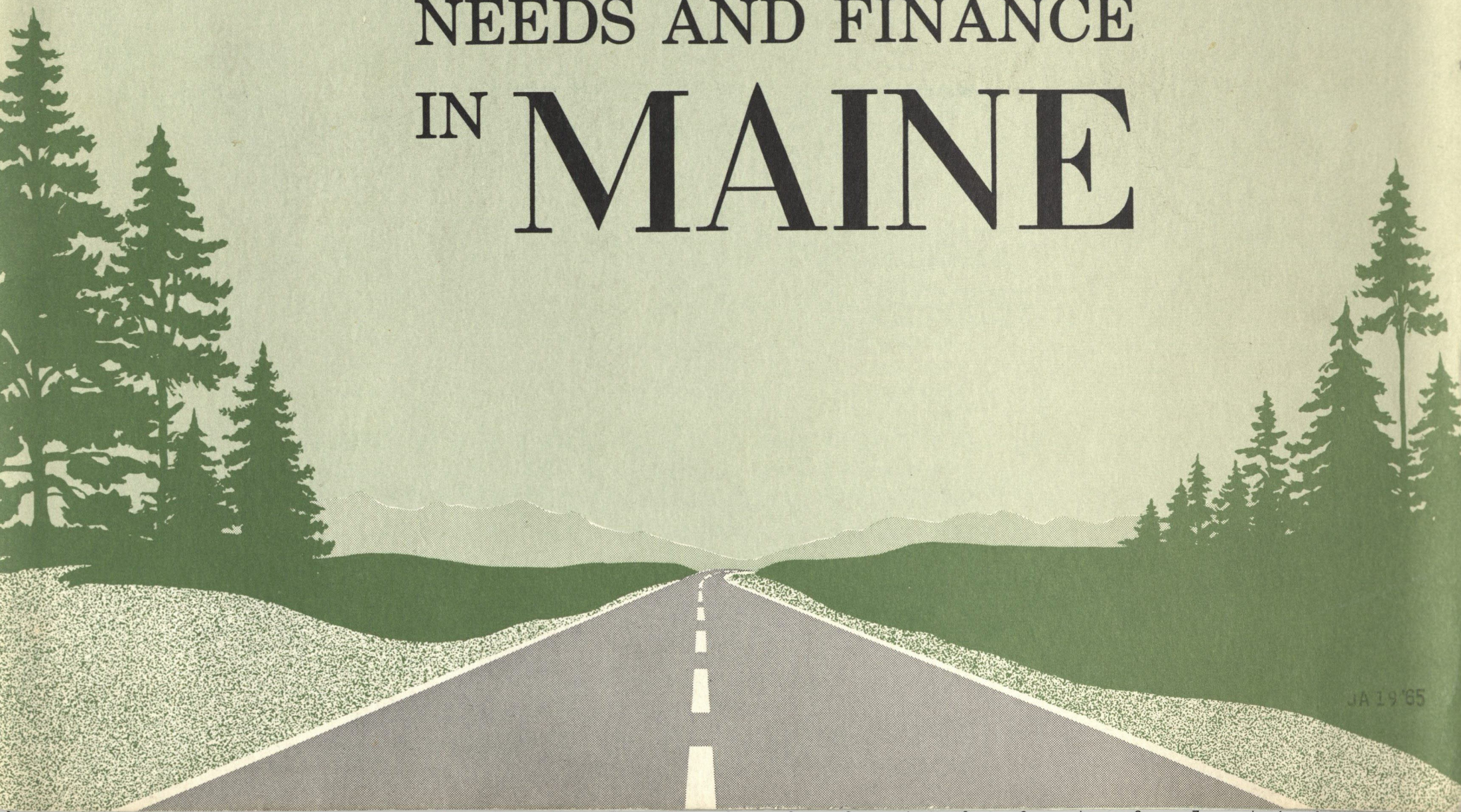
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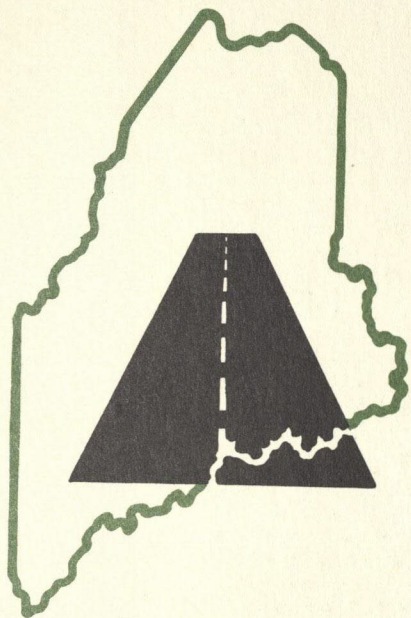
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HIGHWAY NEEDS AND FINANCE IN MAINE



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HIGHWAY NEEDS and FINANCE in

MAINE

a report on the
1965 Highway-User
Tax Study

prepared for the
**MAINE STATE
HIGHWAY COMMISSION**
by
**ROY JORGENSEN
AND ASSOCIATES**
highway engineering and
management consultants

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ROY JORGENSEN AND ASSOCIATES
Highway Engineering and Management Consultants

December 15, 1964

POST OFFICE BOX 575
GAITHERSBURG, MARYLAND

Mr. David H. Stevens, Chairman
Maine State Highway Commission
Augusta, Maine

Dear Mr. Stevens:

We are pleased to submit this report on Maine highway needs and finance as resulting from the 1965 Highway-User Tax Study.

This study was conducted in accordance with the agreement between the State Highway Commission and our organization of highway engineering and management consultants.

Our assignment involved the determination of existing and projected construction needs on all systems, an analysis of past and projected highway revenues and expenditures, and the determination of cost responsibility for highway users and non-users.

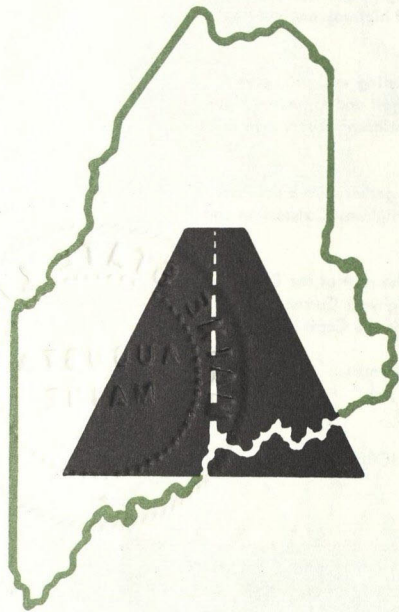
This study included a review and updating of data gathered in a previous highway-user tax study and reported to the State Highway Commission and the 1961 session of the State Legislature.

We appreciate the cooperation and assistance of the staff of the Division of Planning and Traffic and others in the State Highway Commission, as well as many officials and interested parties outside the Commission.

Very truly yours,


ROY E. JORGENSEN

MAINE STATE HIGHWAY COMMISSION



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FOREWORD

The 1963 session of the Maine Legislature authorized and directed the State Highway Commission to have a review made of the highway-user tax study of 1960 as reported to the Commission and the 1961 session by Wilbur Smith and Associates, consulting engineers of New Haven, Connecticut.

The Commission retained Roy Jorgensen and Associates, highway engineering and management consultants of Gaithersburg, Maryland, to conduct a full and comprehensive highway-user tax study, including a review and updating of data from the previous study.

The new study, referred to as the 1965 Highway-User Tax Study, was started in November 1963 and is concluded with this report to the Commission for consideration by the 1965 session of the Legislature.

This report contains a concise but complete presentation of the findings and recommendations of the Consultant in the areas of existing and future needs, past and projected revenues and expenditures, and allocation of cost responsibility between classes of highway users and between users and non-users.

In conducting the study, the Consultant worked directly with staff personnel of the Commission — particularly those of the Division of Planning and Traffic. All data and materials gathered and developed during the study will be transmitted to the Commission for use in its regular planning activities.

STATE OF MAINE

101st Legislature

H. P. 369 — L. D. 542

RESOLVE, Authorizing a Review of Maine Highway User Tax Study.

Maine Highway User Tax Study; State Highway Commission authorized to review. Resolved: That the State Highway Commission arrange to have a review made of the Maine Highway User Tax Study, which study was made by Wilbur Smith and Associates, Consulting Engineers, of New Haven, Connecticut and filed with the Legislative Research Committee by the State Highway Commission on December 7, 1960, the review to be made by the Planning and Traffic Division of the Maine State Highway Commission or by consulting engineers to be employed by the commission. The State Highway Commission is to file with the Legislative Research Committee a report containing a review of the Maine Highway User Tax Study before November 1, 1964. The Legislative Research Committee is directed to transmit the report, with any recommendations it wishes to make in regard to the review, to the 102nd Legislature before January 15, 1965.

Approved by the Governor April 26, 1963.



CONTENTS

	PAGE
SUMMARY AND RECOMMENDATIONS	viii
chapter 1 COMPARATIVE DATA: NEW ENGLAND STATES	1
chapter 2 HIGHWAY SYSTEMS	11
chapter 3 HIGHWAY NEEDS	15
chapter 4 HIGHWAY REVENUES AND EXPENDITURES	23
chapter 5 HIGHWAY COST RESPONSIBILITY	33

SUMMARY AND RECOMMENDATIONS

Maine highway needs and finance data in this report are directed to a 17-year program extending from 1966 to 1982.

This provides a goal for state-wide highway development: All roads improved to minimum acceptable standards by the end of the program period, 1982.

It establishes a basis for presentation and comparison of needs, revenues, expenditures and cost responsibility.

HIGHWAY NEEDS

Existing and future needs have been determined for rural and urban portions of the seven highway systems under State and local jurisdiction.

Construction needs total almost 1.5 billion dollars for the 17-year period — an average of approximately 87 million dollars annually.

Maintenance and other needs will require more than 900 million dollars during the program period — an average of 53 million dollars annually.

That adds up to almost 2.4 billion dollars in total program requirements from 1966 to 1982 — an average of 140 million dollars per year.

FOR 17-YEAR PROGRAM FROM 1966 TO 1982

Construction Needs	Rural	State Highway, Federal-aid Interstate	\$ 106,000,000
		State Highway, Federal-aid Primary	291,000,000
		State Highway, Federal-aid Secondary	151,000,000
		State-aid, Federal-aid Secondary	100,000,000
		State Highway, Non-federal-aid	45,000,000
		State-aid, Non-federal-aid	234,000,000
		Town Way	91,000,000
	Urban	State Highway, Federal-aid Interstate	28,000,000
		State Highway, Federal-aid Primary	44,000,000
		State Highway, Federal-aid Secondary	25,000,000
		State-aid, Federal-aid Secondary	16,000,000
		State Highway, Non-federal-aid	10,000,000
		State-aid, Non-federal-aid	73,000,000
		Town Way	261,000,000
	All Systems		\$1,475,000,000
Maintenance and Other Needs	State	Maintenance	\$ 370,000,000
		Debt Service, Administration, Other	197,000,000
	Local	Maintenance	298,000,000
		Administration	39,000,000
	State and Local		\$ 904,000,000

TOTAL NEEDS

\$2,379,000,000

HIGHWAY REVENUES AND EXPENDITURES

Projected highway revenues from federal, state and local sources total almost 1.7 billion dollars for the 17-year period — an average of approximately 99 million dollars annually.

After providing for maintenance, administration and other non-construction expenditures, only 778 million dollars will be available for construction — an average of approximately 46 million dollars per year.

That amounts to an average annual deficit of 41 million dollars — the difference between construction needs and funds available for construction.

Almost 24 million dollars annually is lacking at the state level and more than 17 million dollars annually at the local level.

Total Highway Revenues during 17-year Program:	\$ 411,000,000 from federal-aid 875,000,000 from state sources 396,000,000 from local sources
	\$1,682,000,000 from all sources

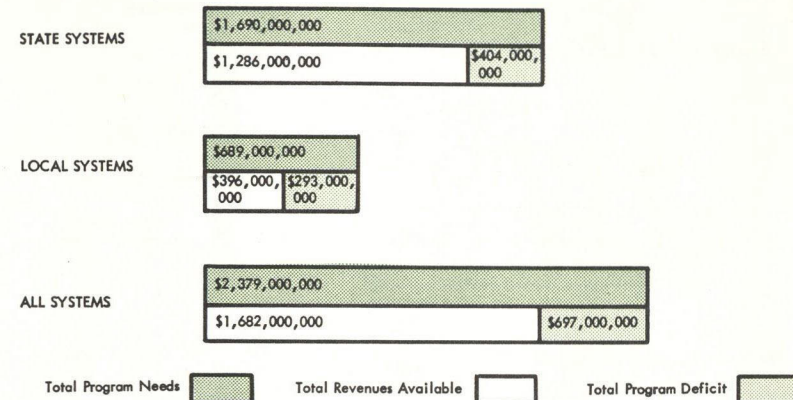
Revenues Required for Non-construction Expenditures:	\$ 567,000,000 for state systems 337,000,000 for local systems
	\$ 904,000,000 for all systems

Balance of Revenues Available for Construction:	\$ 411,000,000 from federal-aid 308,000,000 from state sources 59,000,000 from local sources
	\$ 778,000,000 from all sources

Total 17-year Construction Needs:	\$1,123,000,000 for state systems 352,000,000 for local systems
	\$1,475,000,000 for all systems

Program Deficit:	\$ 404,000,000 for state systems 293,000,000 for local systems
	\$ 697,000,000 for all systems — or a deficit of \$41,000,000 each year

COMPARISON OF PROGRAM NEEDS WITH REVENUES AVAILABLE DURING 17-YEAR PERIOD



COMPARATIVE CONSTRUCTION PROGRAMS

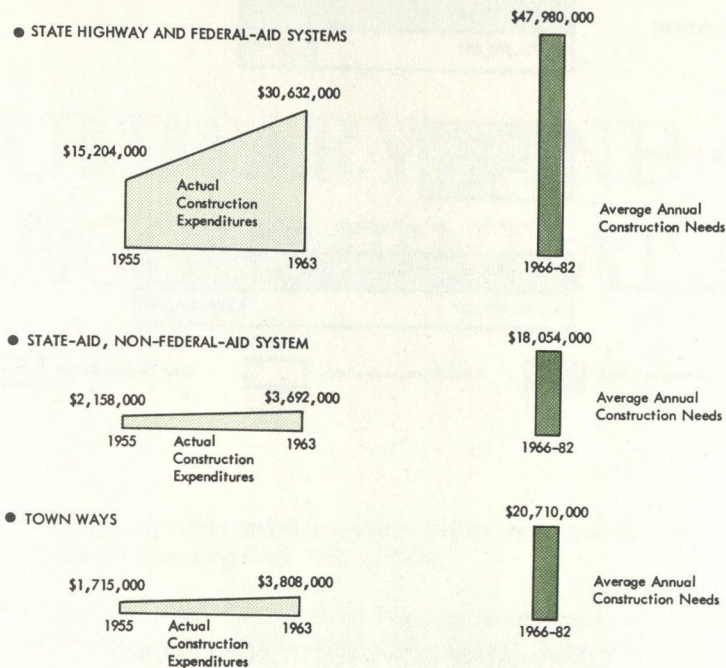
The accompanying charts illustrate the trends of construction expenditures on the state and local highway systems over the last nine years and compare these trends with the average annual construction needs determined in this study.

The average annual needs for 1966 to 1982 are shown at the mid-point of the 17-year program period as an indication of the requirement for increasing expenditures to meet needed improvements.

The trend of past expenditures on the state highway and federal-aid systems indicates that nearly all of these systems could be improved to minimum acceptable standards if the same trend were continued in the future.

The trends of expenditures on both the state-aid, non-federal-aid system and the town ways obviously are far below average annual needs for the future program.

RECENT EXPENDITURES AND FUTURE NEEDS



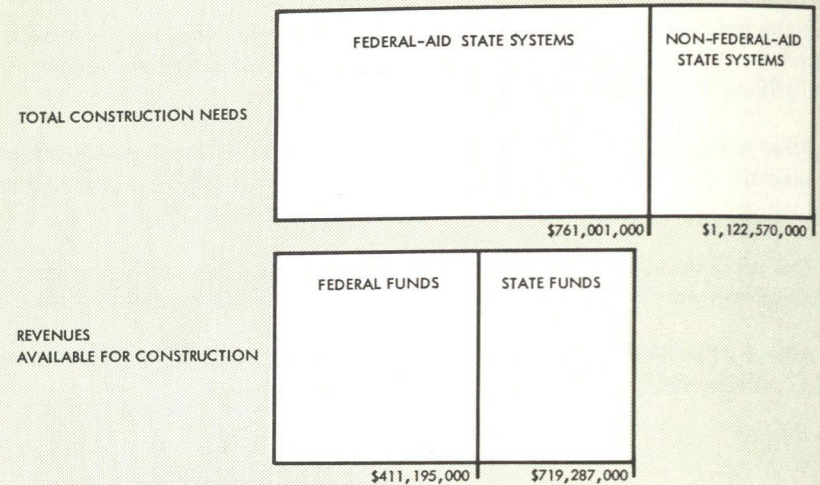
FINANCIAL SITUATION FOR STATE SYSTEMS

This chart compares construction needs on the state systems with funds expected to be available for construction during the 17-year program period.

If present revenue sources plus federal-aid are not changed, Maine will be 404 million dollars short of providing sufficient funds to overcome state construction needs — an average annual deficit of almost 24 million dollars.

Revenues available for construction are sufficient to provide for almost complete modernization of the federal-aid networks. These are the most important routes in the State, and every effort should be made to improve them first.

STATE CONSTRUCTION NEEDS AND REVENUES AVAILABLE DURING 17-YEAR PROGRAM



HIGHWAY COST RESPONSIBILITY

The allocation of highway cost responsibility in this study determined that 61.556 per cent of the total 17-year program costs should be assigned to highway users. The users should be assigned 78.5 per cent of the state systems costs and 30.5 per cent of the local systems costs. The share of the total program costs allocated to the various classes of vehicles is listed in Table 36.

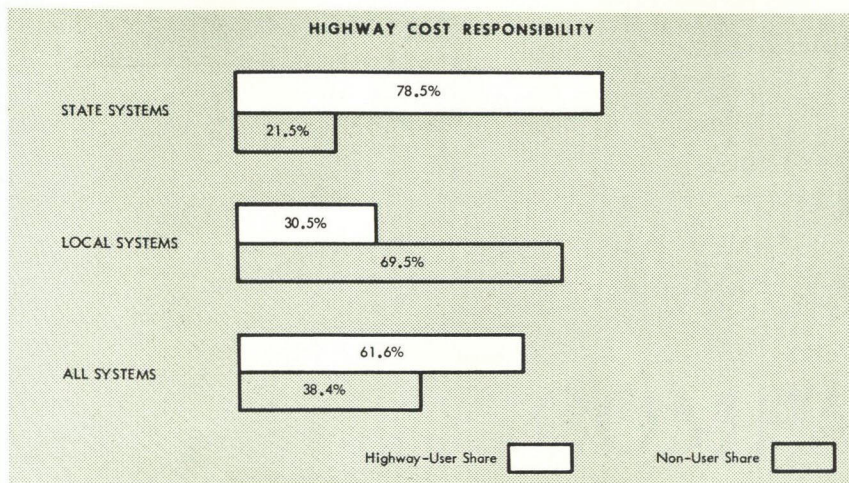
Highway-user revenues largely are derived from motor fuel taxes, motor vehicle registration fees and operator's license fees. These revenues are predominately used to construct and maintain the state systems.

The remaining 38.444 per cent of the 1966-1982 program costs was determined to be a responsibility of non-users. Non-user revenues historically have been derived largely from excise taxes and real property taxes, plus State General Fund appropriations for partial support of the State Police.

The accompanying charts show how the program costs and projected revenues are distributed between highway users and non-users on the state and local systems.

The deficits shown indicate that the state systems require each year an additional 14.8 million dollars in highway-user revenues plus 8.9 million dollars in non-user revenues just to raise the highways to minimum acceptable standards by 1982.

They further indicate that of the 24.3-million-dollar deficit in highway-user revenues, 14.8 million dollars is required for the state systems and 9.5 million dollars for the local systems.



RECOMMENDATIONS

The following recommendations are presented to summarize the general findings of this study:

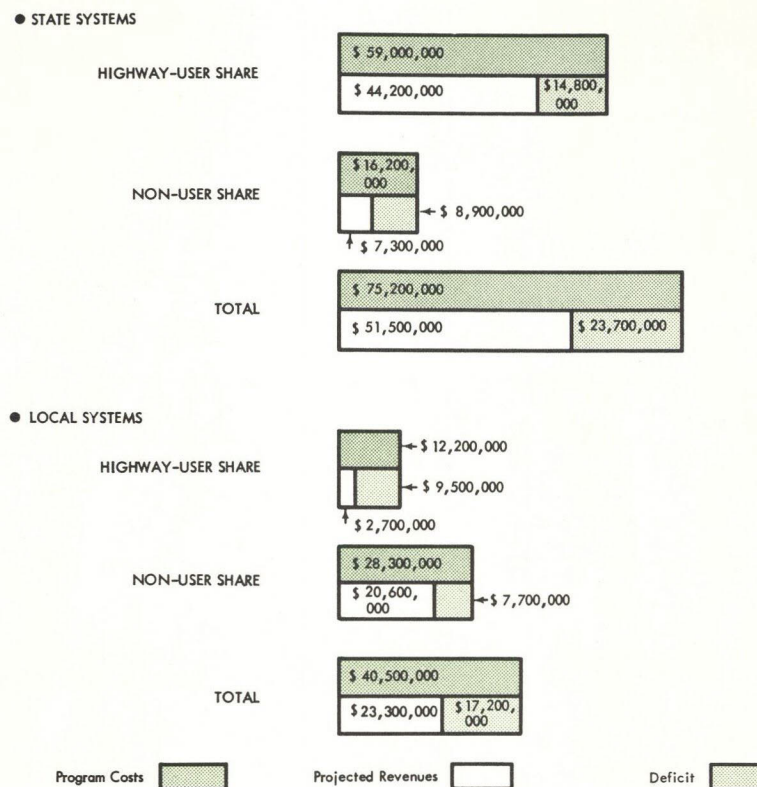
1. The State Highway Commission and the local governments should adopt a 17-year program as their long-range improvement objective. If this objective were achieved, every highway and street in the State would be improved to an acceptable standard by the end of the period.
2. In view of the limited funds available for construction, the State Highway Commission and the local governments should make every effort to improve the most important routes first.
3. Effort needs to be made to provide additional non-user revenues at both the state and local levels to achieve tax equity.
4. If additional highway-user revenues are to be raised, they should be assessed generally in the same ratio as the current tax schedules.

The agreement for the 1965 Highway-User Tax Study does not call for the Consultant to recommend specific tax measures. Only the Legislature can fully evaluate all the factors which influence the raising of highway revenues.

The Consultant has endeavored to provide all basic data necessary in this report, and is prepared to apply these data to the development of any tax schedule which the Legislature or the State Highway Commission may specify and wish to consider.

COMPARISON OF AVERAGE ANNUAL HIGHWAY COST RESPONSIBILITY WITH PROJECTED REVENUES FOR 17-YEAR PROGRAM

(excludes federal funds)



COMPARATIVE DATA: NEW ENGLAND STATES

Virtually all of the data in this report pertain to state and local highway matters — primarily highway needs and highway finance — within the State of Maine.

These are the data which are most significant as a basis for administrative and engineering policies and decisions by Maine's highway officials, as well as for legislative action by the Maine Legislature.

There is value, however, in comparing certain features of Maine's highway program with those of other states — particularly its neighboring states in New England. Conditions affecting highway operations vary in every state, but the perspective gained from comparison offers an advantage for anyone concerned with highway matters.

This chapter, therefore, is devoted to comparison of highway data for Maine and the other New England states: Connecticut, Massachusetts, New Hampshire, Rhode Island and Vermont.

ROAD MILEAGE AND POPULATION

The population of New England states varies from more than 5,000,000 in Massachusetts to less than 400,000 in Vermont (1960 data). Maine ranks third among the six states with almost a million people.

Total road mileage ranges from approximately 26,500 miles in Massachusetts to less than 4,500 miles in Rhode Island (1962 data). Maine follows Massachusetts with just under 21,000 miles.

Vermont has 186 feet of road per capita, compared with 27 feet in Massachusetts and Rhode Island. Maine has 114 feet per person and ranks third.

More than half of Maine's total road mileage is state-administered, and it ranks well ahead of other New England states in this category. State-administered mileage varies from more than 11,000 miles in Maine to less than 1,000 in Rhode Island (1962 data).

Maine has 61 feet of state-administered road per capita, compared to as little as 2 feet per person in Massachusetts.

HIGHWAY REVENUES

Highway revenues for state-administered roads in New England vary from almost \$190,000,000 in Connecticut to approximately \$37,500,000 in New Hampshire (1962 data). Maine ranks third at better than \$54,000,000.

Vermont averages \$104.75 in revenues per capita for state-administered roads compared to a low of \$30.07 for Massachusetts. Maine is fourth with \$55.96 per person.

Massachusetts receives almost \$64,000 in revenues per mile of state highway, while Maine trails all five states with \$4,806 per mile.

Vermont averages \$257.26 in revenues for state-administered roads per registered vehicle, well above the \$80.75 for Massachusetts. Maine ranks third at \$136.94 per vehicle.

Connecticut and Rhode Island both exceed \$37,500 in revenues for state-administered roads per square mile of land area. Maine is last among the six states with \$1,749 per square mile.

