Michigan's HIGHWAYS 1960-1980 Needs

A Technical Engineering Report

Michigan's HIGHWAYS 1960-1980

* Needs
* Costs
* Programs

A Technical Engineering Report

PREPARED BY THE
MICHIGAN STATE HIGHWAY DEPARTMENT
IN COOPERATION WITH THE
COUNTY ROAD ASSOCIATION OF MICHIGAN
AND THE
MICHIGAN MUNICIPAL LEAGUE
WITH THE PARTICIPATION
OF THE
UNITED STATES DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
1962

TO THE
MICHIGAN
JOINT LEGISLATIVE
HIGHWAY
STUDY
COMMITTEE

STATE OF MICHIGAN

HIGHWAY DEPARTMENT

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To The Michigan Legislature and the Citizens of Michigan:

In carrying out my responsibilities under Act 51, Public Acts of 1951 as amended -- and as requested by the Michigan Legislature -- I herewith present for your consideration, "Michigan's Highways: 1960-1980 Technical Engineering Report". This report supplements "Michigan's Highways: 1960-1980, Needs, Benefits, Costs". It shows in greater detail how engineers appraised road and street conditions, determined deficiencies, estimated needed improvements and developed the costs of constructing, maintaining, and administering all road and street systems over the next twenty years. For those who want more information on how the study was made and to evaluate more carefully the fundamental problems existing, this report will be of tremendous value.

The greater detail of this report emphasizes the cooperation that went into this joint endeavor by the state, county, and city engineers and officials.

This engineering report and the comprehensive study of highway financing should contribute substantially in helping the legislature in its decisions affecting highway progress in Michigan.

John C. Mackie
STATE HIGHWAY COMMISSIONER

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E. A. Bellenbaum, Chief Planning Engineer
Paul J. Marek, Chief Assistant Planning Engineer
E. Malcolm Noble, Highway Planning Survey Manager
C. F. Kosie, Administrative Assistant

Highway Needs

R. A. Trebilcock, Director Programming Division
C. J. Carroll, Jr., Asst. Director Programming Division
Howard J. Barrons, Supervisor Highway Needs Study
Tadeusz Kessler, Highway Planning Engineer
Keith J. Rathbun, Highway Planning Technician
Robert Wessling, Administrative Analyst
Arthur R. Heath, Highway Planning Engineer
William L. Strahan, Highway Planning Engineer
Robert J. Allen, Civil Engineer
Homer Thomason, Civil Engineer

Economic and Financial Analysis

Alvin H. Baetz, Accountant

Writing and Editing

R. A. Trebilcock
Keith Rathbun
Marvin Tableman

TRAFFIC DIVISION

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Contents

Foreword

Section 9A of Act 51 of 1951, as amended and supplemented by Acts 153 and 262 of 1957, provides: "The State Highway Commissioner shall make a continuing study or survey of highway conditions and deficiencies throughout the State in order to re-evaluate highway needs at regular intervals and thereby keep current the results of the study contained in the 1955 reports entitled 'Modern Highways for Michigan, An Engineering Base for a Fiscal Report', and 'Financing Modern Highways for Michigan'."

The principal intent of this legislation was to provide a basis for determining an equitable proportioning of State collected motor vehicle highway funds among the three principal agencies responsible for the construction and maintenance of the road and street systems.

Although this section of the Act placed the principal responsibility for the collection and compilation of the needs data upon the State Highway Commissioner, there was an apparent responsibility on the part of each county and municipality in the State to provide accurate information upon which these needs could be evaluated.

In a study of the magnitude and importance of the state-wide needs evaluation, it was necessary to establish certain rules and regulations to provide uniformity in the results of the study commensurate with reasonable anticipated traffic transportation requirements. The State Highway Department worked closely with the County Road Association and Michigan Municipal League in the promulgation of these rules and regulations and the establishment of uniform standards of construction based upon the classification and anticipated traffic volumes of various county roads, municipal streets, and state trunklines.

Each agency—the County Road Association, the Michigan Municipal League, and the State Highway Department, named an Engineering Advisory Committee to assist in establishing study procedures, methods of analysis, review of interpretations, conclusions, recommendations and contents of reports.

The State Highway Department received full cooperation in the collection and compilation of the needs data for the period 1960-1980 in accordance with the rules and regulations, standards and instructions as provided in the procedure manual issued for determining needs of each agency.

Summary

The people of Michigan are served by a vast network of approximately 110,000 miles of highways, roads, and streets. Of this total approximately 9,000 miles are under the jurisdiction of the state, 86,000 under the administration of the county road commission and 15,000 under the responsibility of municipal street authorities. On these systems are approximately 8,500 structures including railroad and highway separation facilities.

Some 94,000 miles of the total 110,000 miles are in rural areas and 16,000 are within incorporated municipalities. The mileages of existing road and street surface types are shown in the accompanying table.

Today, in spite of recent accelerated programs by state, county, and local governments, grave deficiencies handicap traffic on every class of public road and street. Without positive remedial action, these conditions will grow worse. In order to preserve the increased capital investment already expended on the various systems; to bring today's facilities up to design standards; to meet present traffic requirements and to keep pace with future traffic demands, as they accrue, requires responsive and dynamic leadership on the part of legislators and highway administrators, and a fully informed and interested public.

EXISTING MAJOR ROAD AND STREET SURFACE TYPES

	State Trunklines		County Primary		Municipal Major Streets	
Type of Surface	Miles	Percent	Miles	Percent	Miles	Percent
High Type	6,164	65	1,541	7	2,032	51
Intermediate Type	2,720	29	12,401	53	1,606	40
Gravel	594	6	8,058	35	339	8
Unimproved	..	..	1,283	5	40	1
Totals	9,478	100	23,283	100	4,017	100

EXISTING LOCAL ROAD AND STREET SURFACE TYPES

	County Local		Municipal Local	
Type of Surface	Miles	Percent	Miles	Percent
High Type	415	1	3,698	36
Intermediate Type	5,079	8	3,323	32
Gravel	38,151	61	2,413	23
Unimproved	18,897	30	960	9
Totals	62,542	100	10,394	100

A COMPLEX PROBLEM

To provide adequate highway service, it will be necessary to clear the backlog of existing deficiencies, to correct future deficiencies as they accrue, and to maintain and manage the several systems while this work is in progress. Completion of this entire program over a 20-year period will cost approximately $11 billion.

In the past the various highway jurisdictions have faced challenging tasks yet they have constructed and maintained approximately 110,000 miles of highway and street systems that have served the public well. But the accumulation of facilities needed today, and the certain large needs of the future, require closer cooperation of all highway, road and street authorities and improved administrative, financing, and planning procedure.

This engineering report appraises the extent of the state's highway needs and presents alternative programs framed to fit whatever revenue schedule may be recommended by the finance study and approved by legislative action. To provide for efficient operation, the report proposes logical grouping of the roads and streets, clear-cut assignment of highway responsibilities, and a plan for future action. In this study three types of costs are reported.

Improvement Cost or Construction Cost. The cost of improving a road section to a proposed design standard to serve traffic for the next twenty years. This cost includes right-of-way, grading and drainage, curb and gutter, base and surface, structures, traffic control devices, railroad protection, replacement to roadway, etc.

Maintenance Costs. The day-to-day cost of keeping the physical plant in operating condition. These costs, based upon past records and future improvements, were estimated on a cost per mile by surface type. Cost per mile estimates varied according to different conditions such as rural and urban projects, areas within the state, and type and volume of traffic expected on all road systems. If an existing road on any of the systems was to remain a 24 foot gravel surface for 10 years, then maintenance cost was estimated on a cost per mile basis for a gravel surface. If in the last 10 years of this study, this road was proposed to be improved to 24 foot bituminous concrete then maintenance cost was estimated on a cost per mile basis for a bituminous concrete road. In this way, maintenance costs were based on future improvements.

Engineering and Administration Costs. This cost provides for overhead expense for general management, personnel, research, traffic and planning, and allied activities. This cost was computed on a percentage basis of the total estimated cost of construction and maintenance. These percentage allowances decreased as total volume of work increased.