CAPITAL OUTLAYS

Capital outlays for state-administered roads in New England range from more than \$108,000,000 in Connecticut to less than \$26,000,000 in New Hampshire (1962 data). Maine is third with approximately \$33,000,000.

Vermont averages \$81.38 in capital outlays per capita, and Massachusetts spends \$17.64 per person. Maine ranks fourth at \$34.17.

Massachusetts leads with more than \$37,000 in capital outlays per mile of state-administered roads, while Maine is low for the region with \$2,935 per mile.

Vermont spends almost \$200 per registered vehicle, compared to less than \$50 for Massachusetts. Maine ranks fourth at \$83.63 per vehicle.

2 Rhode Island's capital outlays for state-administered roads per square mile of land area average almost \$25,000. Maine ranks last in New England with \$1,068 per square mile.

Table 1
ROAD MILEAGE IN RELATION TO POPULATION
IN NEW ENGLAND STATES

	1960 Population	1962 Total Mileage	Feet of Road Per Capita	1962 State- Administered Mileage	Feet of State- Administered Road Per Capita
MAINE	969,000	20,958	114	11,286	61
Connecticut	2,535,000	17,074	36	3,396	7
Massachusetts	5,149,000	26,438	27	2,432	2
New Hampshire	607,000	14,164	123	4,147	36
Rhode Island	859,000	4,380	27	958	6
Vermont	390,000	13,766	186	2,227	30

Source: U. S. Department of Commerce, Bureau of Public Roads and Bureau of the Census.

Table 2
HIGHWAY REVENUES AND CAPITAL OUTLAYS
FOR STATE-ADMINISTERED ROADS
IN RELATION TO VARIOUS FACTORS IN NEW ENGLAND STATES

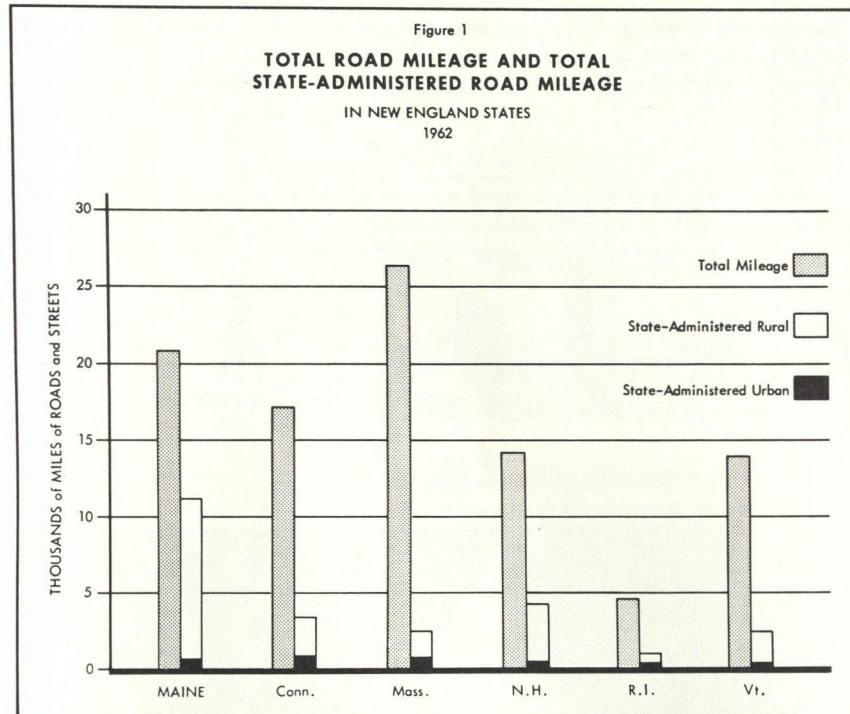
1962

HIGHWAY REVENUES					
	Total	Per Capita	Per Mile of State Highway	Per Registered Vehicle	Per Square Mile of Land Area
MAINE	\$54,240,000	\$55.96	\$4,806	\$136.94	\$1,749
Connecticut	189,981,000	74.94	55,943	158.50	38,780
Massachusetts	154,842,000	30.07	63,669	80.75	19,682
New Hampshire	37,564,000	61.89	9,058	133.35	4,167
Rhode Island	39,680,000	46.17	41,420	110.54	37,505
Vermont	40,842,000	104.75	18,339	257.26	4,403
CAPITAL OUTLAYS					
MAINE	\$33,123,000	\$34.17	\$2,935	\$83.63	\$1,068
Connecticut	108,603,000	42.84	31,980	90.61	22,168
Massachusetts	90,810,000	17.64	37,339	47.36	11,543
New Hampshire	25,843,000	42.58	6,232	91.74	2,867
Rhode Island	26,428,000	30.75	27,587	73.62	24,979
Vermont	31,729,000	81.38	14,247	199.86	3,421

Source: U. S. Department of Commerce, Bureau of Public Roads and Bureau of the Census.

GRAPHICAL PRESENTATION

Figures 1 through 7 show the relative position of Maine when compared with other New England states in regard to several factors involving road mileage, highway revenues and capital outlays (1961 or 1962 data).



Source: U.S. Department of Commerce, Bureau of Public Roads, Highway Statistics, 1962.

Figure 1 indicates that Maine ranks second in total road mileage and first in total state-administered road mileage (more than twice the state-administered mileage of any other state). It also shows that Maine is first in state-administered rural mileage and second in state-administered urban mileage.

Figure 2 shows that Maine is third in total road mileage and first in total state-administered road mileage per 1,000 population. It also points out that Maine ranks first in state-administered rural mileage and state-administered urban mileage per 1,000 population.

Figure 3 indicates that Maine ranks third in highway revenues for state-administered roads and third in capital outlays for state-administered roads.

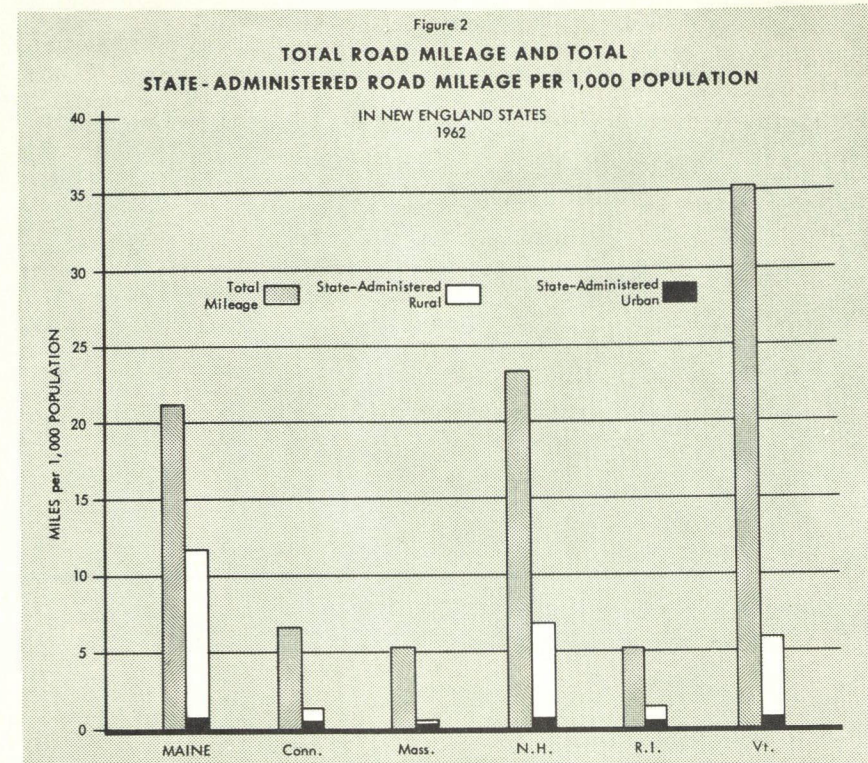
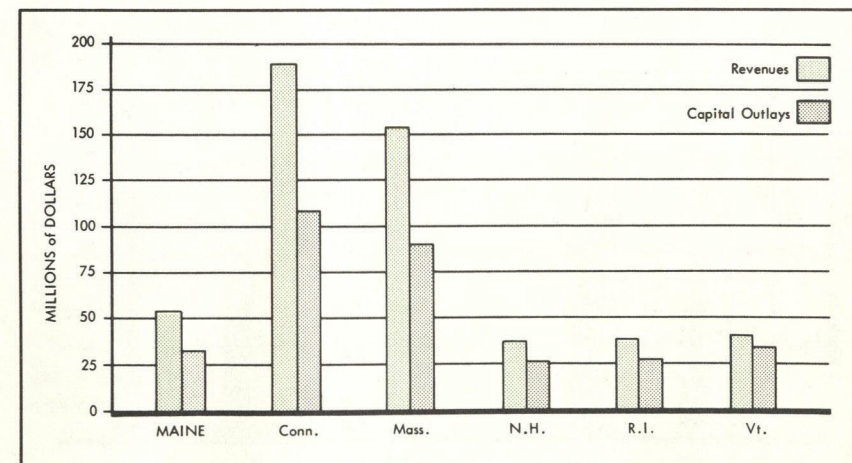
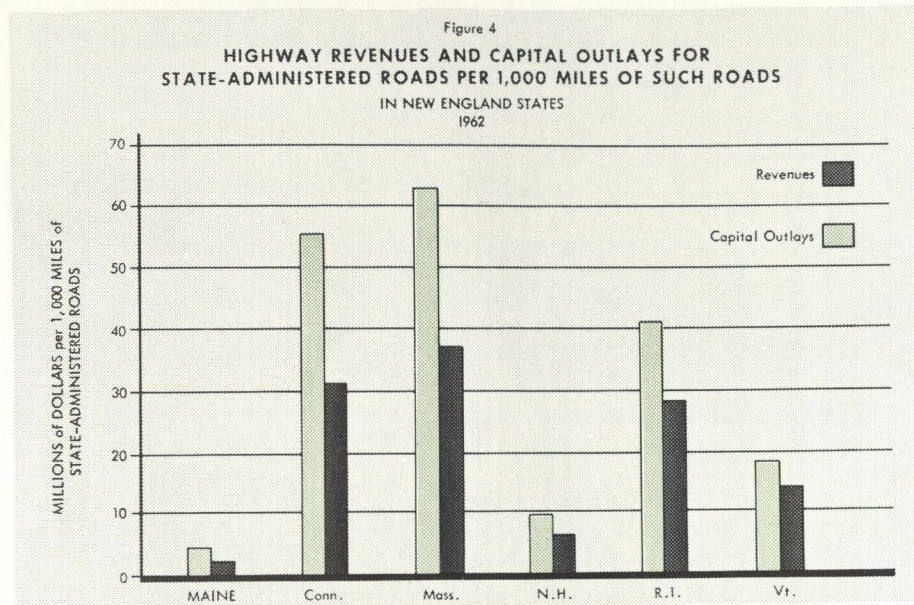


Figure 3
HIGHWAY REVENUES AND CAPITAL OUTLAYS FOR STATE-ADMINISTERED ROADS
IN NEW ENGLAND STATES
1962

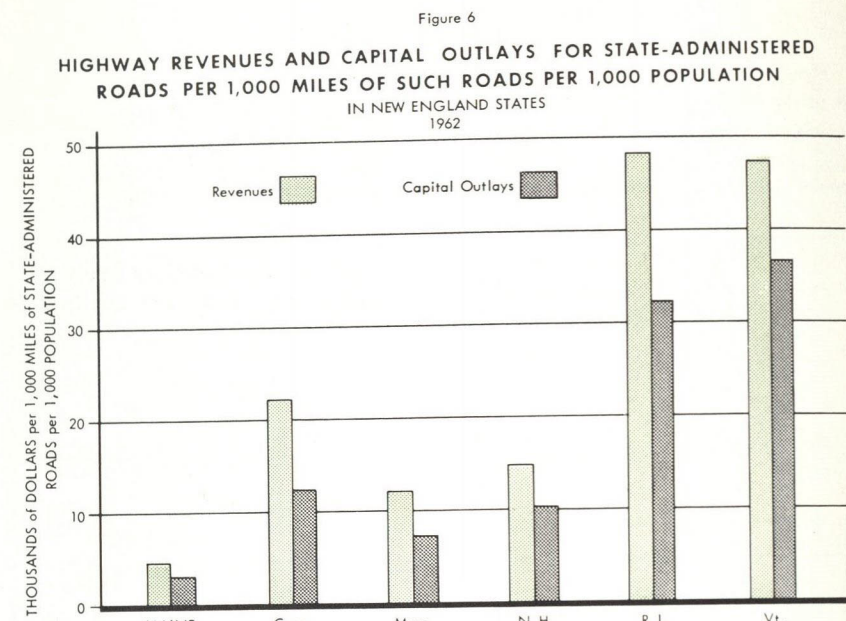


Source: U.S. Department of Commerce, Bureau of Public Roads, Highway Statistics, 1962.



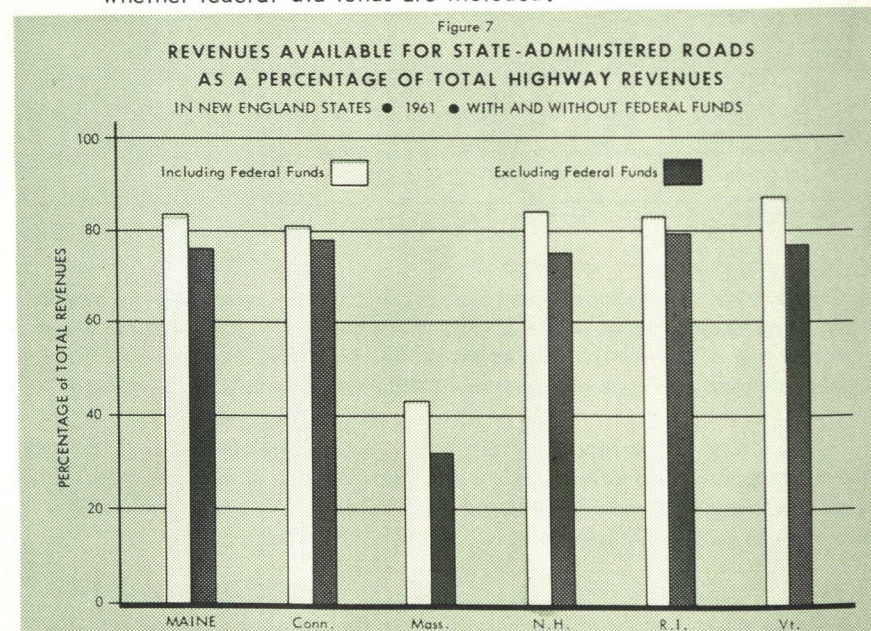
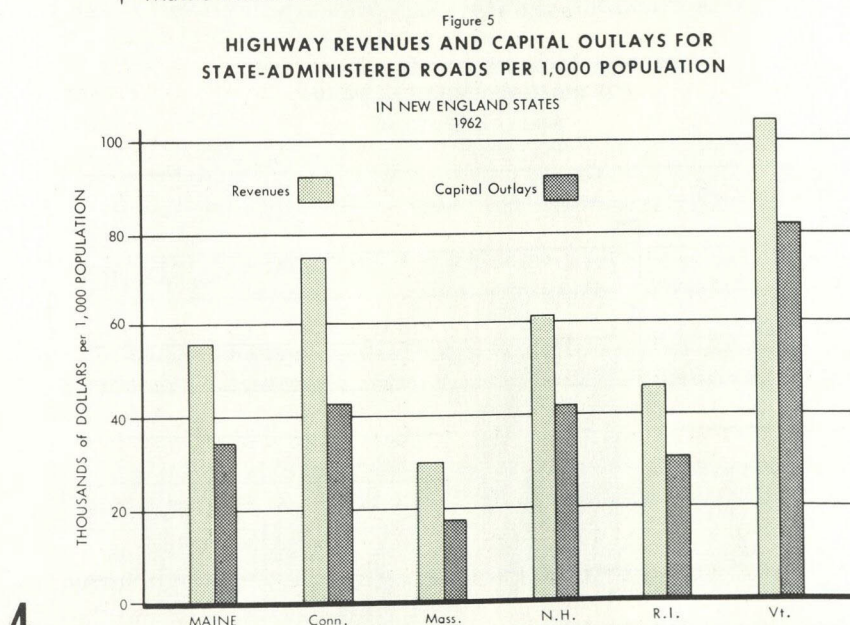
↑ Maine is low among New England states.

↓ Maine ranks fourth.



↑ Maine is last among the six states.

↓ Maine ranks third or fourth, depending on whether federal-aid funds are included.



Source: U.S. Department of Commerce, Bureau of Public Roads, Highway Statistics, 1962.

Summary

The preceding data illustrate the problem of highway development which places Maine in a singular position among New England states.

Maine's great land area and relatively high state-administered road mileage, combined with its low population density, impose a greater proportionate responsibility for highway development on Maine residents than on the residents of any other New England state.

The problem is further compounded because highway travel in Maine is producing less available revenues for state-administered roads per capita than in most of the other New England states, despite the fact that Maine's user tax schedules are among the highest in the region.

MOTOR VEHICLE REGISTRATIONS

Motor vehicle registrations in New England states range from almost 2,000,000 in Massachusetts to little more than 150,000 in Vermont (1962 data). Maine ranks third with 396,085 motor vehicles, well below Massachusetts and Connecticut.

Massachusetts also leads the six-state region in truck registrations with more than 200,000, compared to a low of approximately 31,000 in Vermont. Maine follows Massachusetts and Connecticut with 73,349 trucks.

Table 3
MOTOR VEHICLE REGISTRATIONS IN NEW ENGLAND STATES

	1955	1956	1957	1958	1959	1960	1961	1962
MAINE	322,674	344,135	346,290	357,237	367,070	374,318	384,371	396,085
Connecticut	921,229	970,750	1,007,653	1,028,715	1,061,069	1,107,353	1,143,500	1,198,604
Massachusetts	1,546,234	1,619,140	1,672,261	1,689,522	1,737,546	1,763,313	1,858,946	1,917,575
New Hampshire	212,452	225,341	232,389	238,336	251,716	256,343	276,047	281,705
Rhode Island	308,148	317,196	320,425	324,170	332,111	340,598	347,724	358,960
Vermont	136,307	141,295	144,596	145,413	149,336	151,976	154,963	158,756

Table 4

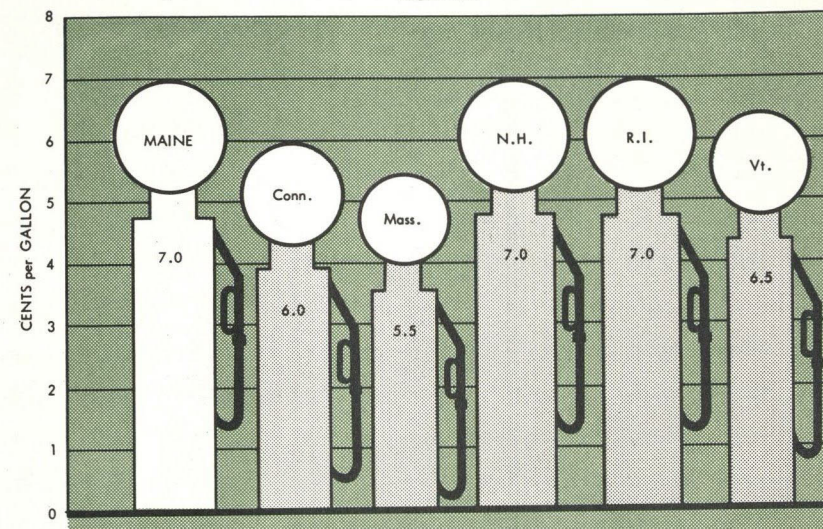
TRUCK REGISTRATIONS IN NEW ENGLAND STATES

	1955	1956	1957	1958	1959	1960	1961	1962
MAINE	68,796	71,717	70,538	73,444	74,146	72,200	73,236	76,349
Connecticut	106,669	120,363	121,439	122,702	122,706	124,300	128,264	132,683
Massachusetts	180,756	184,501	187,504	182,312	186,106	191,806	193,949	201,089
New Hampshire	37,830	43,211	43,777	44,221	45,407	45,759	45,869	49,553
Rhode Island	36,962	37,869	37,646	37,166	36,941	37,017	37,646	39,053
Vermont	15,304	28,096 ^{1/}	28,341	28,012	28,800	29,390	29,992	31,316

^{1/} Prior to 1956, pickup trucks in Vermont were classified as passenger vehicles.

Source: U. S. Department of Commerce, Bureau of Public Roads, Highway Statistics.

Figure 8
GASOLINE TAX RATES
IN NEW ENGLAND STATES
August 1963



Source: U.S. Department of Commerce, Bureau of Public Roads, Highway Statistics, 1962.

REGISTRATION FEES

The bases for registering motor vehicles in New England do not vary greatly between states, although the fees for the various types and sizes vary considerably.

Four states — Maine, Connecticut, Massachusetts and Vermont — use a flat fee for passenger cars. The other two states — New Hampshire and Rhode Island — use gross weight groups.

All New England states use gross vehicle weight as the basis for truck registration fees.

A national summary of typical registration fees and tax payments by different classes of motor vehicles in different states indicates that Maine registration fees range from \$15 for passenger cars and pickup trucks to \$605 for 72,000-pound, 5-axle, diesel-powered tractor-semitrailer combinations (1964 data). These are the highest fees in the six-state region except for Vermont.

Vermont has higher registration fees for every type and size of vehicle, but it does not levy a personal-property or annual excise tax on motor vehicles.

Registration fees in all six states are the same for private operation or contract carrier service.

Table 5

REGISTRATION FEES BY TYPICAL VEHICLES
IN NEW ENGLAND STATES
1964

Vehicle Type	Private Operation							Contract Carrier						
	MAINE	Conn.	Mass.	N. H.	R. I.	Vt.		MAINE	Conn.	Mass.	N. H.	R. I.	Vt.	
Very Light Passenger Car	\$ 15.00	\$ 10.00	\$ 6.00	\$ 12.00	\$ 11.00	\$ 32.00		\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	
Mediumweight Passenger Car	15.00	10.00	6.00	19.50	20.00	32.00		----	----	----	----	----	----	
Heavy Passenger Car	15.00	10.00	6.00	25.00	33.00	32.00		----	----	----	----	----	----	
5,000-pound Pickup Truck	15.00	20.00	15.00	19.50	18.00	32.00		----	----	----	----	----	----	
15,000-pound Stake Truck	80.00	60.00	45.00	90.00	60.00	164.25		80.00	60.00	45.00	90.00	60.00	164.25	
19,000-pound, Single-unit Van Truck	125.00	76.00	57.00	114.00	76.00	222.30		125.00	76.00	57.00	114.00	76.00	222.30	
40,000-pound, 3-axle Dump Truck	321.00	260.00	120.00	240.00	200.00	500.00		----	----	----	----	----	----	
40,000-pound, 3-axle Combination	326.00	260.00	135.00	240.00	202.00	515.00		326.00	260.00	135.00	240.00	202.00	515.00	
55,000-pound, 4-axle, Gasoline-powered Combination	420.00	357.50	180.00	330.00	282.00	724.50		420.00	357.50	180.00	330.00	282.00	724.50	
55,000-pound, 4-axle, Diesel-powered Combination	420.00	357.50	180.00	330.00	282.00	1,256.63		420.00	357.50	180.00	330.00	282.00	1,256.63	
62,000-pound, 5-axle, Diesel-powered Combination	500.00	403.00	201.00	372.00	312.00	1,430.93		500.00	403.00	201.00	372.00	312.00	1,430.93	
72,000-pound, 5-axle, Diesel-powered Combination	605.00	468.00	231.00	432.00	362.00	----		605.00	468.00	231.00	432.00	362.00	----	

Source: U.S. Department of Commerce,
Bureau of Public Roads,
Road-User and Property Taxes
on Selected Motor Vehicles, 1964.

Table 7

PERSONAL-PROPERTY AND MISCELLANEOUS
TAXES BY TYPICAL VEHICLES
IN NEW ENGLAND STATES
1964

Vehicle Type	Private Operation							Contract Carrier						
	MAINE ^{1/}	Conn.	Mass.	N. H.	R. I.	Vt.		MAINE ^{1/}	Conn.	Mass.	N. H.	R. I.	Vt.	
Very Light Passenger Car	\$ 22.63	\$ 46.41	\$ 38.30	\$ 14.85	\$ 58.72	\$ ----		\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	
Mediumweight Passenger Car	31.84	55.25	71.30	21.48	89.14	----		----	----	----	----	----	----	
Heavy Passenger Car	71.56	134.81	150.50	50.09	172.60	----		----	----	----	----	----	----	
5,000-pound Pickup Truck	23.58	44.20	64.70	15.53	59.50	----		----	----	----	----	----	----	
15,000-pound Stake Truck	38.75	70.72	94.40	26.46	107.30	----		68.75	80.72	104.40	29.46	114.30	----	
19,000-pound, Single-unit Van Truck	57.75	101.66	120.80	40.14	165.80	----		87.75	111.66	130.80	43.14	172.80	----	
40,000-pound, 3-axle Dump Truck	169.50	291.72	256.10	120.60	273.60	----		----	----	----	----	----	----	
40,000-pound, 3-axle Combination	149.50	207.74	269.30	91.08	325.01	----		184.50	217.74	279.30	94.08	332.01	----	
55,000-pound, 4-axle, Gasoline-powered Combination	253.74	388.96	483.80	158.27	551.09	----		288.74	398.96	493.80	161.27	558.09	----	
55,000-pound, 4-axle, Diesel-powered Combination	270.18	486.20	526.70	170.10	592.12	----		305.18	496.20	536.70	173.10	599.12	----	
62,000-pound, 5-axle, Diesel-powered Combination	323.13	508.30	602.60	207.54	715.67	----		358.13	518.30	612.60	210.54	722.67	----	
72,000-pound, 5-axle, Diesel-powered Combination	353.42	561.34	579.50	229.35	741.88	----		388.42	571.34	589.50	232.35	748.88	----	

^{1/} In Maine, the personal-property tax is
in the form of an annual excise tax.

Source: U.S. Department of Commerce,
Bureau of Public Roads,
Road-User and Property Taxes
on Selected Motor Vehicles, 1964.

Table 6
MOTOR FUEL TAX PAYMENTS
BY TYPICAL VEHICLES
IN NEW ENGLAND STATES
1964

Vehicle Type	Private Operation							Contract Carrier						
	MAINE	Conn.	Mass.	N. H.	R. I.	Vt.		MAINE	Conn.	Mass.	N. H.	R. I.	Vt.	
Very Light Passenger Car	\$ 23.31	\$ 19.98	\$ 18.32	\$ 23.31	\$ 23.31	\$ 21.64		\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	
Mediumweight Passenger Car	44.31	37.98	34.82	44.31	44.31	41.14		----	----	----	----	----	----	
Heavy Passenger Car	55.02	47.16	43.23	55.02	55.02	51.09		----	----	----	----	----	----	
5,000-pound Pickup Truck	52.50	45.00	41.25	52.50	52.50	48.75		----	----	----	----	----	----	
15,000-pound Stake Truck	98.84	84.72	77.66	98.84	98.84	91.78		164.71	141.18	129.42	164.71	164.71	152.94	
19,000-pound, Single-unit Van Truck	140.00	120.00	110.00	140.00	140.00	130.00		233.31	199.98	183.32	233.31	233.31	216.64	
40,000-pound, 3-axle Dump Truck	525.00	450.00	412.50	525.00	525.00	487.50		----	----	----	----	----	----	
40,000-pound, 3-axle Combination	560.00	480.00	440.00	560.00	560.00	520.00		560.00	480.00	440.00	560.00	560.00	520.00	
55,000-pound, 4-axle, Gasoline-powered Combination	1,050.00	900.00	825.00	1,050.00	1,050.00	975.00		1,050.00	900.00	825.00	1,050.00	1,050.00	975.00	
55,000-pound, 4-axle, Diesel-powered Combination	763.63	654.54	600.00	763.63	763.63	no tax		763.63	654.54	600.00	763.63	763.63	no tax	
62,000-pound, 5-axle, Diesel-powered Combination	1,042.58	893.64	819.17	1,042.58	1,042.58	no tax		1,042.58	893.64	819.17	1,042.58	1,042.58	no tax	
72,000-pound, 5-axle, Diesel-powered Combination	1,139.53	976.74	895.35	1,139.53	1,139.53	----		1,139.53	976.74	895.35	1,139.53	1,139.53	----	

Source: U.S. Department of Commerce,
Bureau of Public Roads,
Road-User and Property Taxes
on Selected Motor Vehicles, 1964.

Table 8
TOTAL ROAD-USER AND PERSONAL-PROPERTY
TAX PAYMENTS BY TYPICAL VEHICLES
IN NEW ENGLAND STATES
1964

Vehicle Type	Private Operation							Contract Carrier						
	MAINE ^{1/}	Conn.	Mass.	N.H.	R.I.	Vt.		MAINE ^{1/}	Conn.	Mass.	N.H.	R.I.	Vt.	
Very Light Passenger Car	\$ 60.94	\$ 76.39	\$ 62.62	\$ 50.16	\$ 93.03	\$ 53.64		\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	\$ ----	
Mediumweight Passenger Car	91.15	103.23	112.12	85.29	153.45	73.14		----	----	----	----	----	----	
Heavy Passenger Car	141.58	191.97	199.73	130.11	260.62	83.09		----	----	----	----	----	----	
5,000-pound Pickup Truck	91.08	109.20	120.95	87.53	130.00	80.75		----	----	----	----	----	----	
15,000-pound Stake Truck	217.59	215.44	217.06	215.30	266.14	256.03		313.46	281.90	278.82	284.17	339.01	317.19	
19,000-pound, Single-unit Van Truck	322.75	297.66	287.80	294.14	381.80	352.30		446.06	387.64	371.12	390.45	482.11	438.94	
40,000-pound, 3-axle Dump Truck	1,015.50	1,001.72	788.60	885.60	998.60	987.50		----	----	----	----	----	----	
40,000-pound, 3-axle Combination	1,035.50	947.74	844.30	891.08	1,087.01	1,035.00		1,070.50	957.74	854.30	894.08	1,094.01	1,035.00	
55,000-pound, 4-axle, Gasoline-powered Combination	1,723.74	1,646.46	1,488.80	1,538.27	1,883.09	1,699.50		1,758.74	1,656.46	1,498.80	1,541.27	1,890.09	1,699.50	
55,000-pound, 4-axle, Diesel-powered Combination	1,453.81	1,498.24	1,306.70	1,263.73	1,637.75	1,256.63		1,488.81	1,508.24	1,316.70	1,266.73	1,644.75	1,256.63	
62,000-pound, 5-axle, Diesel-powered Combination	1,865.71	1,804.94	1,622.77	1,622.12	2,070.25	1,430.93		1,900.71	1,814.94	1,632.77	1,625.12	2,077.25	1,430.93	
72,000-pound, 5-axle, Diesel-powered Combination	2,097.95	2,006.08	1,705.85	1,800.88	2,243.41	----		2,132.95	2,016.08	1,715.85	1,803.88	2,250.41	----	

^{1/} In Maine, the personal-property tax is
in the form of an annual excise tax.

Source: U.S. Department of Commerce,
Bureau of Public Roads,
Road-User and Property Taxes
on Selected Motor Vehicles, 1964.

MOTOR FUEL TAX PAYMENTS

The state gasoline tax rate is 7 cents per gallon in Maine, New Hampshire and Rhode Island; 6.5 cents in Vermont; 6 cents in Connecticut and 5.5 cents in Massachusetts (1963 data).

The national summary of typical tax payments by different classes of motor vehicles in different states indicates that motor fuel tax payments by Maine vehicles — based on the Maine gasoline tax rate — range from \$23.31 for a very light passenger car to \$1,139.53 for the largest tractor-semitrailer combination (1964 data).

Annual payments for Massachusetts vehicles, with the lowest rate per gallon, are indicated as ranging from \$18.32 to \$895.35 for the various types and sizes of vehicles.

Because the heaviest vehicles travel less in Maine than in the average state, tax returns to Maine for these vehicles average approximately half the payments indicated by the national summary.

PERSONAL-PROPERTY AND MISCELLANEOUS TAXES

Four New England states — Maine, Connecticut, Massachusetts and Rhode Island — apply personal-property or annual excise taxes to motor vehicles.

New Hampshire uses a special license tax in lieu of ad valorem taxes on motor vehicles. Vermont does not levy a personal-property or excise tax on motor vehicles.

In Maine, excise and miscellaneous taxes range from \$22.63 for a typical small passenger car to \$353.42 for a typical large tractor-semitrailer combination in private operation, with \$30 to \$35 additional for contract carriers (1964 data).

Personal-property or annual excise taxes on motor vehicles are higher in Rhode Island, Massachusetts and Connecticut. They range from \$58.72 to \$741.88 for private operation in Rhode Island.

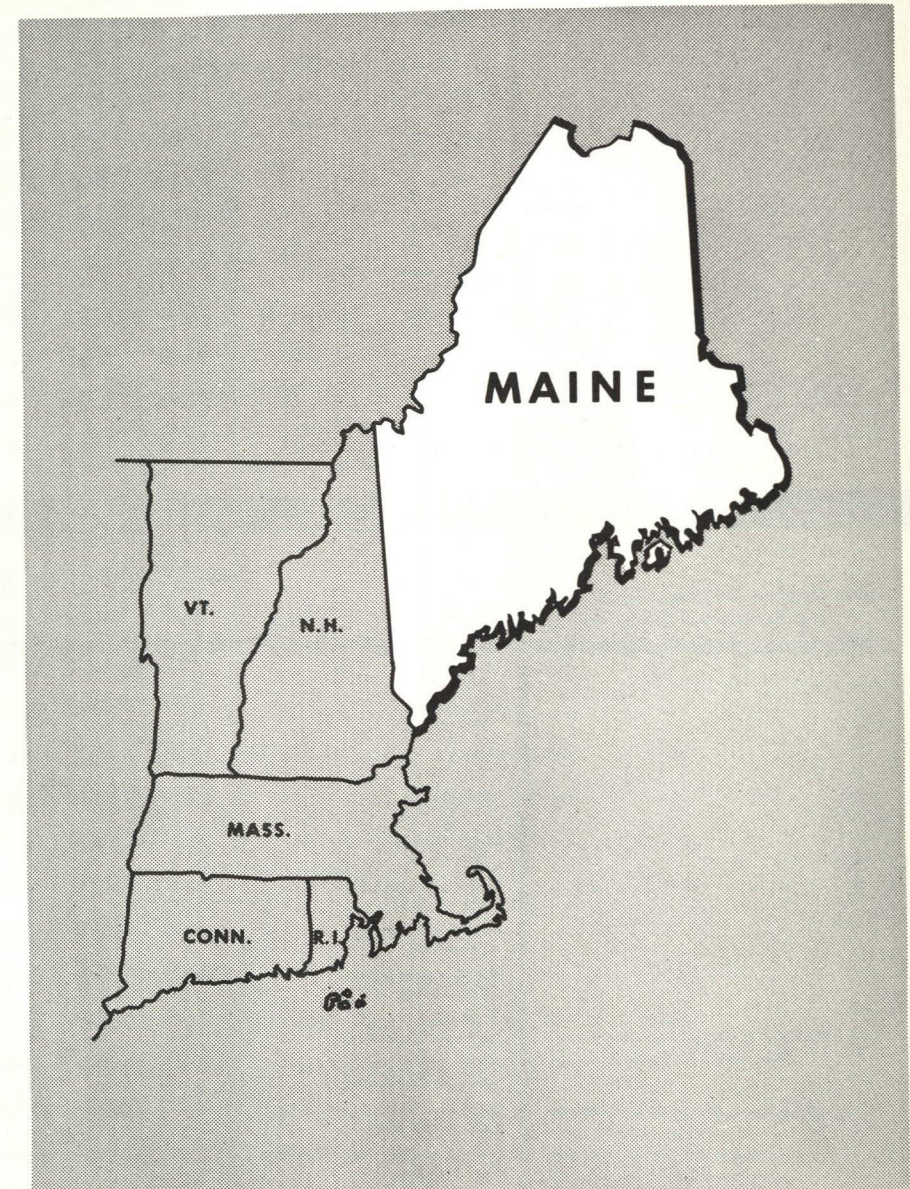
TOTAL ROAD-USER AND PERSONAL-PROPERTY TAX PAYMENTS

The national summary ranks Maine fourth among New England states in total road-user and personal-property or annual excise tax payments for passenger cars and pickup trucks. Maine is generally ranked second in total payments for larger trucks and combinations.

This summary indicates that payments by typical Maine vehicles range from \$60.94 for a very light passenger car to \$2,097.95 for a 72,000-pound, 5-axle, diesel-powered tractor-semitrailer combination in private operation or \$2,132.95 for a contract carrier (1964 data).

Rhode Island is ranked first for most types and sizes of vehicles, with a range from \$93.03 to \$2,243.41 for vehicles in private operation.

Because the heaviest vehicles travel less in Maine than in the average state, tax returns to Maine for these vehicles are not equal to the payments indicated by the national summary.



GRAPHICAL PRESENTATION

Figures 9 through 13 show the relative position of Maine when compared with other New England states in regard to road-user and personal-property or annual excise tax payments for selected vehicles (1964 data).

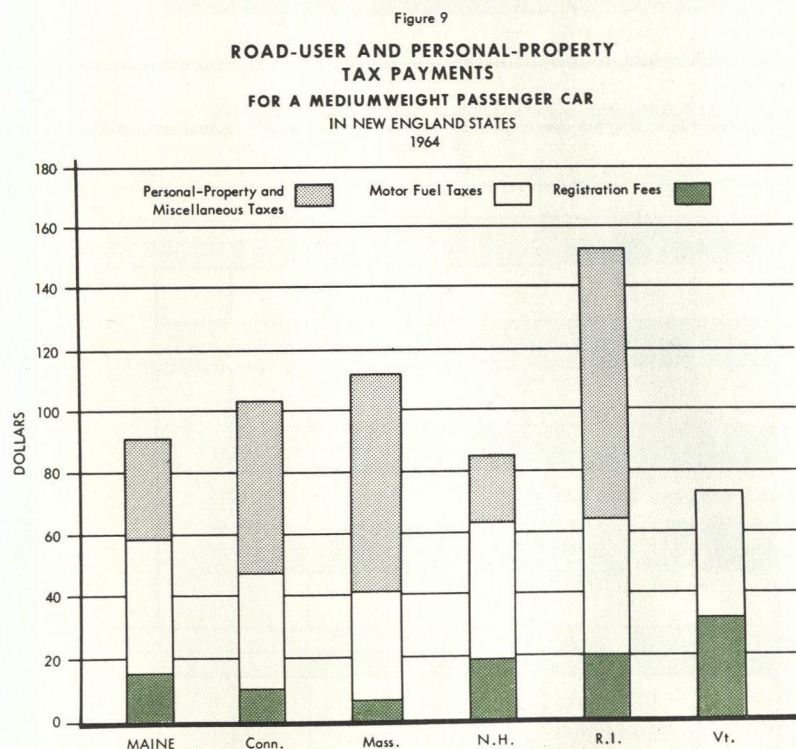
Figure 9 indicates that Maine ranks fourth in total payments for a medium-weight passenger car.

Figure 10 shows that Maine ranks third in total payments for a 15,000-pound stake truck in private operation or contract service.

Figure 11 points out that Maine ranks first in total payments for a 40,000-pound, 3-axle dump truck.

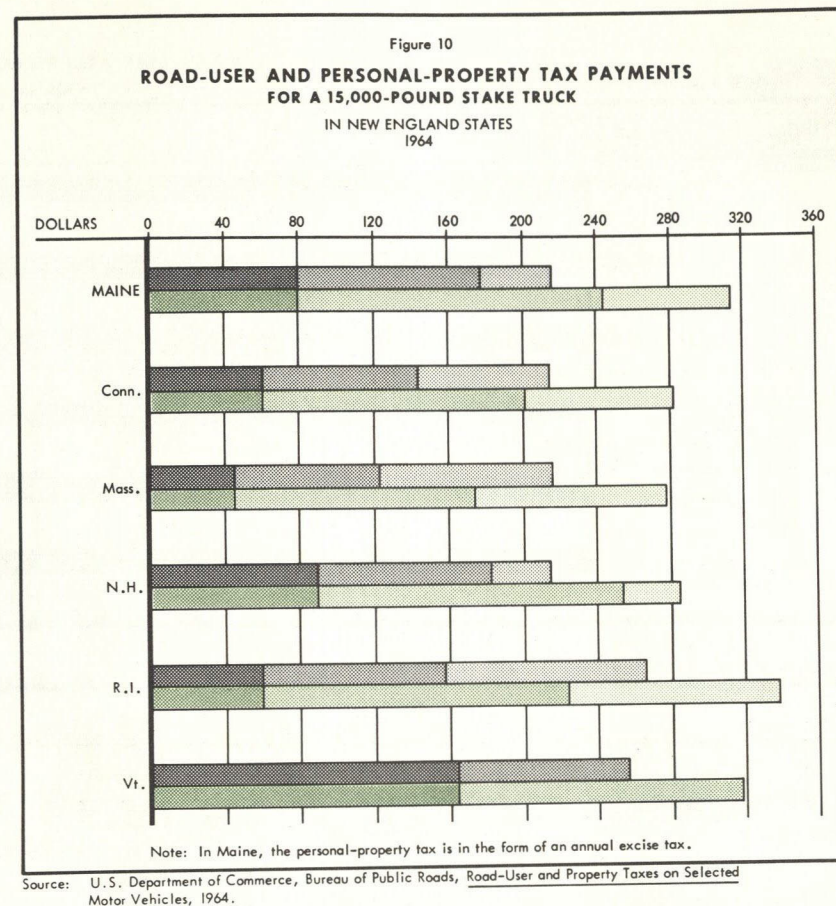
Figure 12 indicates that Maine ranks second in total payments for a 55,000-pound, 4-axle, gasoline-powered combination.

Figure 13 shows that Maine ranks second in total payments for a 72,000-pound, 5-axle, diesel-powered combination.

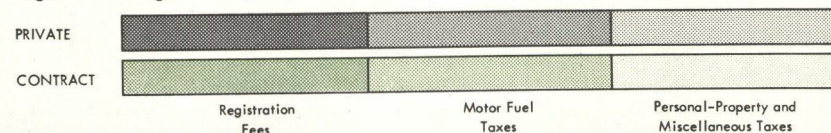


Note: In Maine, the personal-property tax is in the form of an annual excise tax.

Source: U.S. Department of Commerce, Bureau of Public Roads, Road-User and Property Taxes on Selected Motor Vehicles, 1964.



Legend for Figures 10, 11, 12 and 13.



ROAD-USER AND PERSONAL-PROPERTY TAX PAYMENTS

Figure 11 FOR A 40,000-POUND, 3-AXLE DUMP TRUCK

IN NEW ENGLAND STATES • 1964

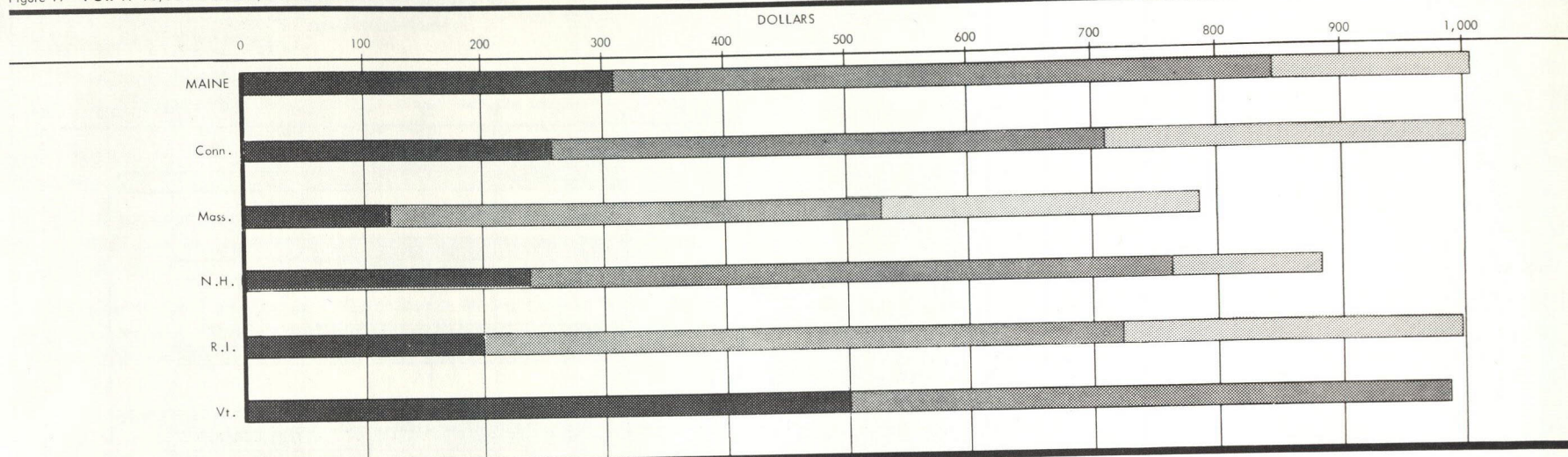


Figure 12 FOR A 55,000-POUND, 4-AXLE, GASOLINE-POWERED COMBINATION

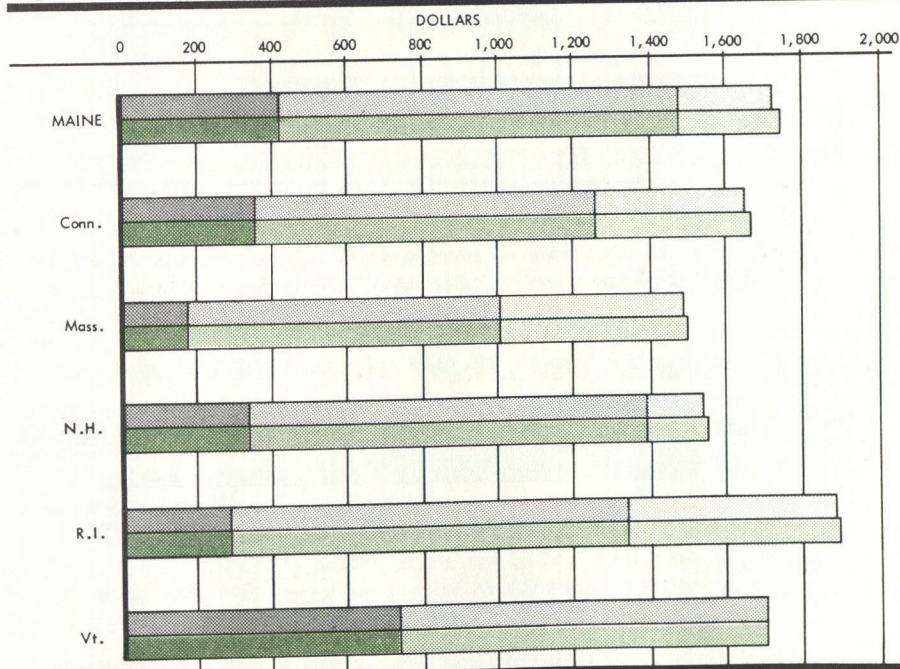
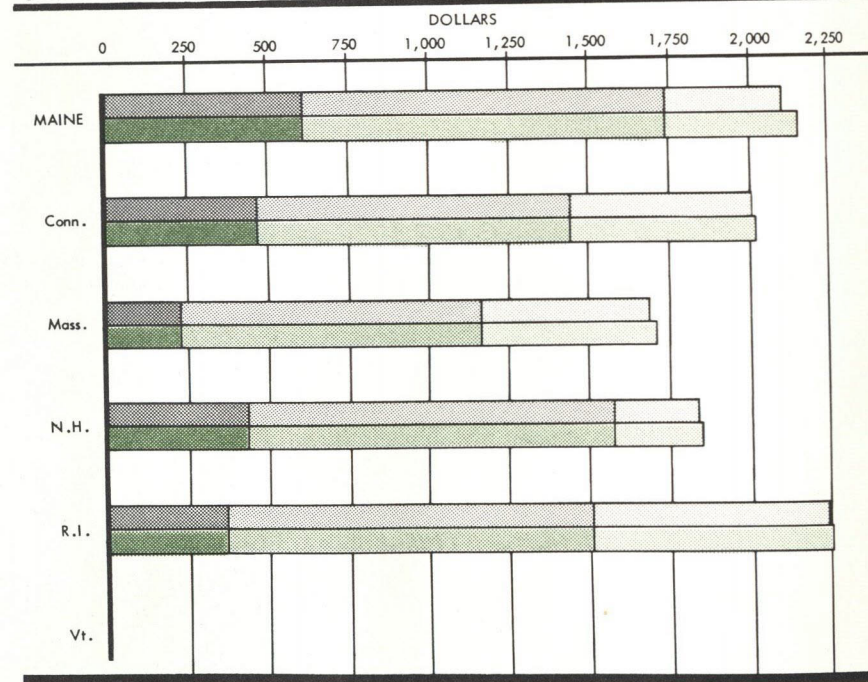


Figure 13 FOR A 72,000-POUND, 5-AXLE, DIESEL-POWERED COMBINATION



Note: In Maine, the personal-property tax is in the form of an annual excise tax.

Source: U.S. Department of Commerce, Bureau of Public Roads, Road-User and Property Taxes on Selected Motor Vehicles, 1964.

HIGHWAY SYSTEMS

Maine has a total of 20,957 miles of public highways, roads and streets under the jurisdiction of the State Highway Commission, 110 urban cities and towns, 381 rural towns and 16 counties.

Legally, for purposes of administration and finance, this mileage is classified into three general systems:

1. State highways — the principal arteries.
2. State-aid highways — the secondary, feeder routes.
3. Town ways — the tertiary, local roads and streets.

Individual routes or sections are designated or approved by the State Highway Commission according to the three state classifications established by statute. Highways on the federal-aid systems are selected by the Commission and approved according to federal highway laws by the U. S. Department of Commerce, Bureau of Public Roads.

State highways include 85 miles of federal-aid Interstate, 1,719 miles of federal-aid primary, 1,357 miles of federal-aid secondary and 477 miles of non-federal-aid — for a total of 3,638 miles.

State-aid highways include 840 miles of federal-aid secondary and 6,856 miles of non-federal-aid — for a total of 7,696 miles.

Town ways are the remaining 9,248 miles of public, non-federal-aid roads and streets.

In addition, the Maine Turnpike is a separate 113-mile toll facility, 62 miles of which also are on the designated federal-aid Interstate System and there are 262 miles of state and federal reservation roads.

Maine's portion of the National System of Interstate and Defense Highways as planned for 1972 is 312 miles. All of this is on Route 95 or its spurs, and includes the 62 miles on the turnpike.

The total highway mileage in Maine includes 18,830 miles in rural areas and 2,127 in urban areas. For purposes of this study, all towns with less than 1,000 population in the urban or "compact" area were considered to be rural. (The term "compact" applies to any section of highway along which buildings are less than 200 feet apart for a distance of at least one-quarter mile.)