ENGINEERING PROCESS

Michigan's network of highways and streets falls into three jurisdictional groups: state, counties, and municipalities. For each group, suitable design standards and uniform procedures were set by engineers and public officials concerned. Although the method used in the development of the study at all three levels was similar, there were some variations, especially in urban areas. All cities over 5,000 population were asked to submit information concerning land-use, zoning, and traffic generators. Following are the steps used in determining highway needs for the various jurisdictions:

1. **Classification** of roads and streets into systems
2. **Field Inventory** of physical conditions
3. **Evaluation** of traffic data
4. **Standards** of appropriate design
5. **Appraisal** to determine deficiencies
6. **Estimate** of type, cost, and time of improvement
7. **Engineering Review** to appraise quality and results
8. **Field Check** to confirm or modify results
9. **Tabulation** of detailed data by system
10. **Analysis** to interpret results
11. **Program Development** to adopt average annual costs for alternative programs

ECONOMIC FACTORS AFFECTING NEEDS

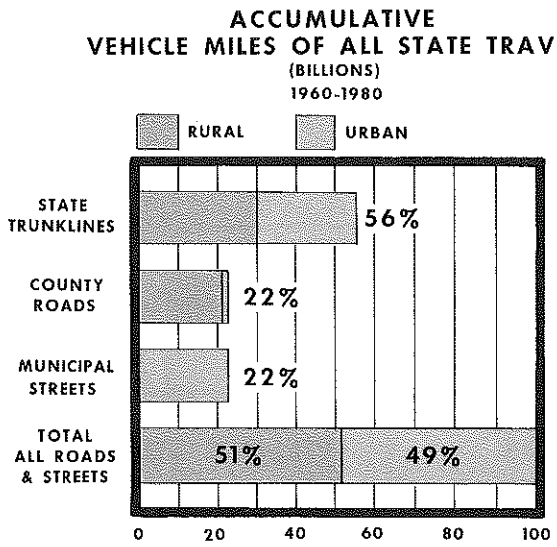
Natural resources, agricultural, industrial, and business activities and their distribution in the state greatly influence highway requirements. Good indicators of a state's economy are revealed in future trends in population, vehicle ownership, and travel.

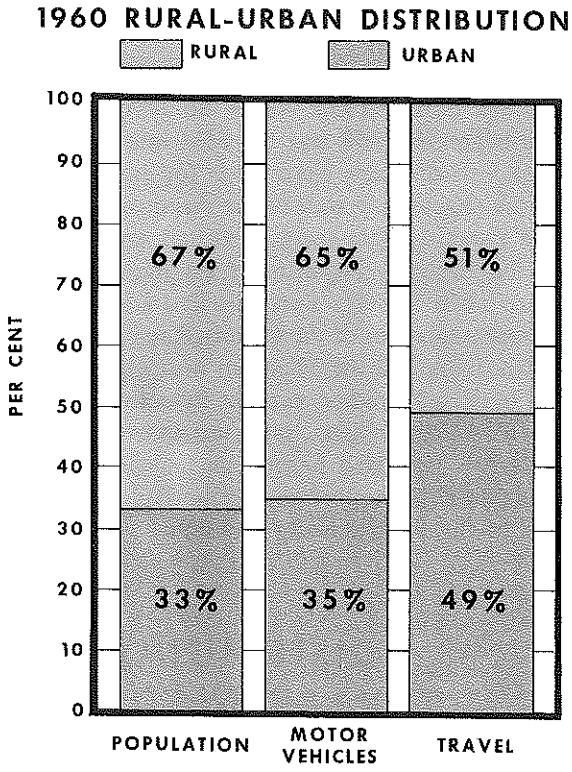
As the state's economic activity increases, more highway traffic is generated and the demand for highway service is intensified. A vital step, therefore, in the development of long-range programs for bringing the rural and street networks up to adequacy is consideration of probable future traffic demands. Highway improvements are a capital investment for many years of service. Facilities designed to meet the requirements only of today's traffic would be obsolete long before their physical life had been expended.

In the 5-year period from 1955-1960 —

- The number of motor vehicles registered in Michigan increased from 3,111,000 to 3,302,000 or 6 percent.
- Motor Vehicle travel increased from 29 billion vehicle miles of travel to 33 billion miles or 14 percent.

During this 5-year period highway, road, and street construction was at its highest level in the history of the state and yet this was not enough to keep pace with the growth rate in population, motor vehicles, and travel. If members of the legislature had not accepted the results of the 1955 Needs Study and had not been responsive to predicted growth trends, the needs as reported in this study would be even greater. It is the factor of growth which has greatly increased the problems of providing highway facilities adequate for safe and efficient vehicular movement and these problems are becoming larger and more complex.





However, for the purpose of this report the Highway Department made preliminary estimates based upon available information.

In the next 20 years it is estimated that —

- Average annual miles traveled per vehicle will increase 13 percent.
- Motor vehicle registrations will increase by 68 percent.
- Motor vehicle miles traveled will increase by 91 percent.
- Population will increase by 57 percent.

As highway service is essential to the growth and prosperity of the state, this challenge of constructing adequate facilities to meet the services

which the above increases will require cannot be disregarded.

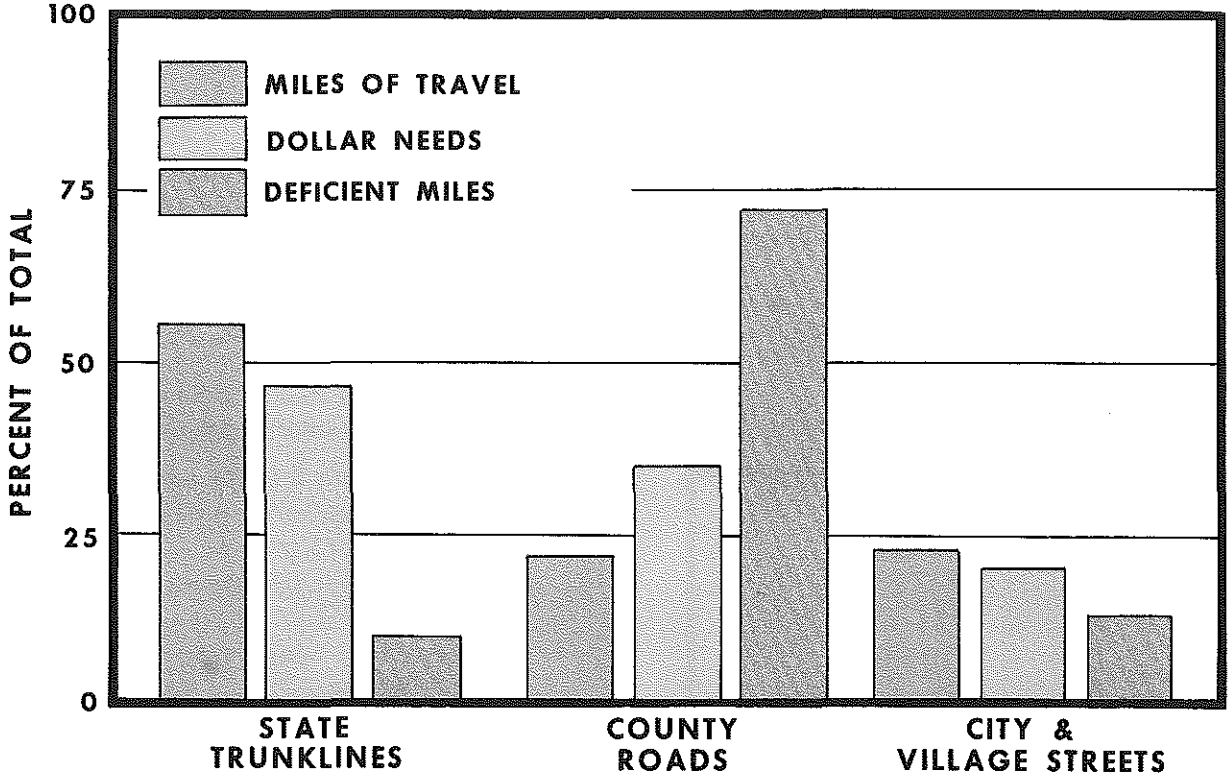
The present study, undertaken to bring the findings of the 1955 Needs Study up to date, was begun in 1958 and the field inventories and appraisals of needs were made for each roadway by the engineering staff of the responsible agency. The resulting data were tabulated and analyzed by the Highway Department Programming Division. Their findings were checked and approved by representatives of the County Road Association of Michigan and the Michigan Municipal League. All basic information such as inventory of existing roads, traffic data, land use information, deficiencies, proposed improvements and estimated costs have been documented and placed in the files of the Programming Division.

This study provides a detailed report of the results of an engineering analysis of physical needs in the next 20 years on each road and street system. It provides alternative programs for state highways, county roads, and municipal streets designed to meet the essential highway transportation requirements in 10, 15, or 20 year periods.

1960 - 1980 NEEDS

At 1958 price levels, the estimated cost of all improvements needed by 1980 on the major systems — state trunklines, county primary roads, and major city streets — is $6.35 billion. An additional $1.77 billion is needed for local roads and local city streets. Total cost of needed im-

DISTRIBUTION OF TOTAL DEFICIENT MILES, DOLLAR NEEDS AND VEHICLE MILES OF TRAVEL BY ROAD SYSTEM



provements for all roads and streets is $8.12 billion. Of this amount $4.88 billion is for work in rural areas and $3.24 billion for work in municipalities. Maintenance and administration costs totaling $2.92 billion bring the total needs to $11.04 billion.