All of these figures are from the State Highway Commission's official mileage table of March 1, 1964. Since that date, an additional 23.4 miles of Interstate have been opened and the federal-aid primary and secondary networks have been adjusted to reflect current service requirements.

Table 9
MAINE HIGHWAY MILEAGE
by administrative systems
March 1, 1964

System	Rural	Urban	Total
State Highway, Federal-aid Interstate	75	10	85
State Highway, Federal-aid Primary	1,505	214	1,719
State Highway, Federal-aid Secondary	1,260	97	1,357
State-aid, Federal-aid Secondary	788	52	840
State Highway, Non-federal-aid	454	23	477
State-aid, Non-federal-aid	6,578	278	6,856
Town Way	7,816	1,432	9,248
Turnpike ^{1/}	104	9	113
Reservation Roads	250	12	262
Total	18,830	2,127	20,957

^{1/} Includes 62 miles on the Interstate System.
Source: Maine State Highway Commission.

Construction Responsibility

The State Highway Commission's construction funds are categorized according to their intended use, as follows:

1. General Highway Fund.

2. State-aid Fund.
3. Town Road Improvement Fund.

The Commission is responsible for construction of both rural and urban portions of the State Highway System, although the financing may be participated in by local governments. State highway improvements are financed by the Commission through the General Highway Fund.

The Commission and the local governments are jointly responsible for construction of both rural and urban portions of the state-aid system. The work usually is handled by the local units under supervision of the Commission. Apportionment of monies to the local units from the State-aid Fund is based on allocations by the Legislature and regulations by the Commission.

Local governments are responsible for construction of both rural and urban portions of towns ways. The Commission contributes to construction of unimproved sections through the Town Road Improvement Fund, as allocated by the Legislature.

The federal government participates in improvement of federal-aid systems. The ratio of federal-state participation is 90-10 for Interstate highways and 50-50 for primary and secondary routes. Urban federal-aid funds are limited to expenditures on urban extensions of primary and secondary routes in urban areas with more than 5,000 population.

Maintenance Responsibility

The State Highway Commission is responsible for year-round maintenance of the State Highway System and for summer maintenance of the "improved" sections of the state-aid system in rural areas. ("Improved" sections are those for which the Commission previously has contributed funds and any additional sections accepted as improved by the Commission.) Local governments are responsible for snow and ice removal on the state-aid system and receive a fixed per-mile contribution from the State for winter maintenance.

Local governments are responsible for maintenance of condition on the state highway and state-aid systems in urban or compact areas with a total population of 5,000 or more. The Commission is responsible for maintenance of these facilities if the population is less than 5,000.

Local governments are responsible for maintenance of condition on the unimproved sections of the state-aid system and on all local roads and streets.

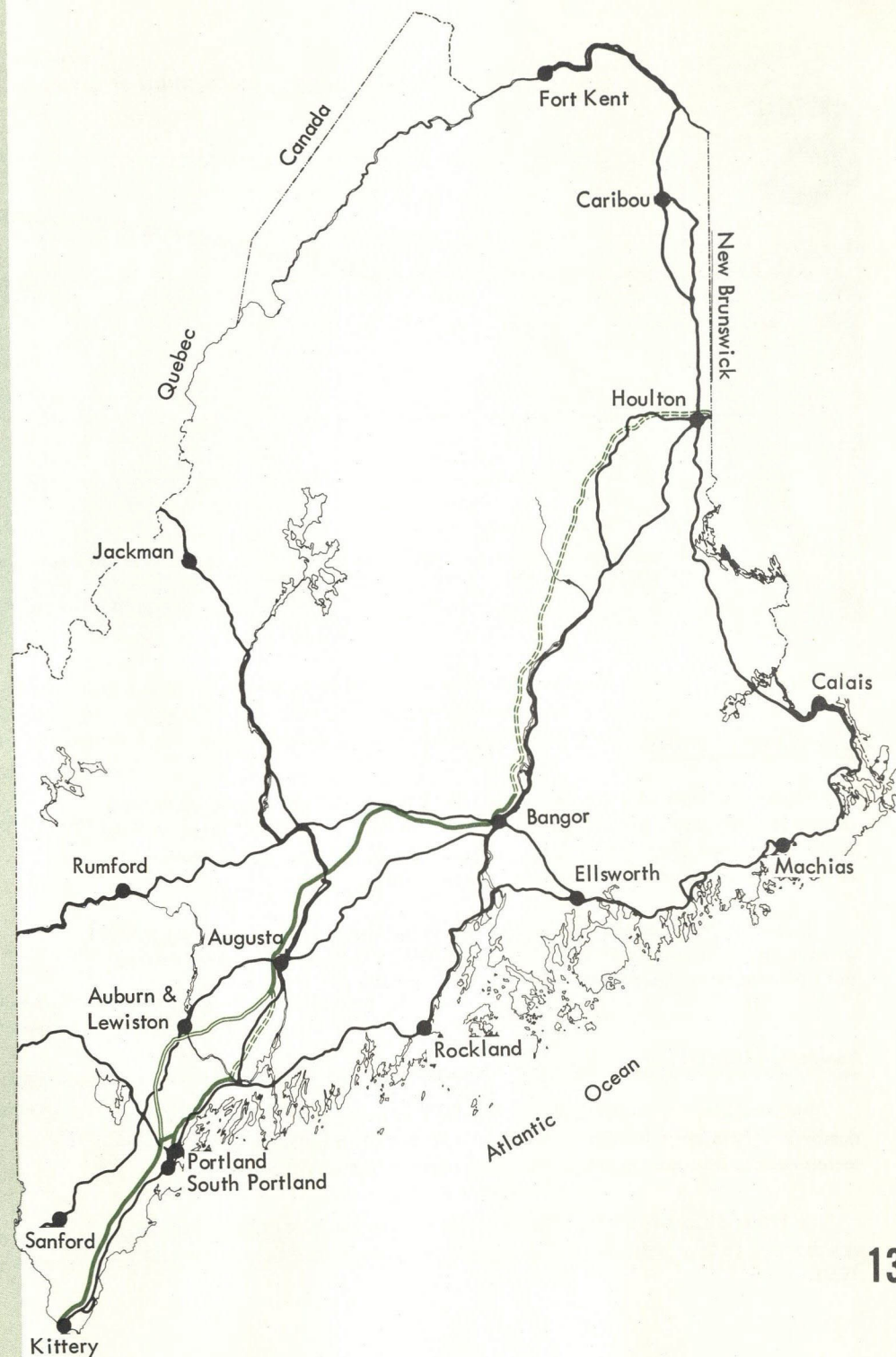
PRINCIPAL HIGHWAYS IN MAINE

This map shows more than 1,500 miles of principal highways in Maine, plus sections of the Interstate System yet to be built.

The 1,365 miles of U. S.-numbered routes in the State are shown in black. These generally are state highways on the federal-aid primary and secondary networks.

The 108 miles of Interstate Route 95 now open to traffic and the 62 miles of Interstate highway on the Maine Turnpike are indicated by the solid green bands. Uncompleted Interstate segments are represented by the broken green lines. Maine has 312 miles on the Interstate System planned for 1972.

The part of the 113-mile turnpike which is not on the Interstate network is shown by the open green band.



It is not practical to expect all highways in the State to have a rating of 100, but there is a point on the sufficiency rating scale which should represent the minimum rating for a section of highway to be acceptable to the traveling public.

Sufficiency ratings have been assigned to Maine's state highway and federal-aid systems by the same field personnel since the ratings were started in 1956, and the historical trend of these ratings is very consistent. The ratings have been recorded on electronic data processing cards to facilitate rapid analysis.

The Consultant reviewed the State's sufficiency rating methods and compared ratings through field inspection of specific road sections. Based on these evaluations and on consultation with State Highway Commission personnel, it was determined that a sufficiency rating of 70 constitutes a minimally acceptable highway and that sections rating below 70 are in need of construction.

Table 10 lists the miles of roadway in the various sufficiency rating groups as of March 1, 1964.

Obsolescence

Highways do not remain static in their ability to provide acceptable service to the public. Over a period of time, the structural components of the roadbed deteriorate and traffic patterns change in composition and volume. These factors eventually cause the highway to become deficient. The rate at which obsolescence has occurred in the past can be measured by analysis of historical sufficiency ratings and construction activity.

Records of historical sufficiency ratings were sorted to provide a table of miles above and below the cutoff point of 70 on road sections that had been rated each of the five times over the eight-year period from 1956 to 1964. This revealed that 2,969.29 miles have been rated each year and that the number of deficient miles has decreased from 1,308.45 in 1956 to 1,184.39 in 1964. Thus, Maine has been making progress toward the goal of eliminating all deficient roadway at an average rate of 15.51 miles per year.

Analysis of the miles of construction actually performed on the same road sections determined that there were 703.64 miles constructed during the same period, or an average rate of 87.96 miles per year. The difference between the two rates ($87.96 - 15.51 = 72.45$) is the number of miles the State Highway Commission had to construct each year over the past eight years just to keep abreast of obsolescence on the 2,969.29 total miles rated each year.

Statistically, the construction expenditure represented by these miles can be expected to continue in the future. This is the mix of construction work involved in providing for (1) structural and traffic obsolescence, (2) stopgaps and (3) replacements. It is viewed as an amount of the total construction effort that must be continuously assigned for these purposes. The "mile" as used in this analysis is representative only and does not refer to a specific project mile for any particular type of project.

When provision is made for the future construction effort that will not contribute to overcoming deficiencies, the historical miles first are logically related to the size of the rated system. In the case of this analysis, the 72.45 miles per year represent a statistical rate of 2.44 per cent per year of the 2,969.29 total rated miles. Application of this rate to the 4,006-mile total highway system on which needs have been determined by the sufficiency rating method gives 97.7 miles per year for which construction must be provided that will not contribute to overcoming deficiencies.

In the needs figures for the individual systems on which sufficiency ratings were utilized, provision has been made for the appropriate relative part of this 97.7 miles — and the resulting cost figures have been denoted as "future needs".

Rural Sampling

The non-federal-aid portion of the state-aid system and the town ways were appraised especially for this study by road inventory crews of the Commission's Division of Planning and Traffic, under guidance and direction of the Consultant. Construction design standards and minimum acceptable standards for these systems, shown in the back of this report, were developed with the cooperation and assistance of a committee of Commission personnel and representatives of local governments.

Table 10
SUFFICIENCY RATINGS ON MAINE
STATE HIGHWAY AND FEDERAL-AID SYSTEMS
1964

System	Miles by Sufficiency Rating Group					Miles Not Rated ^{1/}	Total Miles
	Critical 0-49	Poor 50-59	Fair 60-69	Adequate 70-79	Adequate 80-100		
State Highway, Federal-aid Primary	90.18	242.11	242.82	163.89	765.65	216.60	1,719.25
State Highway and State-aid, Federal-aid Secondary	121.88	322.83	576.28	334.97	690.64	150.51	2,197.11
State Highway, Non-federal-aid	13.78	65.58	153.00	110.09	100.48	33.79	476.72
Total	216.48	639.88	972.10	608.95	1,556.77	398.90	4,393.08

^{1/} Includes urban mileage.

Source: Maine State Highway Commission.

A random sample of approximately 12 per cent of the mileage in each county was selected from road inventory records. These records initially were stratified by surface types to ensure that a reasonable cross section of road types would be selected. The randomly selected sections subsequently were appraised by the road inventory crews following extensive training sessions to ensure uniform application of techniques.

Urban Sampling

The 88 urban areas in Maine were stratified by population groups to ensure a sample representation of all sizes of cities and towns. These groups covered (1) six areas over 20,000, (2) 14 areas 5,000 to 20,000, and (3) 68 areas 1,000 to 5,000. All compact areas under 1,000 population were considered to be rural in this study.

Random samples of three, three and 16 areas respectively were selected from the three stratifications. Appraisal procedures for the urban sample then were developed by the Consultant and performed by Commission personnel.

Maine currently has two comprehensive urban area transportation studies in progress — one in Portland and another in Lewiston-Auburn. Data from these studies will provide long-range needs for the two areas, but the studies were not sufficiently complete in time to incorporate the results into this report.

Sampling Analysis

Information on each sample road section was directly coded by the field crews for electronic data processing. The sample cards then were tabulated and expanded to provide a state-wide needs estimate for the various systems.

Computer programs for these analyses were developed by Commission personnel under direction of the Consultant and may be used in the future as the Commission continues its needs appraisals.

Construction Costs

After the mileage of needed construction was developed for all systems, average construction costs were developed from an analysis of construction cost records.

The Planning and Traffic Division has maintained a record of construction costs as a part of its road life record. The project costs were analyzed by use of electronic data processing programs, and tabulations of per-mile construction costs were developed for numerous improvement types and design standards. These data then were analyzed statistically to obtain average trended cost values.

The resultant costs per mile are listed in Table 11. These costs were applied to the mileage of needed construction to obtain the final needs estimates for each highway system.

THE 17-YEAR PROGRAM PERIOD

Needs are presented on the basis of a 17-year period from July 1, 1965 to June 30, 1982. The principal reason for selection of 1982 as the end of the program period was to fit this needs study with a forthcoming national needs survey, commonly referred to as the "After '72 Study", which is discussed later in this chapter.

A 17-year program presumes that the State will improve all its roads to minimum acceptable standards by the end of that period. Seventeen years is a long time to wait for acceptable roads but, as will be shown later in the report, even this will require a much larger construction program than currently is being performed.

HIGHWAY NEEDS AND CONSTRUCTION COSTS

State Highway, Federal-aid Interstate

The method of financing Maine's portion of the National System of Interstate and Defense Highways provides for periodic estimates of needs remaining to complete the system. Since these needs were updated this year, it was not necessary to conduct a separate needs analysis on the Interstate System.

Needs for Interstate highways are shown in Table 12. The Interstate System is scheduled for completion in 1972 so the average annual construction figures in this table are based on a seven-year period. However, these needs are averaged for a 17-year program period elsewhere in this report to conform with tabulations for the other systems.

State Highway, Federal-aid Primary

The Federal-aid Primary System is composed of 1,719 miles of the most important highways in Maine. The construction needs on this system are shown in Table 13.

The costs for the rural portions of the system make provision for construction improvements fully in accordance with modern design requirements for the traffic served by the system. Included is provision for a program currently under consideration by the Commission: construction of a four-lane improvement on U. S. Route 1 between Portland and Kittery. Because of the degree of urbanization along this particular route, the costs of construction are substantially higher than for other four-lane rural facilities.

Table 11
AVERAGE COST PER MILE
FOR RURAL ROAD CONSTRUCTION IN MAINE
(excluding structures)
1964

System or Design Group	Engineering	Right-of-Way	Grade and Drain	Base and Surface	Roadside and Traffic	Total
State Highway, Federal-aid						
Interstate						\$411,000
2-lane	\$ 59,000	\$ 9,000	\$173,000	\$133,000	\$37,000	807,000
4-lane	123,000	32,000	357,000	210,000	85,000	
Other State Highway and Federal-aid						
0-100	3,000	1,000	9,000	15,000	-----	28,000
101-400	8,000	1,000	23,000	20,000	1,000	53,000
401-1500	10,000	2,000	40,000	42,000	2,000	96,000
1501-6000	24,000	8,000	64,000	68,000	9,000	173,000
over 6000	96,000	32,000	355,000	210,000	86,000	779,000
State-aid, Non-federal-aid						
0-100	-----	-----	13,000	15,000	-----	28,000
101-400	-----	-----	16,000	18,000	-----	34,000
401-1500	1,000	-----	36,000	31,000	-----	68,000
1501-6000	1,000	2,000	79,000	52,000	-----	134,000
over 6000	96,000	32,000	355,000	210,000	86,000	779,000
Town Way	2,000	-----	7,000	11,000	-----	20,000

Some adjustments were made in Maine's federal-aid systems during the course of this study, but they were not officially adopted in time to be included in this report. These changes slightly affect the needs estimates for individual systems but do not affect the combined estimates for all systems.

Urban federal-aid primary costs generally average less per mile than rural costs, notably because of limitations in the kinds of improvements that practically can be effected on existing streets that are part of the primary system. In many cases, the improvements are limited to some form of reconstruction of existing surface widths.

State Highway and State-aid, Federal-aid Secondary

The needs on federal-aid secondary routes are shown in Tables 14 and 15. The Federal-aid Secondary System consists of 1,357 miles on the state highway system and 840 miles on the state-aid system.

State Highway and State-aid, Non-federal-aid

Tables 16 and 17 list the needs on the two remaining state-administered systems. These include 477 miles of state highways and 6,856 miles of state-aid routes.

Town Way

Town ways are the responsibility of the local counties, cities and towns for construction, maintenance and administration. The only highway-user funds presently applied to town ways are in the form of the Town Road Improvement Fund, discussed earlier in this report. The needs on town ways are shown in Table 18.

Summary

The total needs bill for all systems for a 17-year program period is summarized in Table 19. The average annual construction cost is \$86,743,000. Average annual revenues over the period are expected to be \$98,950,000, but these revenues also must provide for costs of maintenance and administration.

The last two chapters of this report analyze more fully the problems of financing Maine's highway needs.

THE "AFTER '72 STUDY"

The U. S. Department of Commerce, Bureau of Public Roads, currently is developing procedures to be used in conducting a nationwide needs study. A major purpose of this study is to help determine the course of federal-aid after 1972, when the Interstate System will be completed and some of the federal highway taxes are scheduled to expire.

The states will be asked to conduct their part of this study during calendar year 1965, and the Bureau of Public Roads plans to complete its analysis and recommendations in time for submission to Congress in January 1967. Although these procedures are as yet unpublished, the Consultant has attempted to conduct this Maine needs study so that much of the data already collected and utilized herein may be readily applied to the "After '72 Study".

Certain procedures will be called for in the "After '72 Study" which have not been incorporated in the studies conducted for this report. Foremost among these is the classification of highways into functional service categories. There are indications that many highways in Maine do need to be reclassified more properly to reflect the travel service they provide.

Although the reclassification phase and the generally broader scope of the "after '72" needs estimates undoubtedly will reflect some revisions in the needs as determined for this report, it is not expected that the overall total needs bill will change materially. Thus, it is likely that the analyses of financial responsibility discussed later in this report will remain valid even following the "After '72 Study".

Table 12
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS
State Highway, Federal-aid Interstate

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Total	145.1	\$106,184,000	20.73	\$15,169,000
Urban — Total	7.4	27,705,000	1.06	3,958,000
Total Needs	152.5	\$133,889,000	21.79	\$19,127,000

Table 13
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS
State Highway, Federal-aid Primary

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Existing Needs	580.18	\$140,041,000	34.13	\$ 8,238,000
Future Needs	624.07	150,635,000	36.71	8,861,000
Total	1,204.25	\$290,676,000	70.84	\$17,099,000
Urban — Existing Needs	116.60	\$ 25,489,000	6.86	\$ 1,500,000
Future Needs	98.39	18,364,000	5.79	1,080,000
Total	214.99	\$ 43,853,000	12.65	\$ 2,580,000
Total Needs	1,419.24	\$334,529,000	83.49	\$19,679,000

Table 14
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS
State Highway, Federal-aid Secondary

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Existing Needs	509.99	\$ 74,817,000	30.00	\$ 4,401,000
Future Needs	522.41	76,640,000	30.73	4,508,000
Total	1,032.40	\$151,457,000	60.73	\$ 8,909,000
Urban — Existing Needs	72.61	\$ 19,411,000	4.27	\$ 1,142,000
Future Needs	24.69	5,594,000	1.45	329,000
Total	97.30	\$ 25,005,000	5.72	\$ 1,471,000
Total Needs	1,129.70	\$176,462,000	66.45	\$10,380,000

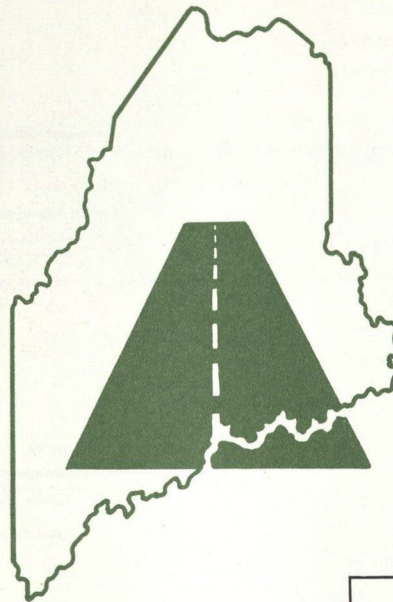


Table 15
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS
State-aid, Federal-aid Secondary

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Existing Needs	514.21	\$ 61,146,000	30.25	\$3,597,000
Future Needs	326.74	38,992,000	19.22	2,293,000
Total	840.95	\$100,138,000	49.47	\$5,890,000
Urban — Existing Needs	45.99	\$ 14,171,000	2.70	\$ 833,000
Future Needs	6.22	1,812,000	0.37	107,000
Total	52.21	\$ 15,983,000	3.07	\$ 940,000
Total Needs	893.16	\$116,121,000	52.54	\$6,830,000

Table 16
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS
State Highway, Non-federal-aid

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Existing Needs	243.24	\$25,096,000	14.31	\$1,476,000
Future Needs	188.36	19,433,000	11.08	1,143,000
Total	431.60	\$44,529,000	25.39	\$2,619,000
Urban — Existing Needs	20.45	\$ 9,435,000	1.20	\$ 555,000
Future Needs	2.46	687,000	0.15	40,000
Total	22.91	\$10,122,000	1.35	\$ 595,000
Total Needs	454.51	\$54,651,000	26.74	\$3,214,000

Table 17
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS
State-aid, Non-federal-aid

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Existing Needs	4,017.12	\$152,484,000	236.30	\$ 8,970,000
Future Needs	2,560.27	81,653,000	150.60	4,803,000
Total	6,577.39	\$234,137,000	386.90	\$13,773,000
Urban — Existing Needs	244.55	\$ 64,205,000	14.39	\$ 3,777,000
Future Needs	33.83	8,576,000	1.99	504,000
Total	278.38	\$ 72,781,000	16.38	\$ 4,281,000
Total Needs	6,855.77	\$306,918,000	403.28	\$18,054,000

Table 18
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS

Town Way

System	Total		Average Annual	
	Construction Miles	Construction Cost	Construction Miles	Construction Cost
Rural — Total	4,335.63	\$ 91,263,000	255.04	\$ 5,368,000
Urban — Existing Needs	1,030.30	\$188,675,000	60.60	\$11,099,000
Future Needs	401.82	72,124,000	23.64	4,243,000
Total	1,432.12	\$260,799,000	84.24	\$15,342,000
Total Needs	5,767.75	\$352,062,000	339.28	\$20,710,000



Table 19
MAINE HIGHWAY NEEDS AND CONSTRUCTION COSTS

All Systems

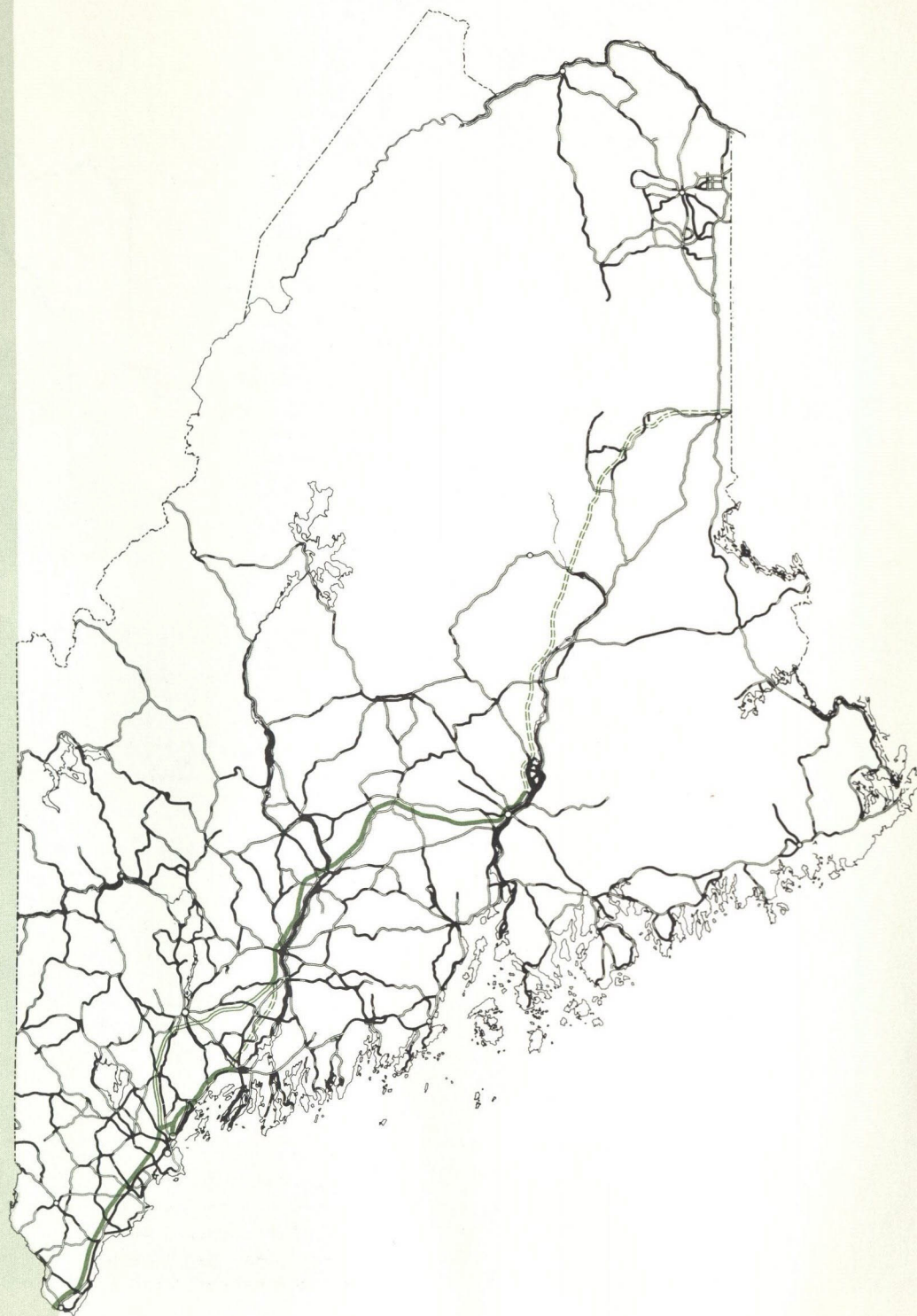
System	Construction Miles	Engineering Cost	Right-of-Way Cost	Grade and Drain Cost	Base and Surface Cost	Roadside and Traffic Cost	Structures Cost	Total Construction Cost
State Highway, Federal-aid Interstate	152.50	\$ 14,704,000	\$ 7,244,000	\$ 36,912,000	\$ 23,465,000	\$ 8,922,000	\$ 42,642,000	\$ 133,889,000
State Highway, Federal-aid Primary	1,419.24	38,651,000	15,448,000	128,303,000	109,463,000	21,149,000	21,515,000	334,529,000
State Highway, Federal-aid Secondary	1,129.70	18,910,000	6,916,000	64,617,000	62,603,000	6,851,000	16,565,000	176,462,000
State-aid, Federal-aid Secondary	893.16	11,689,000	4,674,000	42,519,000	42,541,000	3,189,000	11,509,000	116,121,000
State Highway, Non-federal-aid	454.51	5,050,000	1,847,000	18,981,000	18,426,000	1,224,000	9,123,000	54,651,000
State-aid, Non-federal-aid	6,855.77	7,858,000	6,897,000	131,937,000	131,181,000	2,464,000	26,581,000	306,918,000
Town Way	5,767.75	30,831,000	26,469,000	143,966,000	130,728,000	8,976,000	11,092,000	352,062,000
Total	16,672.63	\$127,693,000	\$69,495,000	\$567,235,000	\$518,407,000	\$52,775,000	\$139,027,000	\$1,474,632,000

SUFFICIENCY RATINGS ON MAINE STATE HIGHWAY AND FEDERAL-AID SYSTEMS

This map indicates the sufficiency ratings assigned to Maine's state highway and federal-aid systems in 1964.