Road and street needs were grouped into four periods of five years each, according to the present degree of adequacy and the relative urgency of the improvement from a traffic and service standpoint. It was found that 60 to 75 percent of improvements needed on various systems, except local roads and streets, should be completed in the first 10 years.

STATE TRUNKLINES

To aid in the appraisal of needs and determination of priorities, the existing State Trunkline System was classified into three groups of routes based upon their service characteristics.

Routes selected as principal trunklines, totaling 3,028 miles are of greatest statewide importance. They are planned for higher standards of improvement than other trunklines. Generally, traffic warrants their development as multi-lane divided highways.

The second group, other major routes totaling 1,044 miles are trunklines in less populated areas which are of more than usual importance to the state as a whole. The remaining 5,406 miles of all other state trunkline routes are of lesser statewide importance, although some serve rather high traffic volumes.

The estimated total capital investment required for trunkline improvements in the next 20 years is $4.22 billion, of which $1.64 billion is in municipalities. Principal trunklines, rural and urban, need 60 percent of the total.

Right of way costs are about 17 percent of capital investment requirements on the State Trunkline System. The size of the needed right of way expenditures indicates the importance of further study in the creation of a revolving advanced right of way fund.

The project work sheets of this engineering study in conjunction with criteria provided by sufficiency rating data form a technical basis for advanced programming procedure.

The $4.22 billion on the trunkline system involves:

	In Thousands
Right of Way	$ 730,086
Roadway	2,491,840
Structures	1,002,554
Total	$4,224,480

RURAL TRUNKLINES

Approximately 2,900 miles of the existing rural trunkline mileage now lacks sufficient capacity to handle present volumes of traffic safely. Most of the remaining mileage is deficient in width, surface type, condition, or alignment. Most miles include several deficiencies.

The $2.58 billion for rural trunkline construction involves 3,244 miles on new location, including 2,516 miles of freeways with full control of access. Also needed are 4,776 miles of reconstruction on existing alignment, including resurfacing and widening. Over a 20-year period, costs include:

	In Thousands
Right of Way	$ 253,796
Roadway	1,822,043
Structures	506,801
Total	$2,582,640

Of the total, $1,584,500,000 is for improvement of 2,189 miles of principal trunkline routes and $998,140,000 for 5,831 miles of improvements needed on other trunklines.

In this total are 3,484 miles of divided multilane improvements of which 2,579 are needed now or within 10 years. Most are on principal trunkline routes.

Top priority rural trunkline work (0-5 years) is recommended for specific projects costing about 47 percent of the amount which should be done in 20 years, in turn, the 10-year total is about 68 percent of the total rural 20-year needs.

URBAN TRUNKLINES

Approximately 500 miles of the urban trunkline mileage is rated as critical or poor in capacity to handle traffic in the next two decades. Most of the remaining mileage is deficient in lane width according to AASHO approved standards.

The $1.64 billion for trunkline construction within municipalities involves:

	In Thousands
Right of Way	$ 476,290
Roadway	669,797
Structures	495,753
Total	$1,641,840

Needed improvements consist of 218 miles of freeway construction, 113 miles of it in Detroit. Also required are 45 miles of arterials on new location and 701 miles of base and surface reconstruction or widening on existing streets.

Since the most severe problems of congestion occur on main city streets, some 63 percent of all proposed urban trunkline work should be completed within 10 years.

Under present laws, municipalities participate to varying degrees, in the urban trunkline costs. This information is reported under the chapter concerning municipal street costs.

MUNICIPAL STREETS

To improve 12,330 miles of streets under the control of municipalities will require an estimated expenditure of $1.43 billion. Of this amount, $884 million is for improvement of 3,503 miles of major streets and $543 million for needed improvements of 8,827 miles of local streets.

Major street needs of individual municipalities vary widely, both as to type of work and urgency. Of the following, 72 percent of the improvement cost is in the 12 largest cities.

Type of Work	Miles	Cost *In Thousands*
Freeways	16	$ 93,992
New Construction	285	72,808
Reconstruction	1,294	317,857
Resurfacing and Widening	1,908	162,486
Structures	—	237,217
Total	3,503	$884,360

In all municipalities over 5,000 population, traffic counts were taken on major streets. A master street development plan, properly integrated with the State Trunkline System, was used to serve as a basis for long-range construction programs.

The procedures and methods used in this needs study and the result determined will provide an adequate base for the development of long-range construction programs in Michigan municipalities. In recent years, increased interest has taken place in urban renewal and the redevelopment of downtown areas in order to revitalize business trade centers. It is anticipated that these factors may vary to some extent from plans adopted in this study. Therefore needs studies will be required to keep pace with changing conditions as they occur in the future.

COUNTY ROADS

Cost of construction needs on the 24,197 miles of the county primary system during the next 20 years totals $1.24 billion of which $1,070 million is in rural areas and $173 million is on primary road extensions in municipalities. The construction requirements on 54,331 miles of local roads during the same period are $1.23 billion. Total cost of needed construction on all county roads is $2.47 billion.

Practically all rural county primary roads require some kind of improvement during the 20-year period. Needs range from a limited mileage of gravel surfaces to multi-lane divided highways. Two-lane intermediate type surface is the predominant type of construction required on the primary road system.

By type of work, the rural needs are:

Type of Work	Miles	Cost *In Thousands*
Freeways	16	$ 34,096
New Construction	1,479	103,559
Reconstruction	13,379	565,411
Resurfacing and Widening	8,620	264,074
Structures	—	102,550
Total	23,494	$1,069,690

The 20-year county primary needs include 1,411 miles of multi-lane highways in 22 counties. About 86 percent of this mileage is in Genesee, Ingham, Macomb, Oakland and Wayne counties.

Nearly all of the 703 miles of proposed improvements on county primary extensions in Municipalities are in Wayne, Oakland, and Macomb counties. The $1.23 billion for needed improvements on local roads in the next 20 years provides for improvement of about 89 percent of all local road mileages. The remaining 11 percent of the mileage was considered adequate with the maintenance costs provided for in this study.

Many counties have used the information gathered in this study to develop long-range construction programs based upon priority of need and consistent with route development in adjacent counties.

FEDERAL-AID NEEDS

To permit evaluation of the effect of an expanded Federal-aid program, construction costs required for the next 20 years are summarized in the accompanying table:

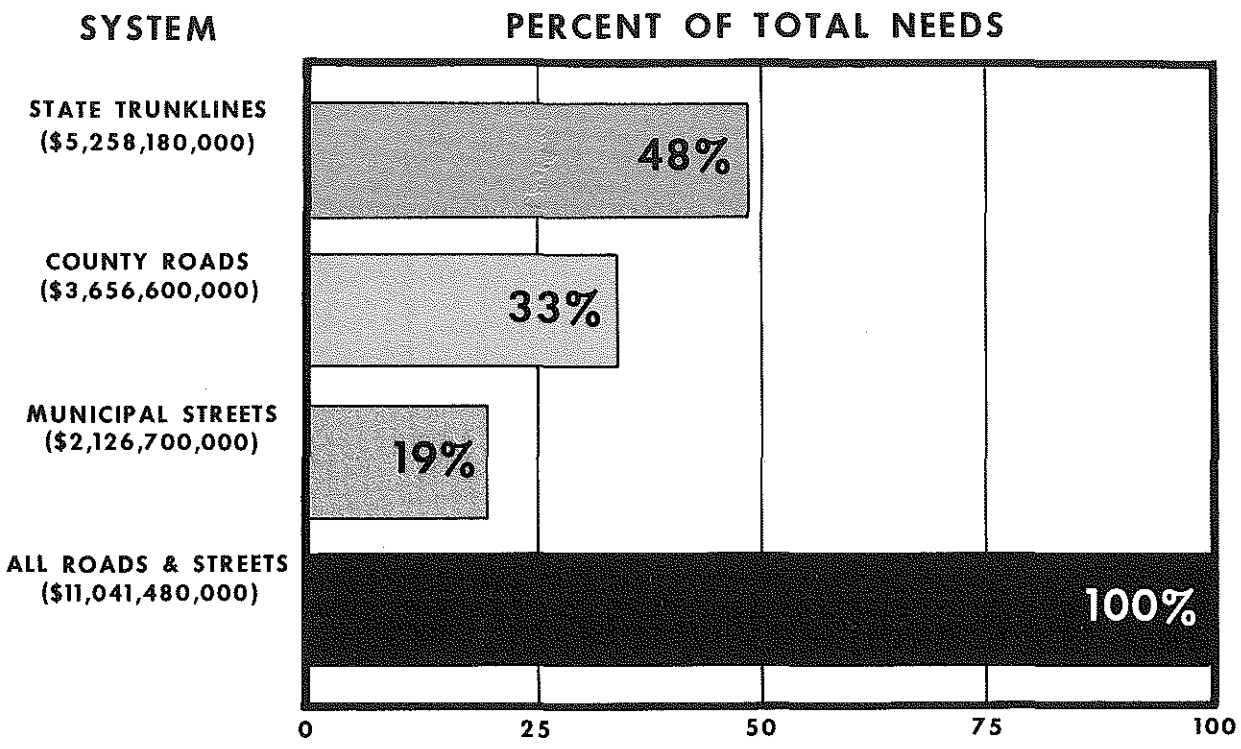
System	Cost *In Thousands*	Percent of Total
Interstate	$1,484,100	29
Primary	1,581,660	31
Secondary	1,371,090	27
Urban Extensions	683,360	13
Total Construction	$5,120,210	100

The Federal-aid construction needs are a duplication of, and are not in addition to, needs previously discussed on existing state and local highway and street systems.

All Federal-aid funds allotted to Michigan totaled $95,243,000 for 1960.

TOTAL NEEDS

The magnitude of the total of Michigan's more than $11 billion of highway needs are portrayed in the following charts. Costs reflect expendi-



tures needed to meet expansion in population, miles of travel, and motor vehicle registrations on the state, county, and municipal road and street systems. Deficient miles and costs are shown in the following table:

System	Miles of Deficient Road	Cost in Billions	Percent of Total Cost
State Trunkline System (Including Interstate)	8,984	$ 5.258	48
County Road Systems	78,528	3.657	33
Municipal Streets	12,330	2.127	19
Totals	99,842	$11.042	100

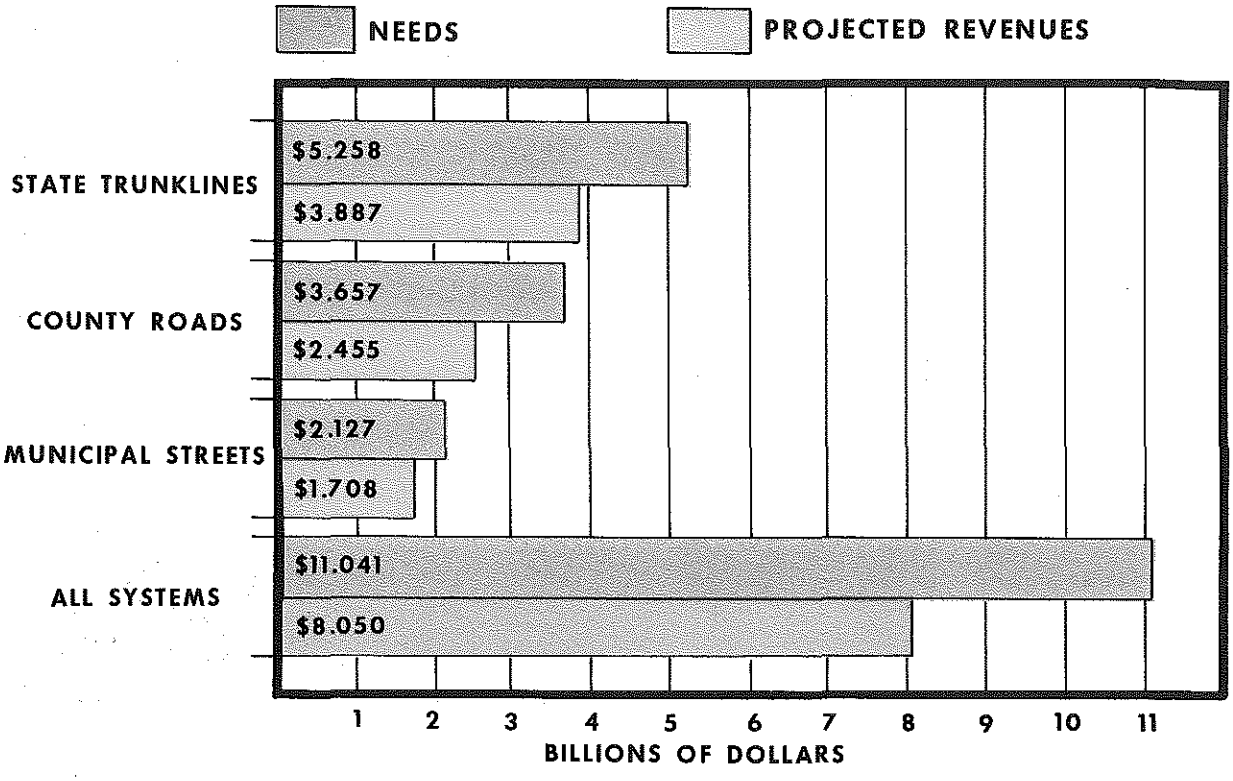
A map showing needs by the various counties has been included. (See page 11.)

The $11 billion total does not represent needs in addition to expected revenues. In order to estimate additional funds required, estimates were made according to existing sources by the Highway Department. The estimated revenues available to meet 20-year needs are:

Revenue Sources	Total (Projected) 1960-1980 *In Billions*	Average Annual (Projected) 1960-1980 *In Millions*
Federal Aid	$1.884	$ 94.200
Motor Vehicle Highway Fund	5.016	250.800
Locally-raised	1.150	57.500
Total Available to Meet Needs	$8.050	$402.500

NOTE: Anticipated Borrowings and Debt Service Requirements for state, county, and municipality are not included in the above amounts. Debt Service Requirements will total approximately $46.6 million annually or $933 million for 20 years.

The following chart shows the comparison of needs versus projected revenues from all sources, 1960-1980:



The dimension of the needs has been reduced to a more manageable figure of approximately $3 billion in 20 years or $150 million annually which could be realistically met in a 20-year span.

On a 20-year basis, relative proportions of the total needs required by the several road and street systems remain about the same as the 1955 study. However, this study shows a total 20-year improvement cost about 1.5 times greater.

The increase in motor vehicle use projected for the 1960 study is 1.3 times the 1955 study and is an important factor creating additional needs.

ALTERNATIVE PROGRAMS FOR RETIRING NEEDS

The magnitude of the total of Michigan's more than $11 billion of highway needs and the details of these needs as they exist on the several classes of highway systems, make it clear that correction will take up to 20 years. Whether these needs can be met in this period will depend on the funds made available for the task by the State, the Federal Government and the local units. To aid the Legislature and county and municipal bodies in arriving at decisions in these matters, estimates have been made of the annual expenditures that would be required under several alternative program periods.

The table below is a breakdown of the average annual program costs for all systems under state, county and municipal jurisdiction.

Each program period has these basic elements:

1. Program costs are reported on an average annual basis.
2. Costs have been developed in order to show the cost of catching-up on the backlog of needs and meeting needs as they occur within a 10-year period, 15-year period, or 20-year period.

ALTERNATIVE AVERAGE ANNUAL PROGRAM COSTS

INCLUDING MAINTENANCE AND ADMINISTRATION

In Thousands

	10 Year Program (Based on catching up in 10 years and meeting needs as they occur in the last 10 years.)		15 Year Program (Based on catching up in 15 years and meeting needs as they occur in last 5 years.)		20 Year Program (Based on meeting the needs in 20 years).
	10 Year Period	2nd 10 Yr. Period	15 Year Period	Last 5 Yr. Period	20 Year Period
State Trunklines Rural & Urban	$330,554	$195,264	$315,225	$105,961	$262,909
Major Municipal Sts.	71,784	52,994	62,768	61,252	62,389
County Primary Rural & Urban	115,440	65,854	100,868	59,984	90,647
Sub-Total Major Roads & Streets	517,778	314,112	478,861	227,197	415,945
Local Municipal Sts.	55,874	32,018	48,786	29,426	43,946
County Local Roads	129,890	54,476	107,565	46,037	92,183
Sub-Total Local Roads & Streets	185,764	86,494	156,351	75,463	136,129
Total All Roads & Streets	$703,542	$400,606	$635,212	$302,660	$552,074

3. Costs of each program period is the annual total of:

   - Construction costs as a result of engineering analysis of roads and streets by state, county, and municipal engineers.
   - Maintenance cost figured on a cost per mile by surface type basis for state trunklines, county roads, and municipal streets.
   - Administration cost estimated as a percent of total volume of construction and maintenance work proposed for each system.