Sections rated below 70 and in need of immediate construction are shown in black. Sections rated above 70 and considered adequate are shown in light green.

Interstate highways and the Maine Turnpike — which were not rated — are shown in dark green.



HIGHWAY REVENUES AND EXPENDITURES

The preceding chapter summarized Maine's long-range highway construction needs. This chapter explores the State's capability to provide sufficient financing to meet those needs.

STATE HIGHWAY INCOME

Principal sources of highway revenues available to the State Highway Commission are motor fuel taxes and licenses, federal-aid, bonds, and State and local governments. Table 20 lists the Commission's income for the past nine years.

The following are pertinent facts about the various revenue sources:

- Motor fuel taxes and licenses.

Maine taxes the highway use of gasoline, diesel fuel and other highway fuels at the rate of 7 cents per gallon. Only Alaska at 8 cents per gallon and Washington at 7.5 cents per gallon have higher gasoline tax rates. Sixteen other states — including two in New England — also tax gasoline at the rate of 7 cents per gallon. Revenues produced by these taxes have increased 48 per cent since 1955.

- Motor vehicle fees and licenses.

Maine registers motor vehicles on a graduated gross-vehicle-weight scale of 21 steps, from 6,000 pounds to 73,280 pounds. A provision in the registration law known as the "frozen roads" clause allows any vehicle that has paid at least \$100 in registration fees to operate during the months of December, January and February at the maximum gross weight allowed for the vehicle type. The registration fee laws also provide for a "short-term" permit, which allows a vehicle to increase its gross operating weight for the duration of the permit at a reduced fee. Short-term permits may be obtained for time periods of from one to eleven months.

Table 20
MAINE STATE HIGHWAY INCOME
by fiscal years

Source	1955	1956	1957	1958	1959	1960	1961	1962	1963
Fuel Taxes and Licenses	\$16,498,391	\$19,729,651	\$20,810,746	\$21,184,785	\$22,151,599	\$23,025,102	\$23,621,826	\$24,253,165	\$24,462,157
Motor Vehicle Fees and Licenses	7,903,447	8,332,525	8,694,413	9,308,684	8,872,487	9,622,552	9,891,869	10,047,642	10,223,394
Inspection Fees and Licenses	-----	-----	-----	-----	-----	-----	-----	91,820	91,270
Federal Matching Funds	4,416,266	5,946,357	7,241,772	9,796,742	20,453,018	19,530,676	16,864,330	17,479,226	19,183,777
Counties, Towns and Cities	1,713,898	1,760,966	1,753,286	1,550,580	1,507,029	2,549,772	1,794,664	1,642,308	1,642,573
Private Contributions	231,489	464,848	37,599	11,783	78	-----	-----	-----	-----
State General Fund	1,109,543	228,179	138,873	962,395	946,156	1,050,531	1,063,026	597,109	590,228
Earnings on Investments	321,964	209,643	354,218	381,602	199,924	452,296	492,161	363,768	269,390
Other Licenses and Permits	97,282	102,299	126,592	116,792	125,819	140,754	150,889	159,285	134,313
Payment for Services Rendered	382,139	516,182	608,670	599,872	445,915	830,988	703,031	922,502	700,191
Operators' Examination Fees	27,053	50,404	56,302	69,936	85,545	98,384	89,352	81,245	92,291
Sale of Automobiles	400	34,387	954	453	-----	-----	-----	-----	-----
Fines and Police Costs	77,849	133,542	225,211	201,213	171,402	224,885	242,184	212,703	179,035
Miscellaneous	39,326	49,209	58,044	60,423	48,855	45,887	45,367	264,831	103,983
Total	\$32,819,048	\$37,558,192	\$40,106,680	\$44,245,259	\$55,007,827	\$57,571,826	\$54,958,698	\$56,115,602	\$57,672,603

Source: Maine State Highway Commission.

The most common use of these two provisions is to register a vehicle for 18,000 pounds, for which the registration fee is \$100. This allows the vehicle to operate at the legal gross weight for the vehicle type during the frozen-road months. The vehicle then is registered for a nine-month, short-term permit. The nine-month, short-term fee for a 73,280-pound truck registering in this manner is \$425, or a total of \$525, compared with the \$600 normal fee for that size vehicle.

- Federal-aid.

The federal government provides funds on a state matching basis for construction of projects on designated federal-aid systems. Federal-aid Interstate projects are financed by 90 per cent federal funds and 10 per cent state funds. The Interstate program is set up to provide sufficient financing for construction of the entire system by 1972.

Federal-aid primary, secondary and urban funds are provided on a limited basis according to a nationwide apportionment formula. These funds are matched on a 50-50 basis by the State. The present

apportionment of funds to these systems will not provide for complete modernization within a foreseeable future period.

- Highway bonds.

The State Highway Commission has been issuing bonds to supplement current income for several years. Table 21 shows the status of this bonding program. Presently, the Commission has available an additional 20 million dollars in bond revenues from current authorizations.

- State and local governments.

The State General Fund currently provides for 25 per cent of the total cost of State Police operations. The remaining 75 per cent is a responsibility of the General Highway Fund and the highway user.

Local governments contribute funds to the State Highway Commission to match state-aid construction. The amount contributed by the cities and towns is based on a schedule of population, assessed valuation and road mileage.

STATE HIGHWAY EXPENDITURES

Table 22 lists the expenditures of the State Highway Commission for the years 1955 to 1963.

Non-construction expenditures in 1963 amounted to 43 per cent of the total 63.5-million-dollar schedule. Construction expenditures in 1963 on the state systems (state highway and state-aid) amounted to 34.3 million dollars. The Commission also provided 1.8 million dollars for local road construction through the Town Road Improvement Fund.

LOCAL GOVERNMENT INCOME AND EXPENDITURES

Local government income and expenditures for the past nine years are listed in Tables 23 and 24. Highway-user revenues are available to the local governments through the Town Road Improvement Fund and through payments for snow removal on the state-aid system.

Local governments also receive the excise taxes paid on motor vehicles in lieu of personal-property taxes. Although the excise taxes must be paid prior to vehicle registration, these taxes usually are not considered to be highway-

user taxes. Excise taxes are not dedicated to highway improvements at the local level, although most towns use them for this purpose. Excise tax receipts amounted to 7.7 million dollars in 1963.

FORECAST OF STATE HIGHWAY INCOME

To determine how well the State will be able to finance its improvement program, the Consultant made independent detailed analyses and estimates of the revenues expected to be available from current tax sources during the 17-year program period.

The procedures used in forecasting were compared with State Highway Commission methods and discussed with members of the Commission's planning staff. The resultant forecasts of motor vehicle registrations and motor fuel consumption made by the Consultant closely paralleled those made independently by the Commission. In view of this, it was decided to use the exact figures prepared by the Commission on these two factors to maintain continuity with various published reports of forecast values for Maine.

Figures 16, 17, 18, 19 and 20 illustrate in summary form the sequence of analysis in forecasting motor vehicle registrations and motor fuel consumption.

Table 21
MAINE'S HIGHWAY BONDING PROGRAM
(excluding toll bridges)
June 30, 1964

Purpose	Date Authorized	Amount Authorized	Date Issued	Amount Issued	Amount Unissued	Principal Retired	Principal Outstanding	Projected Interest
Deer Isle-Sedgwick Bridge		\$ 490,000	11-1-37	\$ 490,000	\$ -----	\$ 384,000	\$ 106,000	\$ 18,960
General Highway	1951	27,000,000	8-1-52 4-1-53 4-1-53	4,000,000 7,500,000 15,500,000	----- ----- -----	4,000,000 7,500,000 10,500,000	----- ----- 5,000,000	----- ----- 304,000
Fore River Bridge	1951	7,000,000	8-1-52	7,000,000	-----	-----	7,000,000	397,500
General Highway	1957	24,000,000	12-15-58 7-1-59 8-1-61 7-15-63	3,500,000 9,000,000 3,000,000 8,500,000	----- ----- ----- -----	900,000 1,850,000 300,000 -----	2,600,000 7,150,000 2,700,000 8,500,000	462,500 1,404,875 803,150 2,554,750
Passagossawaukeag Bridge	1959	3,900,000	8-1-61	3,900,000	-----	800,000	3,100,000	406,450
General Highway	1959	13,000,000	7-15-63	5,500,000	7,500,000	-----	5,500,000	1,625,300
General Highway	1961	6,000,000	-----	-----	6,000,000	-----	-----	-----
General Highway	1963	7,000,000	-----	-----	7,000,000	-----	-----	-----
Total		\$88,390,000		\$67,890,000	\$20,500,000 ^{1/}	\$26,234,000	\$41,656,000	\$7,977,485

^{1/} Consists of \$9,150,000 allocated and \$11,350,000 not allocated.

Source: Maine State Highway Commission.

Table 22
MAINE STATE HIGHWAY EXPENDITURES
by fiscal years

Item	1955	1956	1957	1958	1959	1960	1961	1962	1963
Highway	\$13,171,958	\$13,152,719	\$15,246,735	\$21,836,551	\$31,787,298	\$28,321,141	\$25,861,127	\$27,067,781	\$29,450,645
Construction									
Grade-crossing	14,336	9,706	12,813	29,350	10,408	34,667	7,537	41,339	3,236
Protection									
Picnic Areas	18,674	28,394	24,259	29,740	24,543	39,420	28,559	51,712	37,722
Bridge Construction	1,997,496	2,370,399	929,635	1,243,934	1,172,761	1,189,801	1,213,458	1,235,728	1,140,058
State-aid	2,158,572	2,684,293	2,747,033	2,631,512	2,720,135	2,586,043	2,459,746	2,667,873	2,359,411
Construction									
State-aid Construction (Special)	-----	1,024,840	1,120,698	1,253,854	1,093,516	1,285,920	1,096,758	1,514,136	1,332,660
Town Road	928,352	1,513,234	1,533,576	1,501,460	1,487,000	1,453,335	1,538,675	1,522,907	1,770,995
Improvement									
Special Resolves	27,002	35,334	750	3,413	-----	19,703	2,852	5,637	-----
Special Resolves, Claims	-----	4,636	-----	-----	-----	-----	-----	-----	-----
Island Refunds	-----	2,500	2,859	2,110	1,719	3,426	1,102	3,529	5,008
Bridge Maintenance	557,493	424,411	527,584	544,099	539,069	637,201	833,775	1,550,760	1,055,781
Highway	7,613,202	6,766,135	7,087,788	7,168,446	7,703,804	8,302,591	8,096,635	8,529,862	8,452,806
Maintenance									
Flood Damage	819,300	130,133	-----	-----	-----	-----	-----	-----	-----
Snow Removal	3,703,333	4,107,395	4,284,494	4,900,251	5,192,589	5,250,334	5,483,782	5,422,078	6,366,132
Traffic Services	213,138	228,300	198,788	292,270	334,695	313,387	424,274	460,367	385,256
Administration	583,391	594,815	614,278	694,897	712,278	784,580	800,105	825,602	900,113
Contingent Expenses	138,661	231,459	153,157	102,025	144,547	229,156	141,307	231,192	699,505
Radio Operations	34,362	32,315	32,364	40,461	36,280	38,169	53,669	53,701	47,563
Planning	149,753	167,497	296,406	248,497	319,166	480,062	406,201	301,584	381,289
Compensation	52,468	44,766	43,268	45,293	41,954	57,108	57,898	52,441	50,298
Bond Retirement and Interest	2,358,730	2,006,000	1,873,000	3,538,000	545,250	4,222,113	5,347,618	3,849,763	4,408,538
Secretary of State	537,840	731,939	550,591	627,032	645,366	702,891	1,015,255	722,918	725,425
Secretary of State - Buildings	11,710	12,096	13,412	12,058	15,859	18,050	17,600	18,601	18,729
Secretary of State - Registration	410	785	1,063	1,248	2,028	2,229	1,674	1,848	1,974
State Police	1,172,460	1,465,693	1,396,088	1,662,137	1,923,593	2,066,277	2,143,848	2,018,821	2,365,433
State Police - Buildings	11,947	11,594	10,619	10,467	11,796	17,329	19,358	18,762	17,918
State Police - Garage	-----	-----	-----	55,263	64,127	8,322	-----	-----	-----
State Police - Motor Vehicle Inspection	-----	-----	-----	-----	-----	-----	-----	28,587	28,211
Highway Safety Committee	-----	-----	-----	-----	-----	17,573	30,386	24,778	24,443
Public Utilities	73,869	83,270	91,014	91,817	100,306	112,771	124,248	126,205	117,146
Land Damage Board	-----	-----	-----	-----	-----	-----	-----	26,766	48,831
Contributions and Transfers	503,264	479,996	481,244	619,546	628,055	732,648	789,334	967,518	972,852
Services Rendered Other Agencies	344,822	441,292	402,504	414,670	335,876	328,826	349,459	319,871	311,780
Total	\$37,196,543	\$38,785,947	\$39,676,019	\$49,600,399	\$57,594,015	\$59,255,074	\$58,346,238	\$59,662,667	\$63,479,756

Source: Maine State Highway Commission.

Table 23
LOCAL GOVERNMENT INCOME FOR HIGHWAYS IN MAINE
by fiscal years

Source	1955	1956	1957	1958	1959	1960	1961	1962	1963
Receipts from Local Revenues Counties and Townships Municipalities	\$ 3,858,709 5,119,686	\$ 3,834,283 6,288,325	\$ 4,118,097 6,351,073	\$ 3,876,548 6,412,780	\$ 4,536,519 7,368,240	\$ 4,463,750 6,812,365	\$ 4,648,037 8,340,910	\$ 4,145,113 8,548,437	\$ 4,450,751 9,299,612
Total	\$ 8,978,395	\$10,122,608	\$10,469,170	\$10,289,328	\$11,904,759	\$11,276,115	\$12,988,947	\$12,693,550	\$13,750,363
Other Receipts Counties and Townships Municipalities	\$ 480,828 220,984	\$ 899,991 196,547	\$ 330,943 201,928	\$ 146,279 94,092	\$ 135,705 47,711	\$ 143,336 28,757	\$ 11,884 162,344	\$ 28,150 73,128	\$ 14,259 101,893
Total	\$ 701,812	\$ 1,096,538	\$ 532,871	\$ 240,371	\$ 183,416	\$ 172,093	\$ 174,228	\$ 101,278	\$ 116,152
Receipts from State Counties and Townships Municipalities	\$ 1,267,456 404,067	\$ 1,062,494 360,532	\$ 802,047 218,658	\$ 1,957,808 562,451	\$ 1,990,254 623,298	\$ 2,026,575 564,040	\$ 2,168,072 650,533	\$ 2,037,256 670,079	\$ 2,108,085 664,316
Total	\$ 1,671,523	\$ 1,423,026	\$ 1,020,705	\$ 2,520,259	\$ 2,613,552	\$ 2,590,615	\$ 2,818,605	\$ 2,707,335	\$ 2,772,401
Borrowings Counties and Townships Municipalities	\$ 199,374 333,062	\$ 541,440 274,639	\$ 109,675 403,860	\$ 448,632 448,262	\$ 181,490 173,438	\$ 1,145,040 429,533	\$ 89,260 72,314	\$ 170,740 190,923	\$ 146,708 419,283
Total	\$ 532,456	\$ 816,079	\$ 513,535	\$ 896,894	\$ 354,928	\$ 1,574,573	\$ 161,574	\$ 361,663	\$ 565,991
Total Income Counties and Townships Municipalities	\$ 5,806,367 6,077,799	\$ 6,338,208 7,120,043	\$ 5,360,762 7,175,519	\$ 6,429,267 7,517,585	\$ 6,843,968 8,212,687	\$ 7,778,701 7,834,695	\$ 6,917,253 9,226,101	\$ 6,381,259 9,482,567	\$ 6,719,803 10,485,104
Total	\$11,884,166	\$13,458,251	\$12,536,281	\$13,946,852	\$15,056,655	\$15,613,396	\$16,143,354	\$15,863,826	\$17,204,907

Source: Maine State Highway Commission.

Table 24
LOCAL GOVERNMENT EXPENDITURES FOR HIGHWAYS IN MAINE
by fiscal years

Item	1955	1956	1957	1958	1959	1960	1961	1962	1963
Construction and Maintenance Counties and Townships Municipalities	\$ 4,541,434 5,581,423	\$ 3,787,976 6,276,238	\$ 3,987,163 6,260,777	\$ 4,859,790 6,718,377	\$ 5,526,893 7,446,724	\$ 5,524,642 7,125,031	\$ 5,546,231 8,409,185	\$ 5,110,044 8,470,749	\$ 5,513,818 9,469,421
Total	\$10,122,857	\$10,064,214	\$10,247,940	\$11,578,167	\$12,973,617	\$12,649,673	\$13,955,416	\$13,580,793	\$14,983,239
Miscellaneous Counties and Townships Municipalities	\$ 45,233 87,442	\$ 30,127 149,998	\$ 71,742 229,206	\$ 61,087 127,143	\$ 98,574 14,245	\$ 45,243 8,626	\$ ----- -----	\$ ----- -----	\$ ----- -----
Total	\$ 132,675	\$ 180,125	\$ 300,948	\$ 188,230	\$ 112,819	\$ 53,869	\$ -----	\$ -----	\$ -----
Contributions to State Counties and Townships Municipalities	\$ 856,012 257,621	\$ 1,773,655 351,915	\$ 1,174,803 536,314	\$ 1,032,151 499,131	\$ 1,016,234 561,597	\$ 1,971,132 435,430	\$ 1,031,862 543,973	\$ 947,814 724,923	\$ 878,686 655,217
Total	\$ 1,113,633	\$ 2,125,570	\$ 1,711,117	\$ 1,531,282	\$ 1,577,831	\$ 2,406,562	\$ 1,575,835	\$ 1,672,737	\$ 1,533,903
Debt Service Counties and Townships Municipalities	\$ 325,900 151,313	\$ 624,379 341,892	\$ 323,336 149,222	\$ 268,902 172,934	\$ 325,660 190,121	\$ 331,771 265,608	\$ 349,710 272,943	\$ 323,401 286,895	\$ 327,299 360,466
Total	\$ 477,213	\$ 966,271	\$ 472,558	\$ 441,836	\$ 515,781	\$ 597,379	\$ 622,653	\$ 610,296	\$ 687,765
Total Expenditures Counties and Townships Municipalities	\$ 5,768,579 6,077,799	\$ 6,216,137 7,120,043	\$ 5,557,044 7,175,519	\$ 6,221,930 7,517,585	\$ 6,967,361 8,212,687	\$ 7,872,788 7,834,695	\$ 6,927,803 9,226,101	\$ 6,381,259 9,482,567	\$ 6,719,803 10,485,104
Total	\$11,846,378	\$13,336,180	\$12,732,563	\$13,739,515	\$15,180,048	\$15,707,483	\$16,153,904	\$15,863,826	\$17,204,907

Source: Maine State Highway Commission.

Figure 16
MAINE
POPULATION

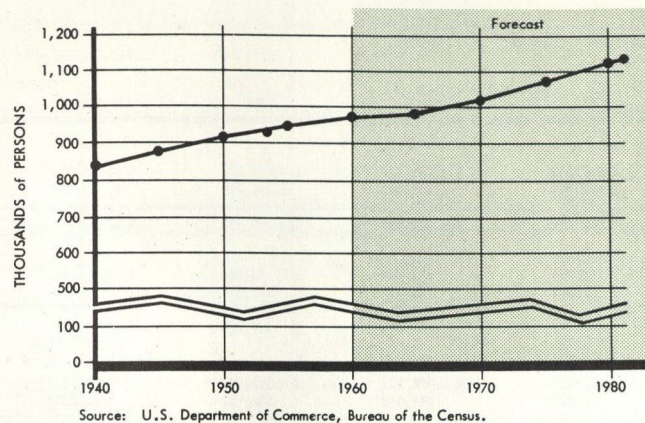


Figure 17
MOTOR VEHICLE
REGISTRATIONS
IN MAINE

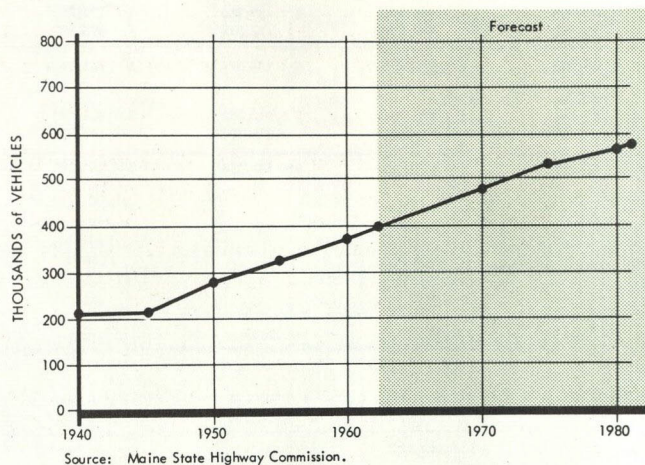


Figure 18
PERSONS PER
REGISTERED
VEHICLE
IN MAINE

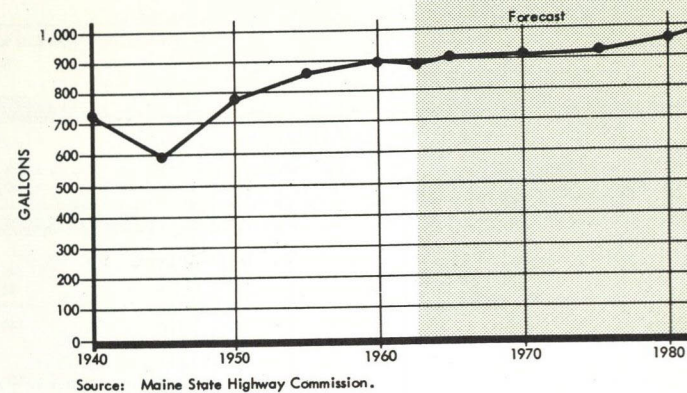
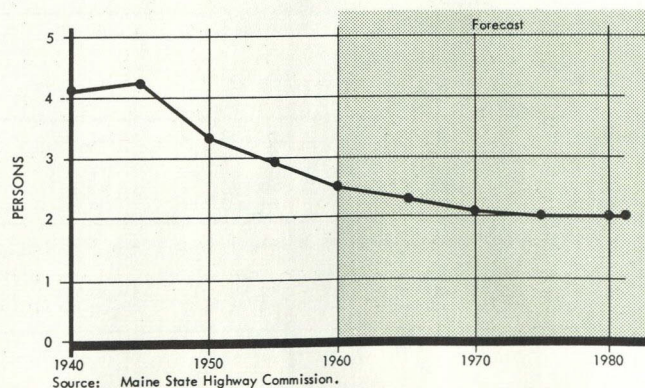


Figure 19
MOTOR FUEL
CONSUMPTION PER
VEHICLE IN MAINE

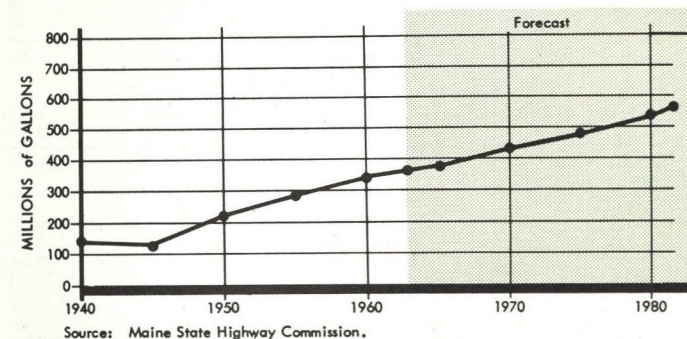


Figure 20
TOTAL MOTOR
FUEL CONSUMPTION
IN MAINE

Figure 16 shows the population projection for the State as made by the U. S. Department of Commerce, Bureau of the Census. Population is recognized as one of the most reliable subjects to forecast.