The cost to catch-up with needs in the various program periods is as follows:

	10-year catch-up period	
	1st 10 years	2nd 10 years
Average annual cost	$703,542,000	$400,606,000
Total Cost	$7,035,420,000	$4,006,060,000

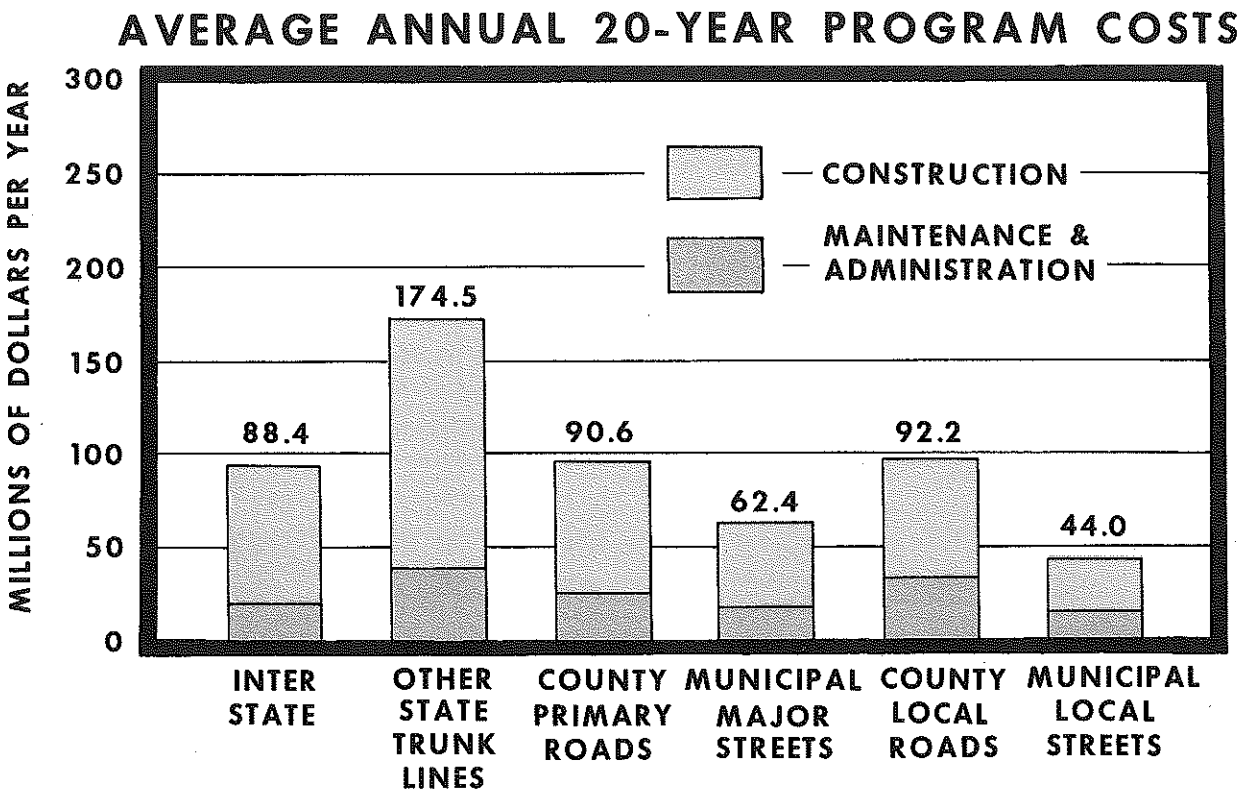
	15-year catch-up period	
	1st 15 years	last 5 years
Average annual cost	$635,212,000	$302,660,000
Total Cost	$9,528,180,000	$1,513,300,000

	20-year catch-up period
Average annual cost	$ 552,074,000
Total Cost	$11,041,480,000

The cost of correcting existing deficiencies and meeting new needs as they occur within 10 years is $7 billion. The cost for the remaining 10 years is $4 billion, since only the deficiencies that occur in the last 10 years have to be corrected.

CONCLUSION

Pertinent information has been included in tables at the end of each section in this report. On page 14 is a table showing a summary of the total needs. Reported in this table for the various road and street systems is the 1960 mileage, miles of streets reported as adequate for 20 years, miles to be improved, ultimate 1980 mileage, total needs in thousands of dollars, and percent of total needs.



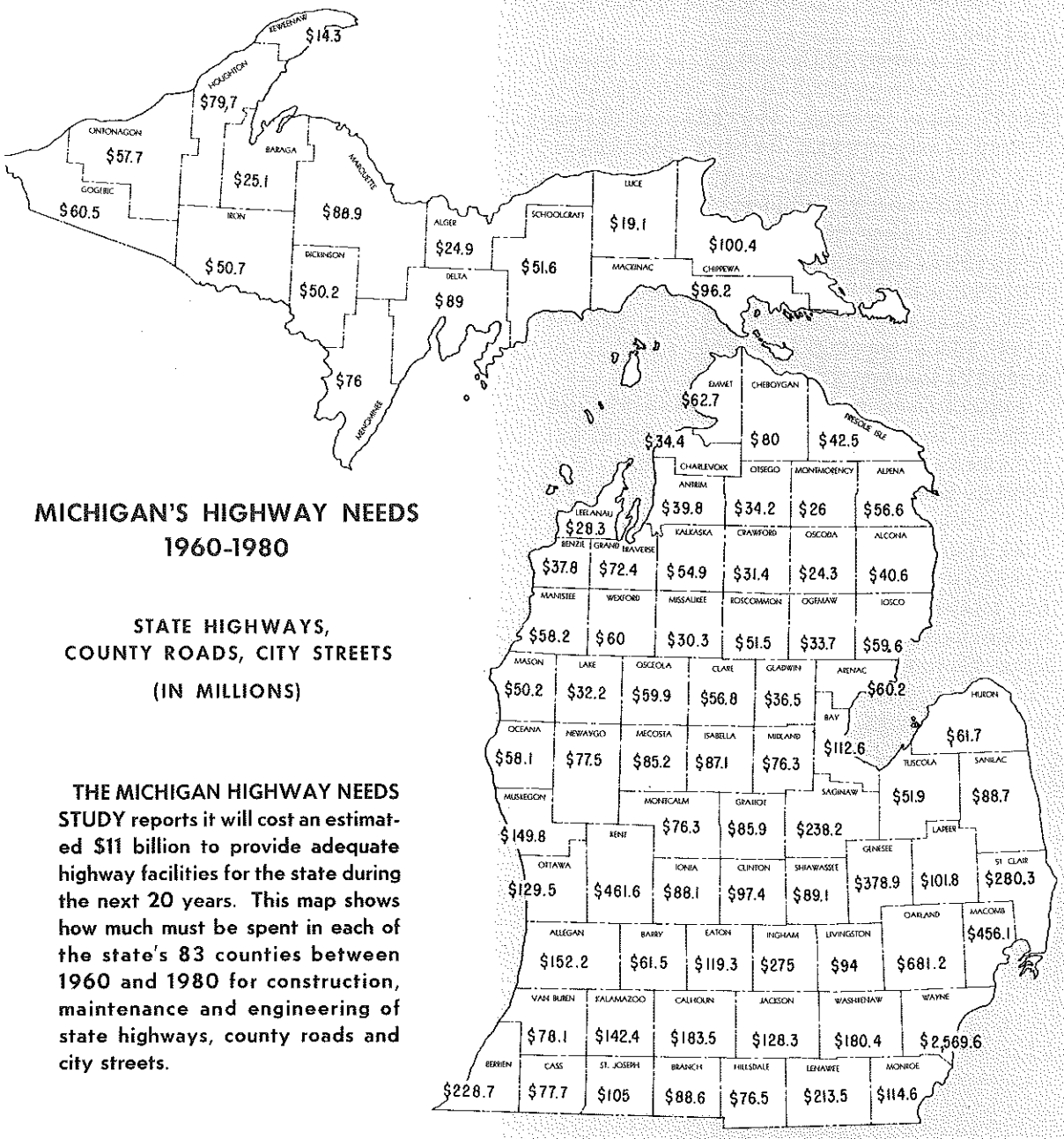
The 1980 mileage of major streets includes 520 miles of streets reported as adequate, 3,503 miles of streets that require improvement, and 363 miles of trunklines turned back to the cities. The total municipal street system was increased by 966 miles from 1960 to 1980. The $2.13 billion required for municipal streets is 19 percent of the total state needs.

The total improvement mileage on the county primary roads reported under the 1980 mileage is 24,197 miles, however, 195 miles in Wayne County is recommended for stage construction. The 1980 mileage consists of 215 miles of road that were considered adequate, 24,002 miles of roads that required improvement, and 3,192 miles of trunklines turned back to the county systems. The total county road system was increased by 1,436 miles from 1960 to 1980. The total of $3.66 billion required for county roads is 33 percent of the state total needs.

Improvements on 65 miles of non-federal aid highways is reported in the 8,984 miles of improvements on the state trunkline system. This mileage, however, was not included in the total 1980 mileage on the state system. Another 3,192 miles of improvement on trunkline turnbacks to counties and 363 miles of improvements on trunkline turnbacks to cities are not reported in the improvement mileage on the state trunkline systems. However, costs to improve these routes to standard for 1980 traffic are included in the needs on state highways. Needs on the interstate and primary systems totals $4.61 billion. When added to the $600 million required on the secondary and non-federal aid routes the total figure for needs on the state trunkline system becomes $5.26 billion or 48 percent of the total needs on all systems.

On page 15 is a table depicting the total needs for highways, roads and streets by system and by nature of work such as construction, maintenance and administration. Construction costs to improve 99,842 miles on all systems is $8.12 billion. Maintenance requirements to keep all roads and streets in condition is an aditional $2.42 billion. Administration and engineering costs is another $500 million. The remaining tables at the end of this section show the existing 1960 mileage by type of surface and total needs on all systems within the 83 counties.

The engineering appraisal re-emphasizes the importance of keeping a complete record of existing conditions on Michigan roads and streets in order to estimate past accomplishments, what needs to be done, and how much it will cost to develop these road and street systems in the most economical and practical manner possible to serve estimated traffic requirements by 1980. This appraisal was possible through the coordinated effort put forth by the engineering staffs of the various municipalities, the 83 county road commissions, and the Highway Department. The end result is an $11 billion needs to complete this 20-year program.



MICHIGAN'S HIGHWAY NEEDS 1960-1980

STATE HIGHWAYS, COUNTY ROADS, CITY STREETS

(IN MILLIONS)

THE MICHIGAN HIGHWAY NEEDS STUDY reports it will cost an estimated $11 billion to provide adequate highway facilities for the state during the next 20 years. This map shows how much must be spent in each of the state's 83 counties between 1960 and 1980 for construction, maintenance and engineering of state highways, county roads and city streets.

TOTAL NEEDS BY COUNTY

County	Cost in Millions	County	Cost in Millions	County	Cost in Millions
Alcona	$ 40.6	Hillsdale	$ 76.5	Monroe	$ 114.6
Alger	24.9	Houghton	79.7	Montcalm	76.3
Allegan	152.2	Huron	61.7	Montmorency	26.0
Alpena	56.6			Muskegon	149.8
Antrim	39.8	Ingham	275.0		
Arenac	60.2	Ionia	88.1	Newaygo	77.5
		Iosco	59.6		
Baraga	25.1	Iron	50.7	Oakland	681.2
Barry	61.5	Isabella	87.1	Oceana	58.1
Bay	112.6			Ogemaw	33.7
Benzie	37.8	Jackson	128.3	Ontonagon	57.7
Berrien	228.7			Osceola	59.9
Branch	88.6	Kalamazoo	142.4	Oscoda	24.3
		Kalkaska	54.9	Otsego	34.2
Calhoun	183.5	Kent	461.6	Ottawa	129.5
Cass	77.7	Keweenaw	14.3		
Charlevoix	34.4			Presque Isle	42.5
Cheboygan	80.0	Lake	32.2		
Chippewa	100.4	Lapeer	101.8	Roscommon	51.5
Clare	56.8	Leelanau	28.3		
Clinton	97.4	Lenawee	213.5	Saginaw	238.2
Crawford	31.4	Livingston	94.0	Sanilac	88.7
		Luce	19.1	Schoolcraft	51.6
Delta	89.0			Shiawassee	89.1
Dickinson	50.2	Mackinac	96.2	St. Clair	280.3
		Macomb	456.1	St. Joseph	105.0
Eaton	119.3	Manistee	58.2		
Emmet	62.7	Marquette	88.9	Tuscola	51.9
		Mason	50.2	Van Buren	78.1
Genesee	378.9	Mecosta	85.2		
Gladwin	36.5	Menominee	76.0	Washtenaw	180.4
Gogebic	60.5	Midland	76.3	Wayne	2,569.6
Grand Traverse	72.4	Missaukee	30.3	Wexford	60.0
Gratiot	85.9			Total Cost	$11,041.5

SUMMARY

Including Maintenance and Administration

System	1960 Mileage	No. Imp. Mileage	Improvement Mileage	1980 Mileage	Total Needs *In Thousands*	Percent of Total Needs
CITY						
Major	4,017	520	3,503	4,386	$ 1,247,780	
Local	10,394	2,164	8,827	10,991	878,920	
Sub-Total	14,411	2,684	12,330	15,377	2,126,700	19%
COUNTY						
Primary	23,283	215	24,197	27,409	1,812,940	
Local	62,542	5,521	54,331	59,852	1,843,660	
Sub-Total	85,825	5,736	78,528	87,261	3,656,600	33%
STATE						
Interstate						
Rural	860	185	750	935	810,740	
Urban	241	21	122	143	956,940	
Sub-Total	1,101	206	872	1,078	1,767,680	
Primary						
Rural	4,842	193	4,491	6,484	1,957,870	
Urban	638	44	593	637	883,250	
Sub-Total	5,480	237	5,084	5,321	2,841,120	
Secondary						
Rural	2,610	13	2,733	2,746	374,850	
Urban	222	11	230	241	73,540	
Sub-Total	2,832	24	2,963	2,987	448,390	
Non Fed. Aid						
Rural	46		46		152,500	
Urban	19		19		48,490	
Sub-Total	65		65		200,990	
Rural	8,358	391	8,020	8,365		
Urban	1,120	76	964	1,021		
Sub-Total	9,478	467	8,984	9,386	5,258,180	48%
TOTAL—Rural	93,602		85,845	94,923		
TOTAL—Urban	16,112		13,997	17,101		
GRAND TOTAL	109,714	8,887	99,842	112,024	$11,041,480	100%

TOTAL NEEDS BY SYSTEM AND NATURE OF WORK

In Thousands

System	Construction	Maintenance	Administration and Engineering	Total
STATE				
Interstate				
Rural	$ 660,880	$ 103,980	$ 45,880	$ 810,740
Urban	823,220	79,540	54,180	956,940
Total Interstate	1,484,100	183,520	100,060	1,767,680
All Other Trunklines				
Rural	1,921,760	422,780	140,680	2,485,220
Urban	818,620	129,760	56,900	1,005,280
Total All Other Trunklines	2,740,380	552,540	197,580	3,490,500
Total State	4,224,480	736,060	297,640	5,258,180
COUNTY				
Primary	1,242,360	510,440	60,140	1,812,940
Local	1,226,800	560,060	56,800	1,843,660
Total County	2,469,160	1,070,500	116,940	3,656,600
CITY				
Major	884,360	314,460	48,960	1,247,780
Local	543,220	303,760	31,940	878,920
Total City	1,427,580	618,220	80,900	2,126,700
GRAND TOTAL	$8,121,220	$2,424,780	$495,480	$11,041,480

State Needs

The analysis of existing facilities reveals the nature and extent of the trunkline deficiencies. This study includes a report of estimated costs for needed improvements.

The engineering appraisal disclosed that within the next 20 years all but 467 miles of state trunkline will need some kind of improvement to accommodate present and anticipated traffic. Many improvement needs are urgently required now or in the near future. Needs range from minor widening to construction of freeways.

Alternate annual programs are included which show annual financial requirements to meet construction needs and provide for maintenance and administration. Alternatives should be considered in relation to the findings and recommendations of the separate concurrent fiscal study.

The estimated total construction needs for all State Highway improvements, rural and urban, in the next 20 years is $4.22 billion. Of this amount $1.48 billion is for work needed on routes of the National System of Interstate and Defense Highways; $2.74 billion for work on other State Highway routes. Some $1.64 billion, of which $823 million is on the Interstate System and $819 million on the all other state trunklines is needed for construction on highways within limits of municipalities. In addition $2.58 billion, of which $661 million is on the Interstate system and $1.92 billion on the all other state trunklines is needed for construction on rural portions of the State Highway system. Maintenance and Administration costs are of $1.04 billion in addition to these amounts.