Population and motor vehicle registrations, shown in Figure 17, illustrate the declining ratio of persons per vehicle, as shown in Figure 18. This ratio is expected to continue to decline until it reaches two persons per vehicle in 1975, and then hold constant. This ratio, coupled with the population forecast, provides the motor vehicle registration forecast.

Analyses of historical motor vehicle registrations, probable vehicular mileages and fuel consumption rates, historical total fuel consumption, and trends in these values provide the basis for the forecast of motor fuel consumption per vehicle shown in Figure 19, and the forecast of total motor fuel consumption shown in Figure 20.

Motor Fuel Taxes And Licenses

Once motor fuel consumption figures are obtained, these must be converted into net revenues expected from them. This involves analysis of collection costs, motor vehicle travel characteristics and motor vehicle fuel consumption rates.

Motor fuel taxes and licenses are expected to provide \$560,749,000 during the 17-year improvement period, for an average annual income of \$32,985,000.

Motor Vehicle Fees and Licenses

Forecasting of registration revenues in Maine involves not only analysis of the numbers of vehicles expected to be registered by gross weight groups but also analysis of the effect of the short-term permit law on revenues. Generally, the State realizes only 88 per cent of the normal registration fees from trucks over 18,000 pounds gross weight.

Motor vehicle registration fees and licenses are expected to bring \$225,888,000 into the General Highway Fund over the 17-year period, for an average annual income of \$13,288,000.

Federal-aid

The course of federal-aid for highways is well defined through fiscal year 1972. It is expected that federal-aid will provide each state with sufficient funds to pay 90 per cent of the cost of completing the Interstate program, plus funds for the federal-aid primary, secondary and urban systems (ABC programs) based on annual apportionments of one billion dollars according to formula. Maine's share of the annual apportionment for ABC roads is \$6,651,503.

What will happen to federal-aid after 1972 is the subject of much conjecture and opinion. The answer to this question is expected to come as a result of the "After '72 Study" described in Chapter Three. The outcome of this decision, of course, is of paramount concern to the people of Maine.

With exception of the Interstate program, federal funds are not now provided on a relative needs basis. It appears that one primary intent of the "After '72 Study" is to develop a federal-aid program which will apportion funds to the states on the basis of needs. In this manner, there would be recognition of the variations between states in the adequacy of existing roads, the comparative costs for improvements in different environments and, possibly, the ability of individual states to meet financial requirements.

For purposes of this study, the Consultant has taken the position that (1) federal taxes for highway purposes will be continued at nearly the same rate as now being levied, (2) the federal-aid primary, secondary and urban apportionments will continue at the one-billion-dollar level, and (3) the balance of federal funds probably will be apportioned to the states on a relative needs basis after 1972.

To forecast federal-aid for Maine, it first was necessary to forecast revenues for the Federal Highway Trust Fund. This was done on the basis of analyzing current Trust Fund growth.

Under the premises listed above, Maine would receive (1) a share of the one-billion-dollar ABC apportionment based on the existing formula, and (2) a share of the balance of Federal Highway Trust Fund revenues, the latter to be determined on the basis of relative needs.

In the absence of current nationwide needs data, three measures were considered as possibly representative of Maine's needs as compared with the needs of the nation as a whole.

The first measure considered was the relationship between Maine's present Interstate apportionments and the national total of Interstate apportionments. Use of this indicator is based on the possibility that Maine's Interstate traffic and construction needs are somewhat representative of its overall needs as compared to the needs of other states. There also may be some possibility that consideration would be given to a minimum allotment to some of the low population-density states based on what they currently are receiving, regardless of the relative needs in these states. On the basis of this indicator, Maine could expect to receive an average of 15.6 million dollars per year from 1973 to 1982 to replace Interstate funds, or a total of 22.3 million dollars per year including the regular ABC program.

The second measure considered was relative needs on federal-aid systems as determined for the national Highway Cost Allocation Study (Section 210, 1956 Federal Highway Act) completed in 1958. On the basis of this needs ratio, Maine could expect to receive an average of 20.9 million dollars per year from 1973 to 1982 to replace the Interstate apportionment, or a total of 27.6 million dollars per year including the ABC program.

The third measure considered was relative needs on the Federal-aid Primary System as determined in the "210 Study". On this basis, Maine could expect to receive average annual federal-aid apportionments of 18.2 million dollars in place of Interstate funds, or a total of 24.9 million dollars per year including the ABC program.

Method Selected for this Study —

For the studies of highway-user and non-user responsibilities required in this study, the Consultant selected the ratio of Maine's federal-aid primary needs to nationwide primary needs as the most consistent comparison of like values.

The federal-aid primary networks are composed of approximately 7 per cent of the total road mileage in each state. They generally are the principal highways in each state and thus reflect similar service characteristics.

These factors are not consistent in either of the other proportioning methods. The Interstate System is a limited network of routes specifically selected to provide a nationwide expressway system. Maine, a border state, does not have transcontinental routes passing through it as do some central states.

The ratio based on total ABC needs is affected by the size and character of the various federal-aid secondary networks in the states. Some states have over 30 per cent of their total road mileage on the ABC systems, while only 19 per cent of Maine's total mileage is on these systems. Other states have as little as 10 per cent of their total mileage on the ABC systems.

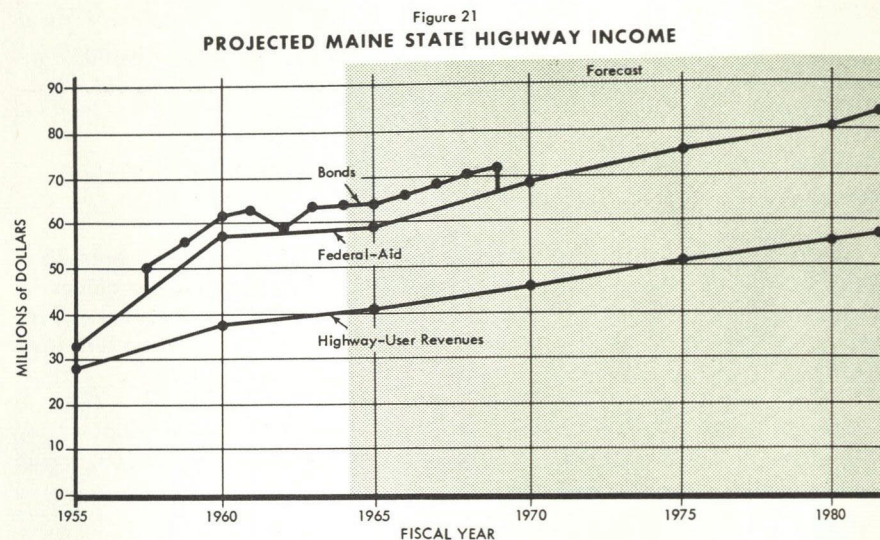
On the basis of the federal-aid primary ratio, Maine would be expected to receive \$182,050,000 in supplemental federal-aid from 1973 to 1982. This amount has been allocated to the existing federal-aid systems on a relative needs basis.

Total federal-aid expected to be received by Maine on this basis for the 17-year program is \$411,195,000, for an average annual income of \$24,188,000. This compares with \$19,800,000 apportioned to Maine in 1966.

Table 25		17-year	17-year
PROJECTED MAINE STATE HIGHWAY INCOME		Total	Annual Average
Fiscal Years 1966-82			
Source			
Fuel Taxes and Licenses	\$ 560,749,000	\$32,985,000	
Motor Vehicle Fees and Licenses	225,888,000	13,288,000	
Federal Apportionments	411,195,000	24,188,000	
Counties, Cities and Towns	30,090,000	1,770,000	
Other	38,154,000	2,244,000	
Subtotal	\$1,266,076,000	\$74,475,000	
General Highway Bonds	20,500,000	1,206,000	
Total	\$1,286,576,000	\$75,681,000	

Summary

Total revenues expected to be available in Maine for the program period are shown in Table 25 and Figure 21. These revenues are expected to average \$75,681,000 each year for the 17 years.



FORECAST OF STATE EXPENDITURES FOR OTHER THAN STATE CONSTRUCTION

From the sizeable amount of revenues estimated to be available to the State Highway Commission, it would appear that Maine would be able to meet its program requirements. However, the State also has large commitments on its funds before balances are available for construction. Principal among these are maintenance, administration and debt service.

The cost of maintaining Maine's highways has increased steadily for several years. A major increase has been brought about by the Interstate System, and these costs will continue to rise as more and more miles of Interstate are completed. The Consultant made detailed analyses of maintenance costs by items for the purpose of forecasting these requirements in the future.

The cost of administration generally is related to the size of the total program. Administration costs were analyzed in relation to program requirements and have been forecast accordingly.

The Commission staff assisted in preparing a schedule of bond retirements and interest expenses for the next 17 years. Table 21 shows the outstanding balances on these issues.

Summary

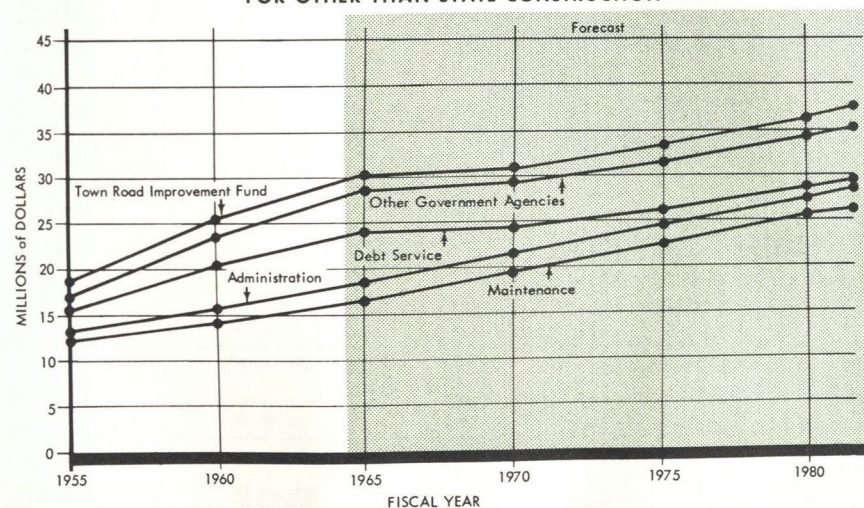
Prior commitments on funds available to the State Highway Commission are summarized in Table 26 and Figure 22. These commitments are expected to average \$33,370,000 annually for the 17-year program period.

Figure 23 compares the total projected state income with the projected expenditures for other than state construction.

Table 26
PROJECTED MAINE STATE HIGHWAY EXPENDITURES
FOR OTHER THAN STATE CONSTRUCTION
Fiscal Years 1966-82

Item	17-year Total	17-year Annual Average
Maintenance	\$370,294,000	\$21,782,000
Administration	36,975,000	2,175,000
Debt Service	42,032,000	2,472,000
Other Government Agencies	91,808,000	5,400,000
Town Road Improvement Fund	26,180,000	1,540,000
Total	\$567,289,000	\$33,370,000

Figure 22
PROJECTED MAINE STATE HIGHWAY EXPENDITURES
FOR OTHER THAN STATE CONSTRUCTION

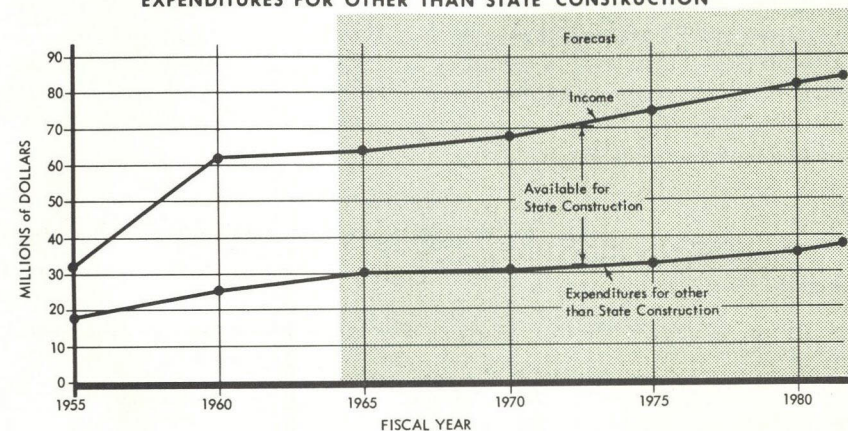


FORECAST OF LOCAL GOVERNMENT INCOME AND EXPENDITURES

Table 27 summarizes the projected revenues and expenditures for highways at the local level.

It is difficult to analyze various town reports in order to determine maintenance and construction differences. For example, one town may report re-surfacing as a maintenance item and another may call it construction. It is the opinion of the Consultant that some portions of reported (and hence projected) maintenance expenditures actually are capital improvements.

Figure 23
COMPARISON OF PROJECTED MAINE STATE HIGHWAY INCOME AND
EXPENDITURES FOR OTHER THAN STATE CONSTRUCTION



STATE SHARE OF STATE IMPROVEMENT COSTS

A primary purpose of this study was to explore the position of the State for financing its construction program. For this analysis, the federal share of the program must be removed from the total cost. This calculation is shown in Table 28 for the state systems. There are no federal funds available for town way construction.

Comparison of the federal-aid expected to be received for the ABC systems over the program period with the 17-year needs for these systems as listed previously reveals the following:

- Available federal-aid for ABC — \$290,695,000.
- Improvement needs for ABC — \$627,112,000.

This means that federal-aid may be expected to meet 46 per cent of the needs on these systems. Revenues available for state highway construction, after providing for operating expenses and Interstate matching, are expected to amount to \$294,703,000 for the 17-year period — or 47 per cent of the needs on these systems.

Table 27		17-year Total	17-year Annual Average
PROJECTED LOCAL GOVERNMENT INCOME AND EXPENDITURES FOR HIGHWAYS IN MAINE Fiscal Years 1966-82	Income	\$395,573,000	\$23,269,000
	Less Expenditures for Other Than Local Road Construction	336,821,000	19,813,000
	Balance Available for Local Road Construction	\$ 58,752,000	\$ 3,456,000

In summary, if all the funds available to the State for construction were to be applied to the Interstate and ABC systems, the Interstate System would be completed and 93 per cent of the ABC systems would be brought up to the minimum acceptable level of adequacy over the 17-year program. This would allow no construction expenditures on the state non-federal-aid systems.

Another point is that if the matching ratio on the ABC systems remains at 50-50, the State must provide \$290,695,000 over the 17-year period. This would leave only \$4,008,000 for the entire period which could be spent for 100 per cent state-financed projects on the state systems. There is considerable likelihood that the federal-state matching ratio will be modified to require less state funds for matching after 1972.

Table 28 shows that the average annual State share of state construction costs is \$41,846,000. Only \$18,123,000 will be available for construction from state revenues, leaving an annual deficit of \$23,723,000. This means that Maine must provide an average of \$23,723,000 in additional state revenues over the next 17 years if it is to meet the construction goals set by the needs appraisal.

The next chapter develops the cost responsibilities for the overall construction and maintenance program.

Table 28 FEDERAL AND STATE SHARES OF STATE CONSTRUCTION COSTS IN MAINE Fiscal Years 1966-82		System	Total Construction Cost	Average Annual Construction Cost	Total Federal Share	Average Annual Federal Share	Total State Share	Average Annual State Share
		State Highway, Federal-aid Interstate						
		Rural	\$ 106,184,000	\$15,169,000	\$ 95,565,000	\$13,652,000	\$ 10,619,000	\$ 1,517,000
		Urban	27,705,000	3,958,000	24,935,000	3,562,000	2,770,000	396,000
		Subtotal	\$ 133,889,000	\$19,127,000 1/	\$120,500,000	\$17,214,000 1/	\$13,389,000	\$ 1,913,000 1/
		State Highway, Federal-aid Primary						
		Rural	\$ 290,676,000	\$17,099,000	\$144,794,000	\$ 8,517,000	\$145,882,000	\$ 8,583,000
		Urban	43,853,000	2,580,000	18,177,000	1,069,000	25,676,000	1,510,000
		Subtotal	\$ 334,529,000	\$19,679,000	\$162,971,000	\$ 9,586,000	\$171,558,000	\$10,093,000
		State Highway, Federal-aid Secondary						
		Rural	\$ 151,457,000	\$ 8,909,000	\$ 66,661,000	\$ 3,921,000	\$ 84,796,000	\$ 4,988,000
		Urban	25,005,000	1,471,000	10,365,000	610,000	14,640,000	861,000
		Subtotal	\$ 176,462,000	\$10,380,000	\$ 77,026,000	\$ 4,531,000	\$ 99,436,000	\$ 5,849,000
		State-aid, Federal-aid Secondary						
		Rural	\$ 100,138,000	\$ 5,890,000	\$ 44,073,000	\$ 2,592,000	\$ 56,065,000	\$ 3,298,000
		Urban	15,983,000	940,000	6,625,000	390,000	9,358,000	550,000
		Subtotal	\$ 116,121,000	\$ 6,830,000	\$ 50,698,000	\$ 2,962,000	\$ 65,423,000	\$ 3,848,000
		State Highway, Non-federal-aid						
		Rural	\$ 44,529,000	\$ 2,619,000	\$ -----	\$ -----	\$ 44,529,000	\$ 2,619,000
		Urban	10,122,000	595,000	-----	-----	10,122,000	595,000
		Subtotal	\$ 54,651,000	\$ 3,214,000	\$ -----	\$ -----	\$ 54,651,000	\$ 3,214,000
		State-aid, Non-federal-aid						
		Rural	\$ 234,137,000	\$13,773,000	\$ -----	\$ -----	\$234,137,000	\$13,773,000
		Urban	72,781,000	4,281,000	-----	-----	72,781,000	4,281,000
		Subtotal	\$ 306,918,000	\$18,054,000	\$ -----	\$ -----	\$306,918,000	\$18,054,000
		Total						
		Rural	\$ 927,121,000	\$54,537,000	\$351,093,000	\$20,653,000	\$576,028,000	\$33,884,000
		Urban	195,449,000	11,497,000	60,102,000	3,535,000	135,347,000	7,962,000
		Total	\$1,122,570,000	\$66,034,000	\$411,195,000	\$24,188,000	\$711,375,000	\$41,846,000
		State Revenues Available for State Construction						
							\$308,092,000	\$18,123,000
		Deficit					\$403,283,000	\$23,723,000

1/ For 7-year period, fiscal years 1966-72.

HIGHWAY COST RESPONSIBILITY

Now that Maine's highway needs and construction costs have been determined as presented in preceding chapters, the question arises: Who is responsible for these costs?

The problems of equitable taxation for highways have been studied extensively, and several methods have been developed to provide guidelines for establishing tax schedules. Five methods were applied in the 1965 Highway-User Tax Study to determine an equitable distribution of Maine's highway cost responsibilities among the various highway beneficiaries.

These methods were:

- Earnings-credit
- Vehicle-miles
- Ton-miles
- Incremental
- Cost-function

BETWEEN HIGHWAY USERS AND NON-USERS

It is obvious that a great many highways provide benefits to properties and businesses adjacent to them. In the case of many local roads and streets, their predominant service is to properties, businesses and other individual and community needs. There is not sufficient traffic on many of them to warrant their cost if highway use were the only consideration. Thus, non-users logically should bear a predominant share of the cost of these facilities.

On other highways, traffic obviously is sufficient to warrant their cost by this factor alone. Nevertheless, there still are benefits to properties and businesses adjacent to these facilities. It is reasonable to expect, however, that the highway users should bear a predominant share of the cost of these facilities.

These two logical conclusions form the basis for establishing the division of cost responsibility between highway users and non-users.

Earnings-Credit Method

The earnings-credit method of determining cost responsibility is based on the considerations given above by reaching a compromise between two extreme assumptions, namely (1) that the costs of all low-volume local roads are the responsibility of property owners, and (2) that the costs of all high-volume primary roads are the responsibility of highway users. The analyses are performed separately for rural and urban facilities.

The 17-year average annual program costs — excluding federal-aid — are determined for six classes of highways by dividing rural and urban facilities into high, medium and low traffic volume classes. Costs per mile and per vehicle-mile of travel are determined for each class. These data are summarized in Table 29.

The first step in the earnings-credit method is commonly known as the "top-drawer" solution. For this solution, highway users are assessed a share of costs as if they were to pay for the full costs of the high-volume routes at whatever rate per vehicle-mile of travel on these roads is required, and as if they were to participate in the costs of the other two volume groups at the same rate per vehicle-mile. The balance of costs on the two lower groups which is not assessed to the users becomes the non-user share.

Results of the top-drawer solution are presented in Table 30-A. This solution is unfair to highway users since no portion of the costs of high-volume routes is assessed to non-users.

The next step is known as the "bottom-drawer" solution. For this solution, non-users are assessed a share of costs as if they were to pay for the full costs of the low-volume routes at whatever cost per mile of road is required, and as if they were to participate in the costs of the other two volume groups at the same cost per mile. The balance of costs on the two higher groups which is not assessed to the non-users becomes the user share.

Table 30-B lists the bottom-drawer solution. This solution is unfair to non-users since users are assessed no charge for the low-volume routes.

The final step in this method is to seek a compromise between the two extreme solutions. To do this, the average cost per vehicle-mile required of highway users for the two higher volume groups as a result of the bottom-drawer solution is determined by (1) dividing the total assigned user cost for both groups by the total vehicle-miles, and (2) averaging this rate per vehicle-mile with the rate per vehicle-mile assigned to highway users in the top-drawer solution. The compromise highway-user share then is redetermined

using the new average rate per vehicle-mile on all systems, and non-users are assigned the remainder of the costs.

Table 30-C presents the compromise solution. By this solution, highway users are assigned responsibility for 61.556 per cent of the costs (still excluding federal-aid) of the total highway program needed in Maine, and non-users are responsible for the remaining 38.444 per cent.

Comparison of this ratio between user and non-user responsibilities with results of similar determinations made recently in other states shows the non-user share to be slightly higher in Maine. A recently completed study in Oklahoma, for example, indicated that 64 per cent of the program costs were the user's responsibility and the remaining 36 per cent were the responsibility of non-users.

The most important reason for this difference is the relationship of federal-aid. For this study, a realistic projection of future federal-aid has taken into account a most likely continuance of the amounts of federal funds that presently are allocated to the Interstate System. These funds, most of which are derived from user taxes, have been applied to the presently designated federal-aid systems — relatively high-volume routes. This has the result of substantially reducing the user share of state funds required for these routes and, accordingly, the total user share determined by the earnings-credit method.

BETWEEN CLASSES OF HIGHWAY USERS

Once the highway-user share of costs has been determined, there remains the problem of distributing this responsibility to the various classes of users. Several factors need to be considered in determining the assignment of responsibility among the users. These include numbers of vehicles, travel characteristics, and weight and size relationships.

To assess these factors and to use them for making proportionate allocations, it is necessary to develop complete schedules of current and projected vehicle registrations, vehicle-miles, ton-miles and axle-miles of travel by vehicle types, by gross weight groups, by administrative highway systems and by traffic classes of rural roads and city streets.

Although the summaries of the solutions as presented in this report show travel summaries broken down only by system classifications and gross vehicle weight groups, the assignment of user responsibilities actually was made for a complete breakdown by vehicle types and average daily traffic groups of roads and streets. These complete schedules have been turned over to the State Highway Commission for future use as needed.

Table 31 is illustrative of the final development of travel data.

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By this solution, highway of the costs (still exclud- d in Maine, and non- ent.

user responsibilities with her states shows the non- ly completed study in of the program costs were ent were the responsibility

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AY USERS

n determined, there remains various classes of users. ng the assignment of re- rs of vehicles, travel char-

ing proportionate alloca- s of current and projected d axle-miles of travel by rative highway systems and

ented in this report show fications and gross vehicle es actually was made for e daily traffic groups of een turned over to the d.

ent of travel data.

Table 29
MAINE DATA FOR EARNINGS-CREDIT METHOD

Highway Class	Total Program Cost	Average Annual Program Cost	Average Annual Federal-aid	State Share of Average Annual Program Cost	Miles of Roads or Streets	Cost Per Mile	1974 Vehicle-miles	Cost Per Vehicle-mile
Rural Roads								
High Volume	\$ 768,533,000	\$ 45,207,000	\$16,188,000	\$ 29,019,000	2,246.31	\$12,919.00	1,920,383,000	\$0.0151110
Medium Volume	584,503,000	34,383,000	4,464,000	29,919,000	7,103.12	4,212.00	1,872,260,000	0.0159800
Low Volume	224,668,000	13,216,000	-----	13,216,000	9,338.66	1,415.19	225,915,000	0.0058060
Subtotal	\$1,577,704,000	\$ 92,806,000	\$20,652,000	\$ 72,154,000	18,688.09		4,018,558,000	
Urban Streets								
High Volume	\$ 341,462,000	\$ 20,086,000	\$ 3,490,000	\$ 16,596,000	547.76	\$30,298.00	1,667,359,000	\$0.0099535
Medium Volume	149,420,000	8,790,000	46,000	8,744,000	140.11	62,408.00	83,967,000	0.1041360
Low Volume	310,156,000	18,244,000	-----	18,244,000	1,432.12	12,739.00	205,116,000	0.0888900
Subtotal	\$ 801,038,000	\$ 47,120,000	\$ 3,536,000	\$ 43,584,000	2,119.99		1,956,442,000	
Total	\$2,378,742,000	\$139,926,000	\$24,188,000	\$115,738,000	20,808.08		5,975,000,000	

Table 30-A
MAINE HIGHWAY-USER AND NON-USER COST RESPONSIBILITY
BY EARNINGS-CREDIT METHOD
(excludes federal funds)

TOP-DRAWER SOLUTION	Cost Per Vehicle-mile (mills)	1974 Vehicle-miles	Average Annual Program Cost	Highway-User Share	Non-User Share
	15.1110	1,920,383,000	\$ 29,019,000	\$29,019,000	\$ -----
	-----	1,872,260,000	29,919,000	28,292,000	1,627,000
	-----	225,915,000	13,216,000	3,414,000	9,802,000
		4,018,558,000	\$ 72,154,000	\$60,725,000	\$11,429,000
	9.9535	1,667,359,000	\$ 16,596,000	\$16,596,000	\$ -----
	-----	83,967,000	8,744,000	836,000	7,908,000
	-----	205,116,000	18,244,000	2,042,000	16,202,000
		1,956,442,000	\$ 43,584,000	\$19,474,000	\$24,110,000
		5,975,000,000	\$115,738,000	\$80,199,000	\$35,539,000

Table 31
DISTRIBUTION OF 1974 VEHICLE-MILES IN MAINE

Gross Vehicle Weight Group	State Highway, Federal-aid Interstate	State Highway, Federal-aid Primary	State Highway, Federal-aid Secondary	State-aid, Federal-aid Secondary	State Highway, Non-federal-aid	State-aid, Non-federal-aid	Town Way	Total
0 - 6000	881,990,000	1,995,510,000	761,810,000	345,770,000	112,970,000	990,480,000	330,330,000	5,418,860,000
6001 - 9000	14,190,000	28,210,000	11,230,000	3,560,000	2,270,000	15,860,000	8,540,000	83,800,000
9001 - 11000	12,220,000	24,450,000	9,100,000	3,670,000	1,960,000	13,860,000	7,450,000	72,710,000
11001 - 14000	8,620,000	33,090,000	6,900,000	2,230,000	1,400,000	10,030,000	4,260,000	66,520,000
14001 - 16000	5,830,000	12,590,000	4,790,000	1,600,000	970,000	7,450,000	3,860,000	37,090,000
16001 - 18000	7,410,000	16,210,000	6,120,000	1,800,000	1,460,000	11,320,000	4,210,000	48,530,000
18001 - 20000	4,480,000	8,150,000	2,960,000	1,060,000	590,000	4,520,000	1,990,000	23,750,000
20001 - 23000	5,790,000	9,560,000	3,270,000	1,190,000	620,000	4,540,000	2,180,000	27,160,000
23001 - 26000	6,110,000	8,690,000	2,480,000	1,070,000	480,000	2,030,000	1,240,000	22,100,000
26001 - 29000	3,960,000	6,600,000	2,000,000	950,000	470,000	3,150,000	900,000	18,030,000
29001 - 32000	6,270,000	8,760,000	2,580,000	1,100,000	500,000	2,930,000	870,000	23,010,000
32001 - 35000	1,130,000	1,440,000	400,000	160,000	60,000	400,000	380,000	3,970,000
35001 - 38000	4,270,000	4,430,000	950,000	350,000	40,000	450,000	220,000	7,220,000
38001 - 42000	1,790,000	2,720,000	820,000	390,000	180,000	1,100,000	590,000	11,080,000
42001 - 46000	1,430,000	1,830,000	490,000	220,000	80,000	530,000	190,000	4,770,000
46001 - 50000	7,900,000	12,310,000	3,370,000	1,860,000	820,000	3,390,000	1,090,000	30,740,000
50001 - 55000	520,000	650,000	450,000	60,000	10,000	80,000	60,000	1,830,000
55001 - 60000	9,430,000	9,210,000	2,200,000	740,000	10,000	540,000	1,250,000	23,380,000
60001 - 65000	17,630,000	21,120,000	5,750,000	1,130,000	20,000	890,000	2,090,000	48,630,000
65001 - 70550	240,000	650,000	240,000	70,000	-----	-----	-----	1,200,000
70551 - 73280	130,000	330,000	120,000	40,000	-----	-----	-----	620,000
Total	1,001,340,000	2,206,510,000	828,030,000	369,020,000	124,910,000	1,073,490,000	371,700,000	5,975,000,000

Table 32
MAINE HIGHWAY-USER COST RESPONSIBILITY
BY VEHICLE-MILES METHOD
(excludes federal funds)

Gross Vehicle Weight Group	State Systems Vehicle-miles	State Systems Cost Responsibility	Town Way Vehicle-miles	Town Way Cost Responsibility	Total Cost Responsibility
0 - 6000	5,088,530,000	\$53,618,000	330,330,000	\$10,843,000	\$64,461,000
6001 - 9000	75,260,000	793,000	8,540,000	280,000	1,073,000
9001 - 11000	65,260,000	688,000	7,450,000	245,000	933,000
11001 - 14000	62,260,000	656,000	4,260,000	140,000	796,000
14001 - 16000	33,230,000	350,000	3,860,000	127,000	477,000
16001 - 18000	44,320,000	467,000	4,210,000	138,000	605,000
18001 - 20000	21,760,000	229,000	1,990,000	65,000	294,000
20001 - 23000	24,980,000	263,000	2,180,000	72,000	335,000
23001 - 26000	20,860,000	220,000	1,240,000	41,000	261,000
26001 - 29000	17,130,000	181,000	900,000	30,000	211,000
29001 - 32000	22,140,000	233,000	870,000	29,000	262,000
32001 - 35000	3,590,000	38,000	380,000	12,000	50,000
35001 - 38000	10,490,000	111,000	590,000	19,000	130,000
38001 - 42000	7,000,000	74,000	220,000	7,000	81,000
42001 - 46000	4,580,000	48,000	190,000	6,000	54,000
46001 - 50000	29,650,000	312,000	1,090,000	35,000	347,000
50001 - 55000	1,770,000	19,000	60,000	2,000	21,000
55001 - 60000	22,130,000	233,000	1,250,000	41,000	274,000
60001 - 65000	46,540,000	490,000	2,090,000	69,000	559,000
65001 - 70550	1,200,000	13,000	-----	-----	13,000
70551 - 73280	620,000	7,000	-----	-----	7,000
Total	5,603,300,000	\$59,043,000	371,700,000	\$12,201,000	\$71,244,000

Table 30-B
MAINE HIGHWAY-USER AND NON-USER COST RESPONSIBILITY
BY EARNINGS-CREDIT METHOD
(excludes federal funds)

Highway Class	Cost Per Mile	Miles	Average Annual Program Cost	Non-User Share	Highway-User Share	1974 Vehicle-miles	Highway-User Cost Per Vehicle-mile (mills)
Rural Roads							
High Volume	\$ -----	2,246.31	\$ 29,019,000	\$ 3,179,000	\$25,840,000	1,920,383,000	-----
Medium Volume	-----	7,103.12	29,919,000	10,052,000	19,867,000	1,872,260,000	-----
Low Volume	1,415.19	9,338.66	13,216,000	13,216,000	-----	225,915,000	-----
Subtotal		18,688.09	\$ 72,154,000	\$26,447,000	\$45,707,000	4,018,558,000	11.3740
Urban Streets							
High Volume	\$ -----	547.76	\$ 16,596,000	\$ 6,978,000	\$ 9,618,000	1,667,359,000	-----
Medium Volume	-----	140.11	8,744,000	1,785,000	6,959,000	83,967,000	-----
Low Volume	12,739.00	1,432.12	18,244,000	18,244,000	-----	205,116,000	-----
Subtotal		2,119.99	\$ 43,584,000	\$27,007,000	\$16,577,000	1,956,442,000	8.4730
Total		20,808.08	\$115,738,000	\$53,454,000	\$62,284,000	5,975,000,000	

Table 30-C
MAINE HIGHWAY-USER AND NON-USER COST RESPONSIBILITY
BY EARNINGS-CREDIT METHOD
(excludes federal funds)

COMPROMISE SOLUTION	Cost Per Vehicle-mile (mills)	1974 Vehicle-miles	Average Annual Program Cost	Highway-User Share	Non-User Share
	-----	1,920,383,000	\$ 29,019,000	\$25,432,000	\$ 3,587,000
	-----	1,872,260,000	29,919,000	24,794,000	5,125,000
	-----	225,915,000	13,216,000	2,992,000	10,224,000
	2430	4,018,558,000	\$ 72,154,000	\$53,218,000	\$18,936,000
	-----	1,667,359,000	\$ 16,596,000	\$15,362,000	\$ 1,234,000
	-----	83,967,000	8,744,000	774,000	7,970,000
	-----	205,116,000	18,244,000	1,890,000	16,354,000
	9.2133	1,956,442,000	\$ 43,584,000	\$18,026,000	\$25,558,000
		5,975,000,000	\$115,738,000	\$71,244,000	\$44,494,000
				61.556%	38.444%

Table 33
MAINE HIGHWAY-USER COST RESPONSIBILITY
BY TON-MILES METHOD

(excludes federal funds)					
Gross Vehicle Weight Group	State Systems Ton-miles	State Systems Cost Responsibility	Town Way Ton-miles	Town Way Cost Responsibility	Total Cost Responsibility
0 - 6000	6,360,690,000	\$29,586,000	412,910,000	\$ 6,208,000	\$35,794,000
6001 - 9000	282,230,000	1,313,000	32,030,000	482,000	1,795,000
9001 - 11000	326,300,000	1,518,000	37,250,000	560,000	2,078,000
11001 - 14000	389,210,000	1,811,000	26,630,000	400,000	2,211,000
14001 - 16000	249,250,000	1,159,000	28,970,000	436,000	1,595,000
16001 - 18000	376,750,000	1,753,000	35,790,000	538,000	2,291,000
18001 - 20000	206,740,000	962,000	18,910,000	284,000	1,246,000
20001 - 23000	268,440,000	1,249,000	23,430,000	352,000	1,601,000
23001 - 26000	255,560,000	1,189,000	15,200,000	229,000	1,418,000
26001 - 29000	235,540,000	1,096,000	12,380,000	186,000	1,282,000
29001 - 32000	337,660,000	1,571,000	13,270,000	200,000	1,771,000
32001 - 35000	60,160,000	280,000	6,360,000	96,000	376,000
35001 - 38000	191,450,000	891,000	10,770,000	162,000	1,053,000
38001 - 42000	140,000,000	651,000	4,400,000	66,000	717,000
42001 - 46000	100,760,000	469,000	4,180,000	33,000	532,000
46001 - 50000	711,600,000	3,310,000	26,160,000	393,000	3,703,000
50001 - 55000	46,470,000	216,000	1,570,000	24,000	240,000
55001 - 60000	636,250,000	2,960,000	35,940,000	540,000	3,500,000
60001 - 65000	1,454,390,000	6,766,000	65,310,000	982,000	7,748,000
65001 - 70550	40,670,000	189,000	-----	-----	189,000
70551 - 73280	22,310,000	104,000	-----	-----	104,000
Total	12,692,430,000	\$59,043,000	811,460,000	\$12,201,000	\$71,244,000

Table 35
MAINE HIGHWAY-USER COST RESPONSIBILITY
BY COST-FUNCTION METHOD

(excludes federal funds)							
Gross Vehicle Weight Group	Construction Costs			State Maintenance Costs		Other Use-Related Cost Responsibility	Total Cost Responsibility
	Standby Credit	Weight-Related Cost Responsibility	Use-Related Cost Responsibility	Weight-Related Cost Responsibility	Use-Related Cost Responsibility		
0 - 6000	(-) \$8,032,000	\$ 8,874,000	\$26,795,000	\$2,714,000	\$ 9,235,000	\$15,403,000	\$54,989,000
6001 - 9000	(-) 141,000	412,000	414,000	120,000	137,000	319,000	1,261,000
9001 - 11000	(-) 118,000	476,000	360,000	139,000	118,000	277,000	1,252,000
11001 - 14000	(-) 81,000	545,000	329,000	166,000	113,000	194,000	1,266,000
14001 - 16000	(-) 48,000	365,000	183,000	106,000	60,000	143,000	809,000
16001 - 18000	(-) 67,000	540,000	240,000	161,000	80,000	167,000	1,121,000
18001 - 20000	(-) 30,000	296,000	117,000	88,000	39,000	80,000	590,000
20001 - 23000	(-) 32,000	382,000	134,000	114,000	45,000	89,000	732,000
23001 - 26000	(-) 29,000	355,000	109,000	109,000	38,000	61,000	643,000
26001 - 29000	(-) 22,000	325,000	89,000	100,000	31,000	46,000	569,000
29001 - 32000	(-) 33,000	460,000	114,000	144,000	40,000	53,000	778,000
32001 - 35000	(-) 5,000	87,000	20,000	26,000	7,000	14,000	149,000
35001 - 38000	(-) 6,000	265,000	55,000	82,000	19,000	30,000	445,000
38001 - 42000	(-) 11,000	189,000	36,000	60,000	13,000	15,000	302,000
42001 - 46000	(-) 5,000	137,000	24,000	43,000	8,000	11,000	218,000
46001 - 50000	(-) 34,000	967,000	152,000	303,000	54,000	69,000	1,511,000
50001 - 55000	(-) 2,000	63,000	9,000	20,000	3,000	4,000	97,000
55001 - 60000	(-) 10,000	881,000	116,000	271,000	40,000	62,000	1,360,000
60001 - 65000	(-) 22,000	1,991,000	240,000	620,000	84,000	118,000	3,031,000
65001 - 70550	(-) 2,000	53,000	6,000	17,000	2,000	2,000	78,000
70551 - 73280	(-) 1,000	29,000	3,000	10,000	1,000	1,000	43,000
Total	(-) \$8,731,000	\$17,692,000	\$29,545,000	\$5,413,000	\$10,167,000	\$17,158,000	\$71,244,000

Table 36
COMPARISON OF MAINE HIGHWAY-USER COST RESPONSIBILITY FOR THE RECOMMENDED PROGRAM
BY METHOD OF ALLOCATION WITH CONTRIBUTION BY 1964 TAX LAWS

(excludes federal funds)					
Gross Vehicle Weight Group	Cost Responsibility Per Registered Vehicle				Contribution by 1964 Tax Laws 1/
	Vehicle-miles Method	Ton-miles Method	Incremental Method	Cost-Function Method	
0 - 6000	\$134	\$ 75	\$ 124	\$ 115	\$ 75
6001 - 9000	128	213	119	150	84
9001 - 11000	132	294	147	177	111
11001 - 14000	164	455	190	260	169
14001 - 16000	165	551	189	279	188
16001 - 18000	151	574	208	281	210
18001 - 20000	162	686	216	325	246
20001 - 23000	177	844	293	386	285
23001 - 26000	149	810	261	367	320
26001 - 29000	164	996	361	442	375
29001 - 32000	134	904	337	397	389
32001 - 35000	168	1,266	441	502	441
35001 - 38000	347	2,808	1,077	1,887	605
38001 - 42000	126	1,119	378	471	473
42001 - 46000	168	1,652	522	677	578
46001 - 50000	172	1,833	539	748	574
50001 - 55000	228	2,609	772	1,054	739
55001 - 60000	469	5,993	1,510	2,329	928
60001 - 65000	421	5,830	1,383	2,281	1,084
65001 - 70550	105	1,524	379	629	742
70551 - 73280	111	1,651	397	683	794
All Vehicles	\$136	\$ 136	\$ 136	\$ 136	\$ 90

1/ Contributions by 1964 tax laws represent a highway-user average annual deficit of \$24,337,000, which may be even higher as a result of the frozen-road and short-term permit laws.

Table 37
17-YEAR AVERAGE ANNUAL MAINE HIGHWAY-USER CONTRIBUTIONS
PER VEHICLE BASED ON 1964 TAX LAWS

Gross Vehicle Weight Group	Average Annual Registrations	Motor Fuel Taxes and Licenses 1/	Motor Vehicle Fees and Licenses 2/	Total Contribution
0 - 6000	480,203	\$ 58	\$ 17	\$ 75
6001 - 9000	8,412	62	22	84
9001 - 11000	7,079	72	39	111
11001 - 14000	4,862	104	65	169
14001 - 16000	2,896	101	87	188
16001 - 18000	3,991	102	108	210
18001 - 20000	1,817	111	135	246
20001 - 23000	1,896	124	161	285
23001 - 26000	1,751	132	188	320
26001 - 29000	1,287	145	230	375
29001 - 32000	1,959	131	258	389
32001 - 35000	297	151	290	441
35001 - 38000	375	288	317	605
38001 - 42000	641	128	345	473
42001 - 46000	322	202	376	578
46001 - 50000	2,020	173	401	574
50001 - 55000	92	283	456	739
55001 - 60000	584	440	488	928
60001 - 65000	1,329	554	530	1,084
65001 - 70550	124	153	589	742
70551 - 73280	63	159	635	794

1/ Maine vehicles are credited with fuel taxes paid by out-of-state vehicles in the same weight group.

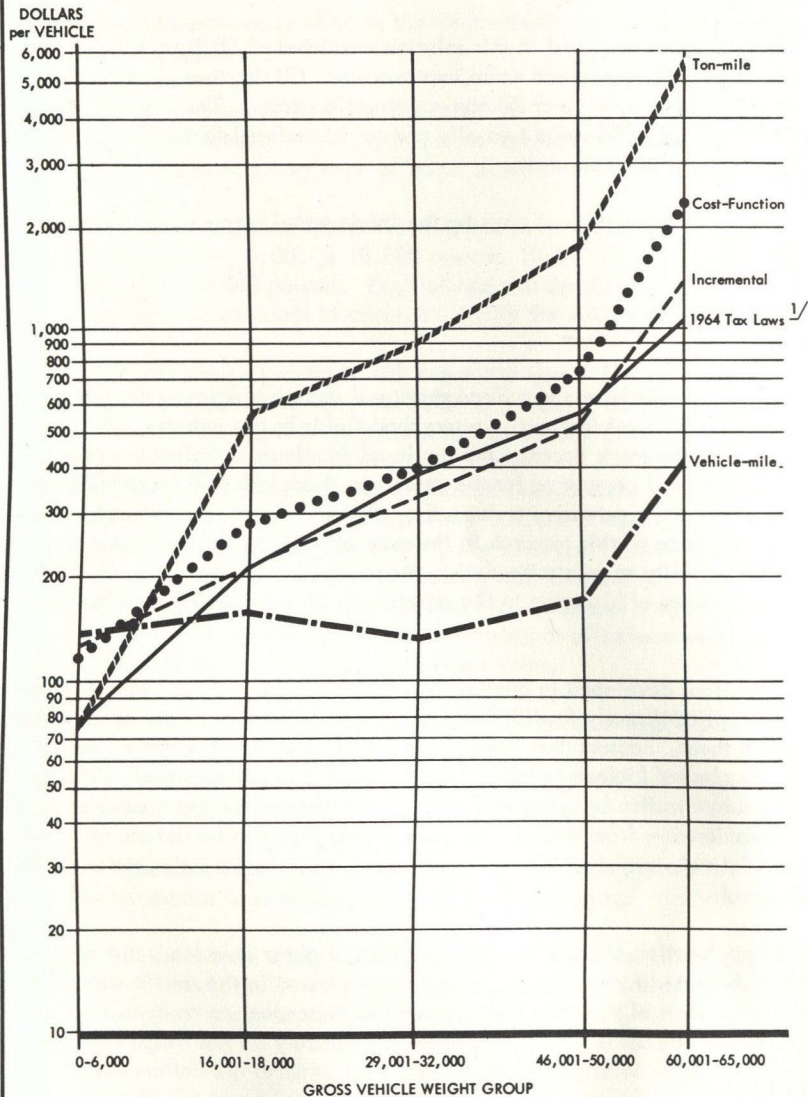
2/ Based on the present schedule of registration fees; do not consider the possibility of reduced fees as a result of the frozen-road and short-term permit laws.

Table 38
INDEX VALUE COMPARISON OF MAINE HIGHWAY-USER
COST RESPONSIBILITY BY METHOD OF ALLOCATION

(excludes federal funds)					
Gross Vehicle Weight Group	Vehicle-miles Method	Ton-miles Method	Incremental Method	Cost-Function Method	Contribution by 1964 Tax Laws
0 - 6000	.99	.55	.91	.85	.83
6001 - 9000	.94	1.57	.87	1.10	.93
9001 - 11000	.97	2.16	1.08	1.30	1.23
11001 - 14000	1.21	3.35	1.40	1.91	1.88
14001 - 16000	1.21	4.45	1.39	2.05	2.09
16001 - 18000	1.11	4.22	1.53	2.10	2.33
18001 - 20000	1.19	5.04	1.59	2.39	2.73
20001 - 23000	1.30	6.21	2.15	2.84	3.17
23001 - 26000	1.10	5.96	1.92	2.70	3.56
26001 - 29000	1.21	7.32	2.65	3.25	4.17
29001 - 32000	.99	6.65	2.48	2.92	4.32
32001 - 35000	1.24	9.31	3.24	3.69	4.90
35001 - 38000	2.55	20.65	7.92	13.87	6.72
38001 - 42000	1.26	8.23	2.78	3.46	5.26
42001 - 46000	1.24	12.15	3.84	4.98	6.42
46001 - 50000	1.26	13.48	3.96	5.50	6.38
50001 - 55000	1.68	19.18	5.68	7.75	8.21
55001 - 60000	3.45	44.07	11.10	17.12	10.31
60001 - 65000	3.10	42.87	10.17	16.77	12.04
65001 - 70550	11.21	11.21	2.79	4.62	8.24
70551 - 73280	.82	12.14	2.92	5.02	8.82
All Vehicles	1.00	1.00	1.00	1.00	1.00

Figure 24

**COMPARISON OF MAINE HIGHWAY-USER COST RESPONSIBILITY
FOR THE RECOMMENDED PROGRAM BY METHOD OF ALLOCATION WITH
CONTRIBUTION BY 1964 TAX LAWS FOR SELECTED WEIGHT GROUPS**



^{1/} Contributions from 1964 tax laws represent a highway-user average annual deficit of \$24,337,000, which may be even higher as a result of the frozen-road and short-term permit laws.

Vehicle-miles Method

The amount of highway use is recognized as a principal measure of the benefits received by highway users. There are problems, however, in developing an equitable measure of use. Several factors need to be considered in addition to travel alone — factors such as the size of vehicles and their gross weights, both of which are measures of the amount of goods or people transported.

For this reason, the vehicle-miles method of allocation is not recognized as being adequate by itself to establish a final cost responsibility between vehicle types. It is presented here to provide a basis of comparison with other methods which take into account additional use factors.

The vehicle-miles allocation is the essence of simplicity since it involves only (1) the determination of annual vehicle-miles of travel on each class of road and street by each type and gross weight of vehicle, and (2) the distribution of the user share of program costs, as determined by the earnings-credit method, among the vehicle types and weight classes in direct proportion to the vehicle-miles.

Table 32 summarizes the allocation of cost responsibility by the vehicle-miles method.

Ton-miles Method

The gross ton-miles method of allocating cost responsibility is almost as easy to apply as the vehicle-miles method, except for the problem of estimating the actual average gross operating weights of the different types and classes of vehicles on the highways. The loadometer studies which have been conducted by the State Highway Commission for a number of years were essential to this determination.

Ton-miles are not considered to be a good measure of costs occasioned on the highways by different sizes and weights of vehicles since there has been ample research to show that these costs are not in direct proportion to ton-miles.

As in the case of the vehicle-miles allocation, the ton-miles allocation is an attempt to distribute costs on the basis of the theory of benefits received from use of the highways. As a measure of benefits, the ton-miles allocation also has been questioned by researchers who claim benefits derived from highway use are not altogether related to the weight of merchandise carried. It is contended that even in the case of freight vehicles the value of transporting goods is not necessarily related to weight.

Although ton-miles thus may be ruled out as giving a direct measure of cost responsibility for different vehicles under either cost-occasioned or benefits theory, this type of allocation usually is included to give a relationship between cost and weight of vehicles using the highways.

The allocation of cost responsibility by the ton-miles method is shown in Table 33.

Incremental Method

The difficulty in obtaining a good measure of relative benefits received from highway travel by different vehicle types has caused researchers to emphasize another theory of cost responsibility which allows more objective determination. This is the cost-occasioned theory briefly mentioned previously.

It is reasoned that if the cost of providing the kind of highways required for different sizes and weights of vehicles can be determined, this would be a fair and equitable method for allocating responsibility. There are problems with this theory, however, since highways universally are built for a mixture of vehicles and it is not easy to determine the actual costs occasioned by each type. Two methods of reaching a solution commonly are employed, with some difference in results.

One of these is known as the incremental method. This method approaches the allocation of responsibility on the basis of costs occasioned by various sizes and weights of vehicles by dividing the highway into increments of structure. The first increment is one required by all vehicles, and is what might be considered a basic road. The next increment is one which has to be built for a larger size or heavier class of vehicle. Still other increments are added for progressively larger and heavier vehicles.