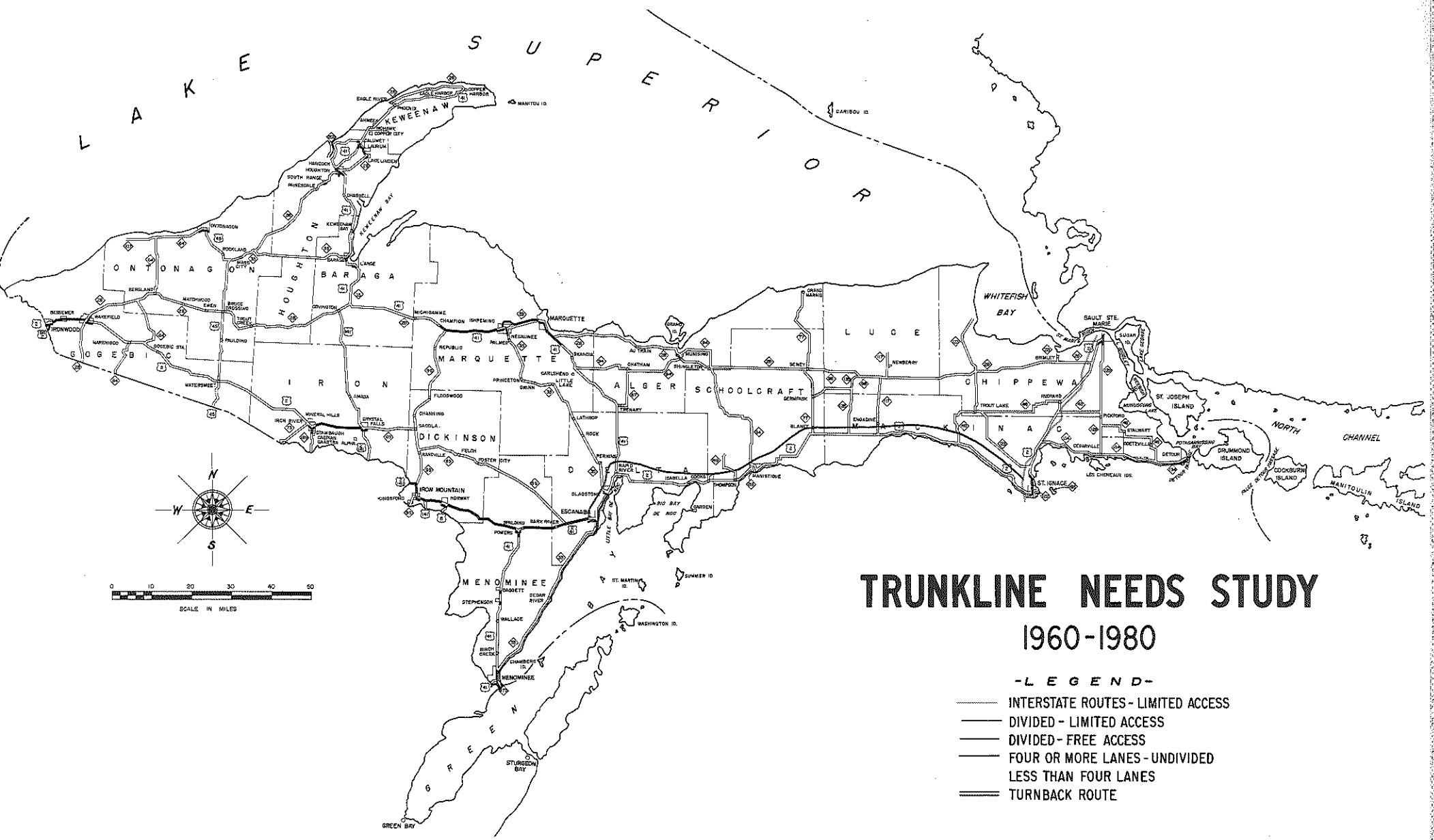
Despite an accelerated program of construction $2.79 billion will be needed in 10 years if construction is maintained at the level of requirements as determined by this study.

METHOD OF APPRAISAL

In order to analyze existing highway facilities and predict future design requirements, the following procedures were undertaken:

1. Inventory of existing conditions
2. Evaluation of traffic data
3. Selection and application of standards
4. Determination of deficiencies
5. Appraisal of type and cost of improvement
6. Review and tabulation of data
7. Estimate of maintenance and administration costs
8. Program development

The scope of the study included all rural and urban trunkline highways and structures. The guide for the Interstate Highway Study was the 104 (b) 5 Study which was completed in 1960. All traffic estimates, design requirements and cost estimates that are reported in this needs report were taken from that study. An individual analysis of each municipality over 5,000 population was made and an integrated pattern of streets and highways was developed according to future travel desires, land uses and growth potential.