In the determination of the basic increment, all vehicles on the highway are considered as if they were of the lowest size and weight class. This increment is distributed accordingly to all vehicles on the basis of relative use: axle-miles for surfaces and vehicle-miles for other roadway elements.

For the next higher increment, all larger and heavier vehicles are considered as if they were of the next highest size and weight class. This increment of cost is distributed accordingly, again by the relative-use measures of axle-miles and vehicle-miles.

Additional increments of structure are determined and these costs distributed in the same manner until the increment for the heaviest vehicles is reached, and this increment is distributed exclusively to these vehicles.

The above description — in order properly to describe the incremental concept — is more a description of the results achieved than of the detailed techniques employed. In actual methodology, it is necessary to give separate consideration to different basic parts of a highway — such as roadbed and structures — and to other costs that are not related to vehicle size and weight.

Cost breakdowns used in this solution consisted of (1) base and surface improvement, (2) grade and drain improvement, (3) structure improvement, (4) other improvement, and (5) non-construction costs. The costs of town ways, where size and weight usually are not considered factors for construction, were treated separately.

The final allocation of costs by the incremental method is presented in Table 34.

Base and Surface Costs —

The design of base and surface structural characteristics of highways has been one of the most thoroughly researched fields in the industry. In 1960, the Highway Research Board of the National Academy of Sciences—National Research Council completed for the American Association of State Highway Officials the most extensive tests on the behavior of surfaces yet conducted. The significance of this research in the area of incremental cost allocation lies in the ability to relate the design requirements of surfaces constructed for different classes of highways to the repetitions of axle loads found in mixed traffic.

Equations developed in conjunction with the AASHO road test findings can be applied directly to distribute surface requirements to the axles which occasion them. Factors that need to be known are (1) the surface requirements by class of highway as determined from the needs appraisal, (2) the expected future traffic by types and weights of vehicles for the classes of highway considered — from which axle-load repetitions can be determined, and (3) special values of equation constants applicable to Maine's particular soils and gravels.

In application of the AASHO equations, lighter axle loads are progressively substituted for equivalent heavier ones found in the traffic stream so that the amounts of surface structure are not dependent on amounts of traffic — these remain the same — but are dependent entirely on the weights of the axles. Once the total depths of the required surfaces are determined for each axle load, the increments easily are obtained by subtraction. The costs of these increments are assigned to the vehicles which require them.

For example, if an axle-weight group of 6,001 to 10,000 pounds requires an additional depth of surface of three inches over that which is required by

an axle-weight group of 0 to 6,000 pounds, then the 6,001 to 10,000 group is assigned the cost of the three-inch increment. This group also must participate with the 0 to 6,000 group in the cost of the first increment, which is required by both groups.

Special considerations applied in the determination of surface increments in Maine were as follows:

- Increments were determined separately for rural and urban design classes of highway — taking into consideration the particular traffic estimated to occur on each of these classes.
- Increments were established for the four axle-weight groups of 0 to 6,000 pounds, 6,001 to 10,000 pounds, 10,001 to 14,000 pounds and over 14,000 pounds. Equivalence was developed between tandem and single axle loads in accordance with the AASHO equations.
- Highway design practices with respect to severe frost conditions were taken into consideration. An AASHO structural number was determined for the specific depth and type of surface structure specified by Maine's designers as a minimum requirement for the severe frost conditions in the State. Material constants appropriate to Maine's gravels were used. In terms of equivalent number of applications of the axle loads found in mixed traffic, the structural number of the design for frost conditions indicated that any road now being built by the State Highway Commission will carry repetitions of a 6,000-pound axle. For this reason, additional increments of surface were developed only for more than 6,000-pound axles.
- Axle-load equivalents were developed in terms of 6,000-pound loads.
- The more complex equations were used because Maine designers specify a terminal serviceability index of 2.
- Actual loads imposed on the highways as determined from the loadometer studies were used to develop the increments.

Once the incremental costs were developed for the axle-load groups, they were distributed among the various vehicles in accordance with the relative axle-miles traveled by each type and gross vehicle weight group.

Grade and Drain Costs —

The costs of grading and drainage occasioned by vehicles are not closely related to vehicle weight. However, the amount and costs of grading and

drainage are related to the width of the constructed highway, and the question arises: Do certain classes of highway users require additional widths of pavement and shoulders because of their size?

An analysis of vehicle widths shows that vehicles range in size from six feet for the mediumweight passenger car to a legal maximum of eight feet for heavy trucks and combinations. Most trucks weighing 26,000 pounds or more are eight feet wide.

The trend of highway design has been toward provision of added width regardless of the number of wider vehicles using particular facilities. There are great safety values associated with provision of added highway width, particularly with regard to pavements, regardless of the width of vehicles. For this reason, no increment of pavement width was assigned to wider vehicles.

A more pronounced distinction has been made for shoulder widths, since they must provide sufficient width to remove a stalled or parked vehicle completely from the traffic stream. It was determined that a two-foot increment of shoulder width should be assigned to wider vehicles on high-volume rural roads constructed with shoulders ten feet wide. No increment of shoulder width was assigned to wider vehicles on medium and low-volume rural routes, since the width of shoulder initially constructed for these highways is only eight feet or less. Further, no increment of width was assigned for urban streets.

The increment of cost for grading and drainage required for the wider shoulders was assigned to the vehicles requiring this increment on the basis of the relative number of vehicle-miles traveled by them.

Structure Costs —

Highway structures are designed with strength characteristics related to the loads they are required to carry. However, to interject certain safety factors where there are possible combinations of loadings, the approved bases of highway structure designs are standard loadings not altogether related to a load applied by any single vehicle. The relationship between theoretical and actual structure loadings is close enough to develop reasonable increments of structure required by vehicles of different types and weights.

For purposes of this study, the Consultant and State Highway Commission staff personnel prepared estimates of structure costs for structures with H-10, H-15, H-20 and H-20 S-16 theoretical loadings. The equivalent gross weight groups which these structures are designed to support are (1) single-unit vehicles with gross weights of 20,000 pounds, 30,000 pounds, 40,000 pounds

and over 40,000 pounds; and (2) combinations with gross weights of 27,000 pounds, 40,000 pounds, 54,000 pounds and over 54,000 pounds, respectively.

The increments of cost were developed by subtracting the cost of these structures one from the other. These increments then were distributed progressively to the vehicles requiring them in the usual manner. For example, the heaviest combinations were assessed the cost of the increment allowing structures to support vehicles over 54,000 pounds, all combinations and single-unit vehicles over 40,000 pounds shared the cost of the increment allowing structures to support over 40,000 pounds, and so on. Costs were distributed in accordance with a measure of the use of the increment; in this case, vehicle-miles.

Other Improvement Costs —

A significant amount of improvement costs are occasioned by all classes and weights of vehicles alike. Among these are right-of-way acquisition costs, engineering and other similar costs of construction. These costs were assigned to the various vehicles on the basis of the relative vehicle-miles traveled.

Non-construction Costs —

Maintenance and administration costs likewise were assigned to all vehicles on the basis of relative vehicle-miles. Although there may be some justification for incremental assignment of a portion of maintenance expenditures, especially those related to surface maintenance, the maintenance records of the Commission did not provide a breakdown of data appropriate for any incremental determination. Aside from this, the amount of these costs that might be involved in an incremental distribution would not be such as to greatly influence the results.

Town Way Costs —

The low-volume characteristics of town ways — with their correspondingly low percentage of travel by larger vehicles — warrant the allocation of their costs without regard for incremental analysis. Town way cost responsibilities for the various highway users were assessed on the basis of the relative number of vehicle-miles traveled.

Cost-Function Method

The cost-function approach is another method of allocating the user share of highway costs between motor vehicles of different sizes and weights in accordance with the cost-occasioned theory.

In this case, the cost elements of construction projects and maintenance operations — as well as the administrative costs that go with them — are classified in accordance with the purpose they are judged logically to serve. Thus, there are elements of construction that are judged to provide strength to the highway structure for the purpose of supporting weight, and there are elements of maintenance operations associated with this. The costs of these elements are called weight-related costs.

Other cost elements of construction are judged as providing a "standby" or "readiness-to-serve" facility; only the most basic road would be required if there was a minimum of use by highway vehicles. The costs of the construction and maintenance elements that provide the difference between a basic road and the kind of highways that actually are built are called use-related costs unless they already are identified as weight-related costs.

The costs of the elements that go with the standby facility — the basic means of providing a route for travel in corridors between points and for access to property — are called standby costs. All societies have recognized the need to provide basic routes to travel, and as such the costs of this provision are not logically related to the degree of use or weight of the vehicles.

It also has been observed earlier in this chapter that the costs of the roads needed for access to rural property could not be justified by the amount of use of these roads.

In separating the elements of construction and maintenance and assigning them to one of the three purposes noted, researchers have been able to be definitive only about weight-related elements. These are the elements that go into the surface and base courses of highways and into highway structures. Otherwise, it has been difficult to make a distinction between use-related and standby elements, although some individual elements do associate readily.

For the Maine solution, the actual costs of standby facilities were calculated by determining the average construction cost of a typical land-service road and considering that this cost would equal the standby portion of the cost of every facility constructed to higher standards. Weight-related elements of this standby cost were identified. These were subtracted from total identified weight-related costs. The sum of the remaining weight-related costs plus the standby costs when subtracted from total improvement costs gave the costs related to use. The standby costs, calculated and used in this manner, include the costs of bridge structures built to "country road" standards.

Weight-related costs were identified as those related to road surfaces and all of the remaining costs of bridge structures not related to the standby facility. Although there is reason to consider that some of the remaining costs of structures should be use-related, it is almost impossible to distinguish these costs. It must be understood that the cost-function approach does not pretend the degree of refinement in associating costs that is inherent in the incremental solution.

A unique feature of the Maine cost-function analysis was the handling of the standby costs once they were determined. For consistency with the earnings-credit solution which determined the user and non-user shares of highway construction costs, it was reasoned that the non-user share basically should encompass the standby costs. That is, logically the non-user should pay for the standby facility and possibly some of the additional costs of higher-type roads. Accordingly, when the non-user costs exceeded the standby costs, the difference was applied as a credit to vehicles against use-related and weight-related costs.

There was a significant technical problem in removing federal-aid from the three breakdowns of cost so that it would be subtracted in proportion to the extent of these costs. This was handled by determining the proportions of weight-related and standby costs to total costs and subtracting the same proportion of federal-aid from each. The state share of use-related costs then was determined by subtracting the resulting state shares of weight-related and standby costs from the total state share of costs.

Once the remaining weight-related and use-related costs were determined after credits, these were distributed among vehicles in accordance with the usual cost-function method: weight-related costs in proportion to ton-miles of travel, use-related costs in proportion to vehicle-miles of travel, and standby costs or non-user paid credits on the basis of the number of registered vehicles.

Results of the cost-function solution are shown in Table 35.

Summary

Table 36 contains a summary of highway-user cost responsibilities by registered gross vehicle weight groups as resulting from the different methods of allocation.

It is important to realize that these cost responsibilities are based on obtaining from the highway user the full user share of future program needs as developed in Chapter Three. Current tax laws will not return the necessary amount of money — an annual deficit of \$24,337,000 is indicated.

There are difficulties in interpretation that apply both to individual schedules of tax responsibilities and to comparison with expected contribution by current tax laws:

- In evaluating the results of the responsibility allocations, it will be noted that the "charges" by gross vehicle weight do not increase smoothly. This is the result of relationships between registrations of Maine vehicles and travel characteristics of vehicles on Maine highways. In some gross weight groups — the two heaviest, for example — there presently are only small numbers of vehicles

registered in Maine. These may be special-purpose vehicles for which travel characteristics are unique. Out-of-state travel by Maine registered vehicles may have an effect, as may travel by out-of-state registered vehicles in Maine. These factors could not be separated satisfactorily due to limitations in the data that could be obtained from the existing system of registration records.

- The expected average annual contributions by current tax laws — which are broken down in Table 37 — do not take into account operations under the frozen-road and short-term permit laws. Lack of detail in current state records did not permit any firm prediction of the effect of these laws on revenues by gross weight group. The flexibility in the advantages provided by these laws also makes prediction difficult. However, as a result of these laws, the actual revenue deficit almost certainly will exceed the indicated \$24,337,000 annually.

These methods of cost allocation should be considered — at best — as approximate guides to relative vehicle responsibility. No method has absolute validity. The incremental method is accepted as providing the most specific determinations, but it probably falls short of assigning all elements of highway cost where size and weight are factors. The cost-function method uses reasonable judgments rather than absolute determinations.

The differences between the incremental and cost-function solutions mainly are caused by two basic differences in approach:

1. In accordance with common practice, many local road and street facilities are excluded from the incremental method because their structural characteristics are not considered to be influenced by vehicle size and weight. The cost-function method, on the other hand, associates elements of construction with vehicle weight on all systems.
2. The cost-function method has the effect of distributing more surface costs to heavier vehicles than does the incremental method.

Results of the incremental method — as it has been applied in Maine — are conservative with respect to responsibilities for heavy vehicles, but not to a significant degree.

The kind of evaluations made in determining needs, for example, did not permit a prediction of the number of miles of climbing lanes — or their specific costs — that might be built on future facilities. This does not mean that provisions for climbing lanes are not included in the needs cost estimate, but that these provisions are indistinguishable from other grading costs. These additional costs primarily would be chargeable to large and heavy vehicles.

Nevertheless, although this results in a conservative analysis, the proportions of total highway cost involved would not lead to a material increase in cost assignments.

Table 38 and Figure 24 have been developed to provide a better visualization of vehicular responsibilities by the different methods of allocation.

In Table 38, responsibilities per vehicle and present contributions per vehicle under 1964 tax laws have been converted to index values based on 1.00 being the average for each method. Relationships between theoretical responsibilities and present contributions may be obtained by dividing the value in the last column by the value in any other column. For example, the 0 to 6,000 group presently is paying 98 per cent (.83 divided by .85) of its relative responsibility by the cost-function method.

It will be noticed that the index values under the Contribution by 1964 Tax Laws column increase fairly consistently, while there is some fluctuation in the values by any of the theoretical methods. This is primarily because the registration fees under the 1964 tax laws increase uniformly with additional weight, but the travel and weight relationships reflected in the four theoretical methods may not increase uniformly. It should be pointed out that regardless of the results of cost allocation, a reasonably uniform gradation of the registration fees is appropriate.

Figure 24 is a graphical representation of Table 36, using only the values for predominate registration groups. The contributions by the 1964 tax laws will be short of returning the full highway-user share of the recommended program costs by an average of \$24,337,000 each year. It may be observed that the current tax laws generally have the same slope characteristics of the cost-function method. The cost-function method and the incremental method constitute the most widely accepted allocation techniques.

Although the tables contained in this report show only cost assignments by combined registered gross vehicle weight groups, complete assignment schedules have been developed for different types and classes of vehicles within these groups for each method of allocation. Types and classes of vehicles include single-unit trucks, buses, combinations and types of combinations. These schedules are on file with the State Highway Commission.

CONCLUSION

The Consultant finds no significant inequity in Maine's present tax structure for motor vehicles. The present tax structure follows generally the same course as that of the cost-function method, which is one of the most widely accepted techniques for cost allocation. The changes made in the registration fee schedules since the time of the Smith report in 1960 appear to have achieved reasonable equity among highway users in the State.

The 1965 Highway-user Tax Study has found that a higher percentage of total program costs are the responsibility of the highway user than was the case in the 1960 study — 61.6 per cent in this study and 55 per cent in 1960. This may be explained largely by the increased demand for high-volume through routes, which are predominately the responsibility of the highway user.

Maine's financial problems, broadly speaking, are not tax inequities but a severe shortage of both user and non-user revenues to achieve the program goals.



ADEQUACY STANDARDS for RURAL ROADS
State-aid, Non-federal-aid and Town Way Systems

CURRENT AVERAGE DAILY TRAFFIC GROUP				1501 - 5000			801 - 1500			401 - 800			101 - 400			51 - 100			26 - 50			0 - 25 (essential use)			0 - 25 (occasional use)					
ROADWAY	Rating Item	Component Item	Adequacy Level																						Graded and drained and unimproved roads are considered adequate when there are no adjacent dwellings and there is no essential use. Occasional maintenance will provide adequate service for normal use.					
	Surface Width		Adequate	24 feet			22 feet			20 feet			18 feet			16 feet														
			Acceptable	24 feet			20 feet			18 feet			16 feet			14 feet														
	Surface Condition		Adequate	High-type surface, smooth, little or no deterioration.			Intermediate-type surface, smooth, little or no deterioration.			Bituminous-treated surface, smooth, sufficient stability for repetitions of large vehicles.						Gravel surface, with sufficient stability to provide year-round service to light vehicles.														
			Acceptable	High-type surface, some roughness, occasional cracking or slight deterioration.			Intermediate-type surface, some roughness, occasional cracking or slight deterioration.			Bituminous-treated surface, smooth, stability for repetitions of large vehicles.			Sufficient gravel to provide year-round service for all vehicles.			Sufficient gravel to remain passable in gll but extremely wet conditions.														
	Cross-Section Width	Shoulder Width	Adequate	8 feet			6 feet			4 feet			3 feet			2 feet														
			Acceptable	6 feet			4 feet			3 feet			2 feet			1 foot			None required.											
		Overall Width	Adequate	40 feet			34 feet			32 feet			28 feet			24 feet			22 feet			20 feet								
			Acceptable	36 feet			32 feet			26 feet			24 feet			20 feet			16 feet			14 feet								
	Cross-Section Condition	Shoulders	Adequate	Paved, good condition.			Gravel, good condition.									Earth or sod, good condition.						None required.								
			Acceptable	Gravel, good condition.																		Earth or sod, good condition.						None required.		
		Drainage	Adequate	Sufficient graded elevation, side-drain ditches and cross-drain provisions to protect the riding surface from all but extremely heavy storms and runoff.																										
			Acceptable	Sufficient drainage provisions to protect the riding surface from all but extremely heavy storms and runoff.															Sufficient drainage provisions to prevent excessive flooding and erosion.											
	Alignment and Grade	Terrain		Flat	Rolling	Mtns.	Flat	Rolling	Mtns.	Flat	Rolling	Mtns.	Flat	Rolling	Mtns.	Flat	Rolling	Mtns.	Flat	Rolling	Mtns.	Flat	Rolling	Mtns.						
		Maximum Curvature		3°	5°	7°	4°	6°	8°	5°	7°	10°	5°	7°	10°	6°	8°	12°	6°	10°	12°	6°	10°	12°						
		Maximum Grade		4%	4%	5%	5%	6%	7%	5%	6%	8%	10%	6%	8%	12%	6%	10%	12%	6%	10%	12%								
			Adequate	May exceed maximums approximately once in three miles.															May exceed maximums one or two times per mile.											
			Acceptable	May exceed maximums one or two times per mile.															May exceed maximums three or four times per mile.											
	Right-of-Way			66 feet																										
		Adequate	100 feet			No additional acquisition required for any proposed improvement.																								
Acceptable																														
STRUCTURES	Load Limit		Adequate	H-20 S-16			H-20																							
		Acceptable	H-20 S-16			H-20			Sufficient strength to carry usual maximum load.																					
	Roadway Width	Under 50 feet long	Adequate or Acceptable	Equal to the cross-section width.																										
		Over 50 feet long	Adequate or Acceptable	Equal to the surface width plus three feet on each side.												Equal to the surface width plus one foot on each side.														
	Clearance	Waterway	Adequate	Sufficient clearance to pass the peak 50-year storm.												Sufficient clearance to pass the peak 25-year storm.														
			Acceptable	Sufficient clearance to pass the peak 10-year storm.												Very minor flooding, limited to once each year.														
		Underpass - Overpass Vertical	Adequate	14 feet 6 inches																										
			Acceptable	13 feet																										
		Horizontal	Adequate	Equal to the approaching cross-section width plus two feet on each side.																										
			Acceptable	Equal to the approaching cross-section width.																										

ADEQUACY STANDARDS for URBAN STREETS

All Systems

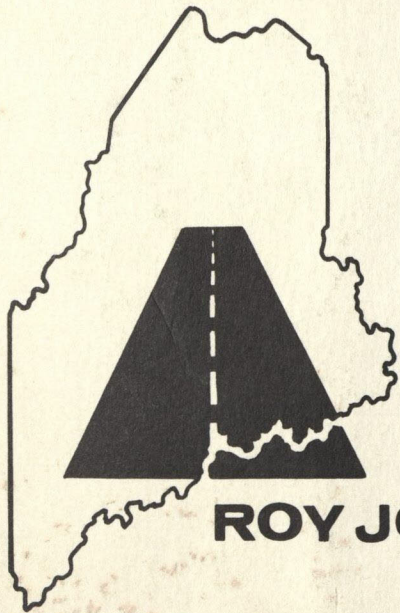
ROADWAY

Street Service Type			Central Business District			Intermediate and Outlying Area Arterial						Local Residential	
Cross-Section Type			Urban Street	Urban Street	Urban Street	Urban Street	Rural	Urban Street	Rural	Urban Street	Rural	Urban Street	Rural
Current Average Daily Traffic Group			Arterial Over 6000	Arterial 0-6000	Local 0-1500	Over 6000	1501-6000		0-1500		0-1500		

Rating Item	Component Item	Adequacy Level	48 feet plus median barrier	44 feet	32 feet	48 feet plus median barrier	44 feet	24 feet	40 feet	22 feet	32 feet	20 feet	
Surface Width		Adequate	48 feet plus median barrier	44 feet	32 feet	48 feet plus median barrier	44 feet	24 feet	40 feet	22 feet	32 feet	20 feet	
		Acceptable	48 feet	40 feet	16 feet	48 feet	44 feet	22 feet	36 feet	20 feet	16 feet	16 feet	
Cross-Section Width	Shoulder Width	Adequate					10 feet		10 feet		6 feet	6 feet	
		Acceptable					8 feet		8 feet		6 feet	2 feet	
	Overall Width	Adequate	48 feet plus median barrier	44 feet	32 feet	48 feet plus median barrier	44 feet plus median barrier	44 feet		40 feet	34 feet	32 feet	
		Acceptable	48 feet	40 feet	16 feet	48 feet	60 feet	40 feet	38 feet	36 feet	32 feet	16 feet	20 feet
Surface Condition		Adequate	High-type, smooth, no warping or heaving.			Bituminous-treated, smooth.			High-type, smooth, no warping or heaving.			Bituminous-treated, smooth, no warping or heaving.	
		Acceptable	High-type, some roughness but causing little driver discomfort.			Bituminous-treated, some roughness.			High-type, some roughness but causing little driver discomfort.			Bituminous-treated, some roughness, but causing little driver discomfort.	
Cross-Section Type	Adjacent Development												
	80% to 100%	Adequate	Curbs on both sides, sidewalks on both sides.				Curbs on both sides, sidewalks on at least one side.						
		Acceptable	Curbs on both sides, sidewalks on both sides.				Curbs, gutters, or curbs and gutters on both sides.						
	50% to 80%	Adequate	Curbs on both sides, sidewalks on both sides.				Curbs, gutters, or curbs and gutters on both sides.						
		Acceptable	Curbs on both sides.				Curbs or gutters in front of developed sections.						
	0 to 50%	Adequate	Curbs in front of developed sections.				Curbs or gutters in front of developed sections.						
Drainage	Curbs	Adequate	Sufficient curb elevation to control all storm runoff. Underground drainage provided and capable of handling all storm runoffs. Sufficient crown elevation to prevent standing water in travel lanes.										
		Acceptable	Sufficient curb elevation to control normal storm runoff. Underground storm drains not necessary if runoff can be drained away from street and adjacent properties. Sufficient crown elevation to limit standing water in travel lanes to short periods of time.										
	Gutters	Adequate	Formed, paved gutter capable of directing all storm runoffs to underground storm drains. Sufficient crown elevation to prevent standing water in travel lanes.										
		Acceptable	Formed, paved gutter capable of draining normal storm runoffs away from street and adjacent properties. Underground storm drains not necessary. Sufficient crown elevation to limit standing water in travel lanes to short periods of time.										
	Ditches	Adequate	Constructed ditches with culverts having sufficient gradients to prevent standing water in ditches. Sufficient ditch capacity to handle all storm runoffs. Sufficient crown elevation to prevent standing water in travel lanes.										
		Acceptable	Ditches capable of meeting adequate ditch standards by applying normal maintenance. Sufficient crown elevation to limit standing water to short periods of time.										

STRUCTURES

Load Limit		Adequate	H-20 S-16					H-20				
		Acceptable	H-20 S-16		H-20	H-20 S-16			H-20	Sufficient to carry usual loads found in the area.		
Roadway Width	Under 150 feet long	Adequate	Equal to the cross-section width plus sidewalks.									
		Acceptable	Equal to the cross-section width.									
	Over 150 feet long	Adequate	Equal to the travel-lane width plus sidewalks.									
		Acceptable	Equal to the travel-lane widths.									
Clearance	Waterway	Adequate	Sufficient to pass the peak 50-year storm.									
		Acceptable	Sufficient to pass the peak 25-year storm.									
	Underpass-Overpass Vertical	Adequate	14 feet 6 inches									
		Acceptable	13 feet									
	Horizontal	Adequate	Equal to the approaching cross-section width plus sidewalks (if any) or plus two feet on each side.									
		Acceptable	Equal to the travel-lane widths plus sidewalks (if any) or plus two feet on each side.									



ROY JORGENSEN AND ASSOCIATES