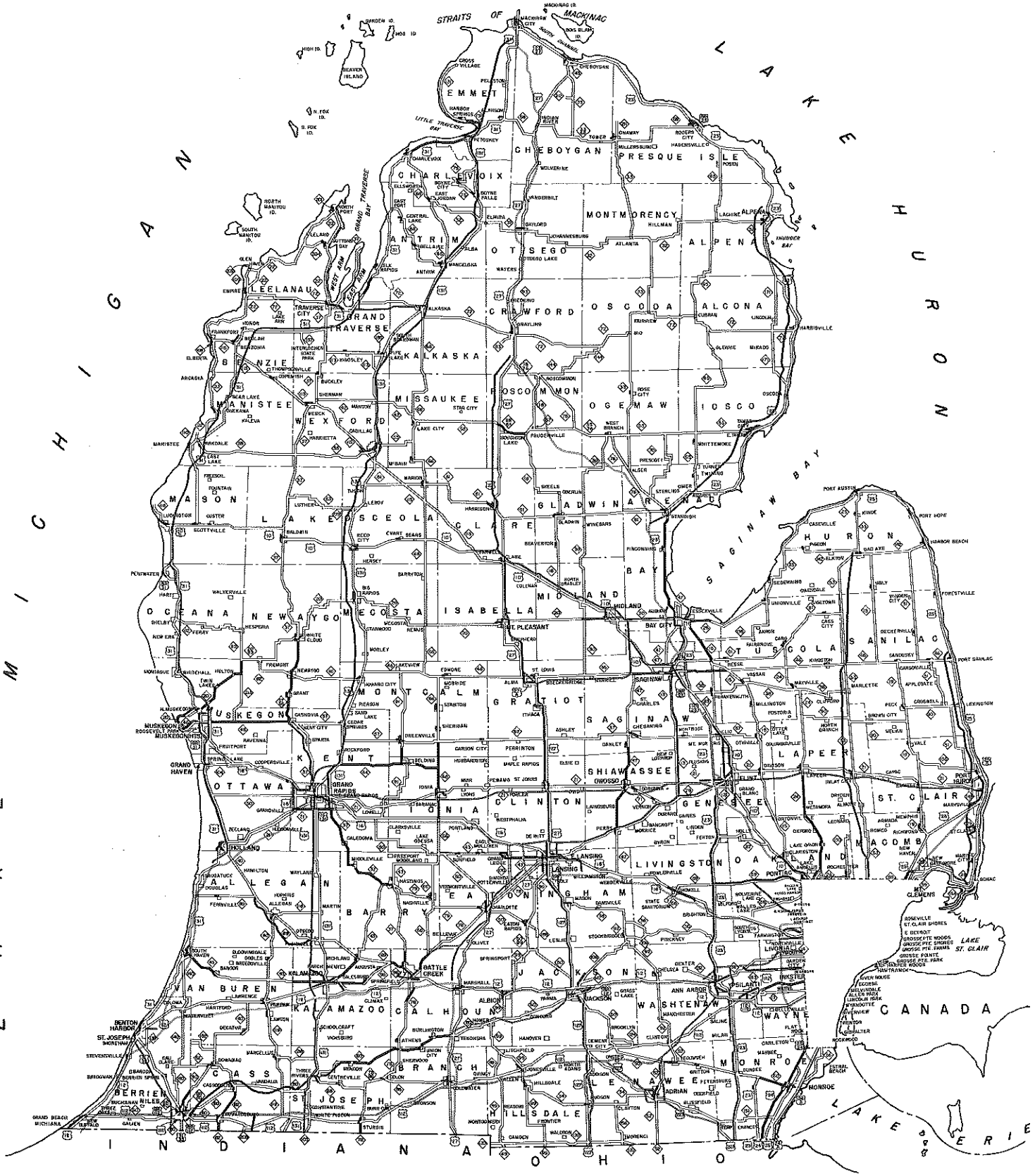


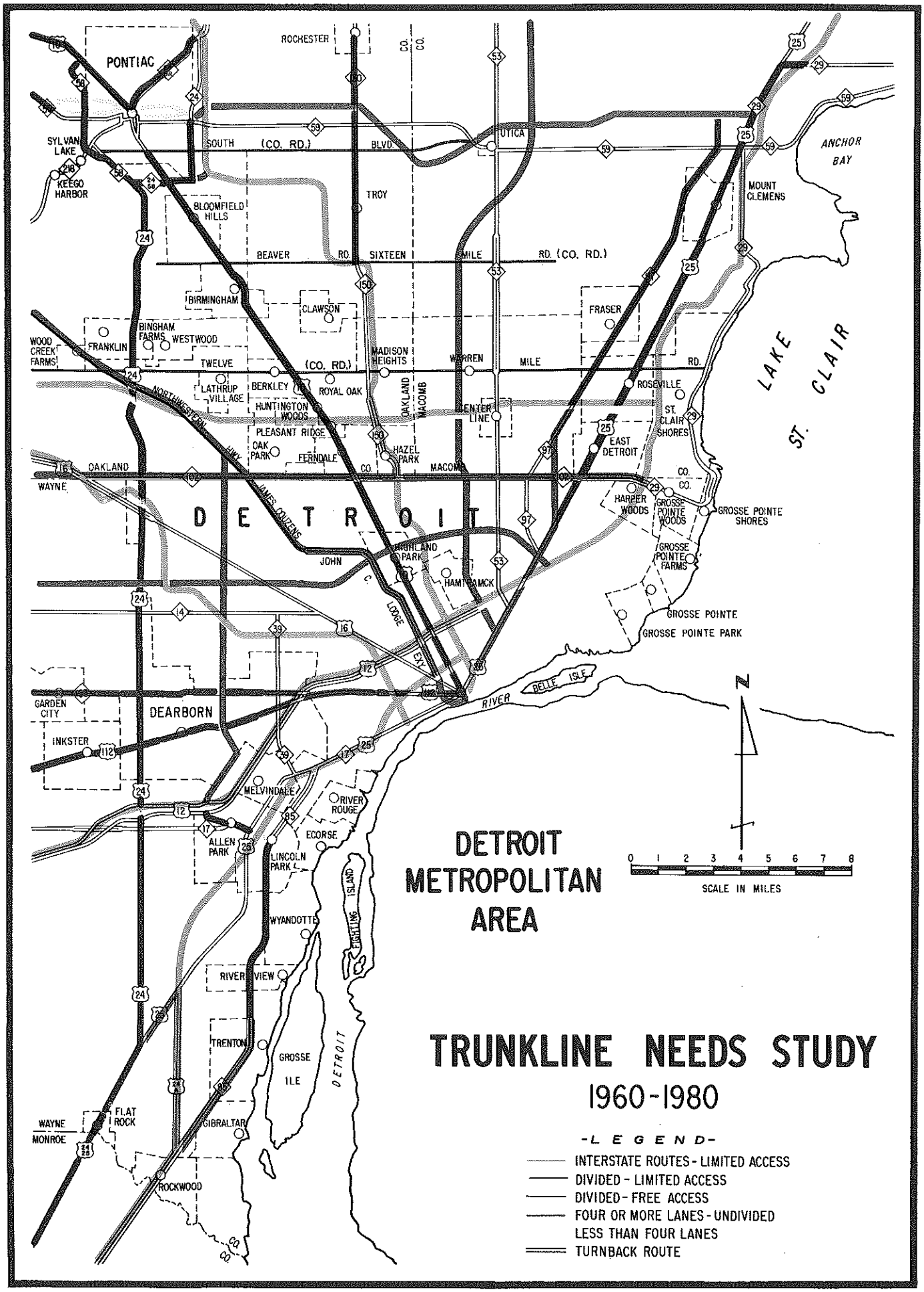
TRUNKLINE NEEDS STUDY

1960-1980

-LEGEND-

- INTERSTATE ROUTES - LIMITED ACCESS
- DIVIDED - LIMITED ACCESS
- DIVIDED - FREE ACCESS
- FOUR OR MORE LANES - UNDIVIDED
- LESS THAN FOUR LANES
- TURNBACK ROUTE


LAKE MICHIGAN
LAKE HURON
STRAITS OF MACKINAC
MACKINAC ISLAND
BOIS BLANC ISLAND
BEAVER ISLAND
CROSS VILLAGE
PELLSTON
CHEBOYGAN
PRESQUE ISLE
EMMET
CHARLEVOIX
ANTRIM
OTSEGO
MONTMORENCY
ALPENA
LEELANAU
GRAND TRAVERSE
CRAWFORD
OSCODA
ALCONA
BENZIE
KALKASKA
MANISTEE
MISSAUKEE
ROSCOMMON
OGEMAW
IOSCO
WEXFORD
MASON
LAKE
OSCEOLA
CLARE
GLADWIN
ARENAC
HURON
SAGINAW BAY
OCEANA
NEWAYGO
MECOSTA
ISABELLA
MIDLAND
BAY
TUSCOLA
SANILAC
MUSKEGON
MONTCALM
GRATIOT
SAGINAW
LAPEER
KENT
OTTAWA
IONIA
CLINTON
GENESEE
ST. CLAIR
SHIAWASSEE
MACOMB
ALLEGAN
BARRY
EATON
INGHAM
LIVINGSTON
OAKLAND
JACKSON
VAN BUREN
KALAMAZOO
CALHOUN
WASHTENAW
WAYNE
CASS
BRANCH
LENAWEE
MONROE
BERRIEN
ST. JOSEPH
HILLSDALE
CANADA
LAKE ST. CLAIR
LAKE ERIE
INDIANA
OHIO


PONTIAC
ROCHESTER
SYLVAN LAKE
KEEGO HARBOR
BLOOMFIELD HILLS
TROY
UTICA
SOUTH (CO. RD.) BLVD
BEAVER RD. SIXTEEN MILE RD. (CO. RD.)
MOUNT CLEMENS
ANCHOR BAY
BIRMINGHAM
CLAWSON
FRASER
BINGHAM FARMS
WESTWOOD
WOOD CREEK FARMS
FRANKLIN
TWELVE (CO. RD.)
MADISON HEIGHTS
WARREN MILE RD.
LATHRUP VILLAGE
BERKLEY
ROYAL OAK
HUNTINGTON WOODS
PLEASANT RIDGE
OAK PARK
FERNDALE
HAZEL PARK
OAKLAND
MACOMB
CENTER LINE
ROSEVILLE
ST. CLAIR SHORES
EAST DETROIT
LAKE ST. CLAIR
NORTHWESTERN HWY.
JAMES COUZENS
JOHN C. LODGE EXP.
WAYNE
D E T R O I T
HARPER WOODS
GROSSE POINTE WOODS
GROSSE POINTE SHORES
GROSSE POINTE FARMS
HIGHLAND PARK
HAMTRAMCK
GROSSE POINTE
GROSSE POINTE PARK
BELLE ISLE
DETROIT RIVER
GARDEN CITY
DEARBORN
INKSTER
MELVINDALE
RIVER ROUGE
ALLEN PARK
ECORSE
LINCOLN PARK
WYANDOTTE
ECORSE ISLAND
RIVER VIEW
TRENTON
GROSSE ILE
DETROIT
WAYNE
MONROE
FLAT ROCK
GIBRALTAR
ROCKWOOD
N
0 1 2 3 4 5 6 7 8
SCALE IN MILES
DETROIT METROPOLITAN AREA
TRUNKLINE NEEDS STUDY
1960-1980
-LEGEND-
INTERSTATE ROUTES - LIMITED ACCESS
DIVIDED - LIMITED ACCESS
DIVIDED - FREE ACCESS
FOUR OR MORE LANES - UNDIVIDED
LESS THAN FOUR LANES
TURNBACK ROUTE

INVENTORY OF EXISTING CONDITIONS

An exhaustive inventory of the existing highway system was made. Some of the data required were available in the various divisions in the Lansing Office. This data in addition to information gathered from the district offices gave an accurate picture of existing conditions on the trunkline system.

Conditions recorded:

1. The type, physical condition, and anticipated life of the vital structural parts of the highway (roadways themselves and structures).

2. The important physical conditions such as roadway widths, clearances, the vertical alignment, the horizontal alignment, etc.

3. Topography including soil and terrain.

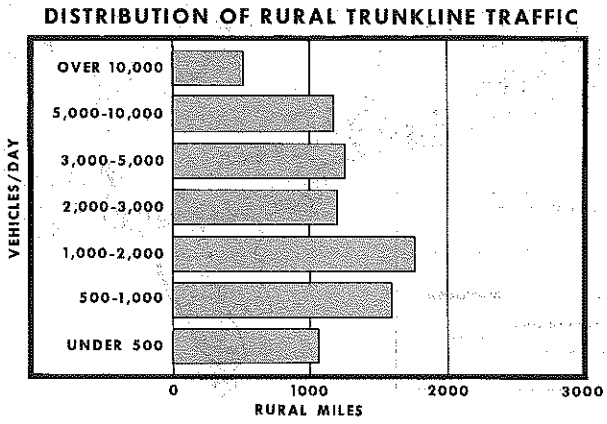
After this and other necessary information had been gathered, the next step was to divide the highway system into study sections having approximate uniformity. Highway routes were broken down into sections. These control sections were broken down into subsections having uniform conditions. The termini of these subsections occurred at significant changes in roadway conditions, at the limits of incorporated places, at major intersections, and at county lines.

EVALUATION OF TRAFFIC DATA

Complete and accurate information about the movement and type of vehicular traffic on the state trunkline system was assembled by the Traffic Division of the Department.

In order to evaluate existing capacities of the various road sections, the practical capacity was determined. Practical capacity is equal to the ideal capacity adjusted to reflect differences in actual sight distance restricting lane width and commerical vehicles from the norms as defined by ideal capacities: 12′ lane width, no passing sight distance restriction, 100% passenger vehicles. The resulting information formed part of the analysis of its deficiencies.

Increases in these traffic volumes were projected over the next twenty years as a guide to future needs. The forecast of general statewide travel for the twenty years of this study was an increase of 120 percent on the principal and major trunkline system and an increase of 80 percent on other trunklines. Pictured is the distribution of rural trunkline traffic.



SELECTION AND APPLICATION OF STANDARDS

It was necessary to select the appropriate design standards for each study section. Selection was governed by the highway classification, the traffic volume anticipated in twenty years, and the type of terrain in which the section was located. These factors were applied to the tables in the appendix and the controlling elements of design were determined.

DETERMINATION OF DEFICIENCIES

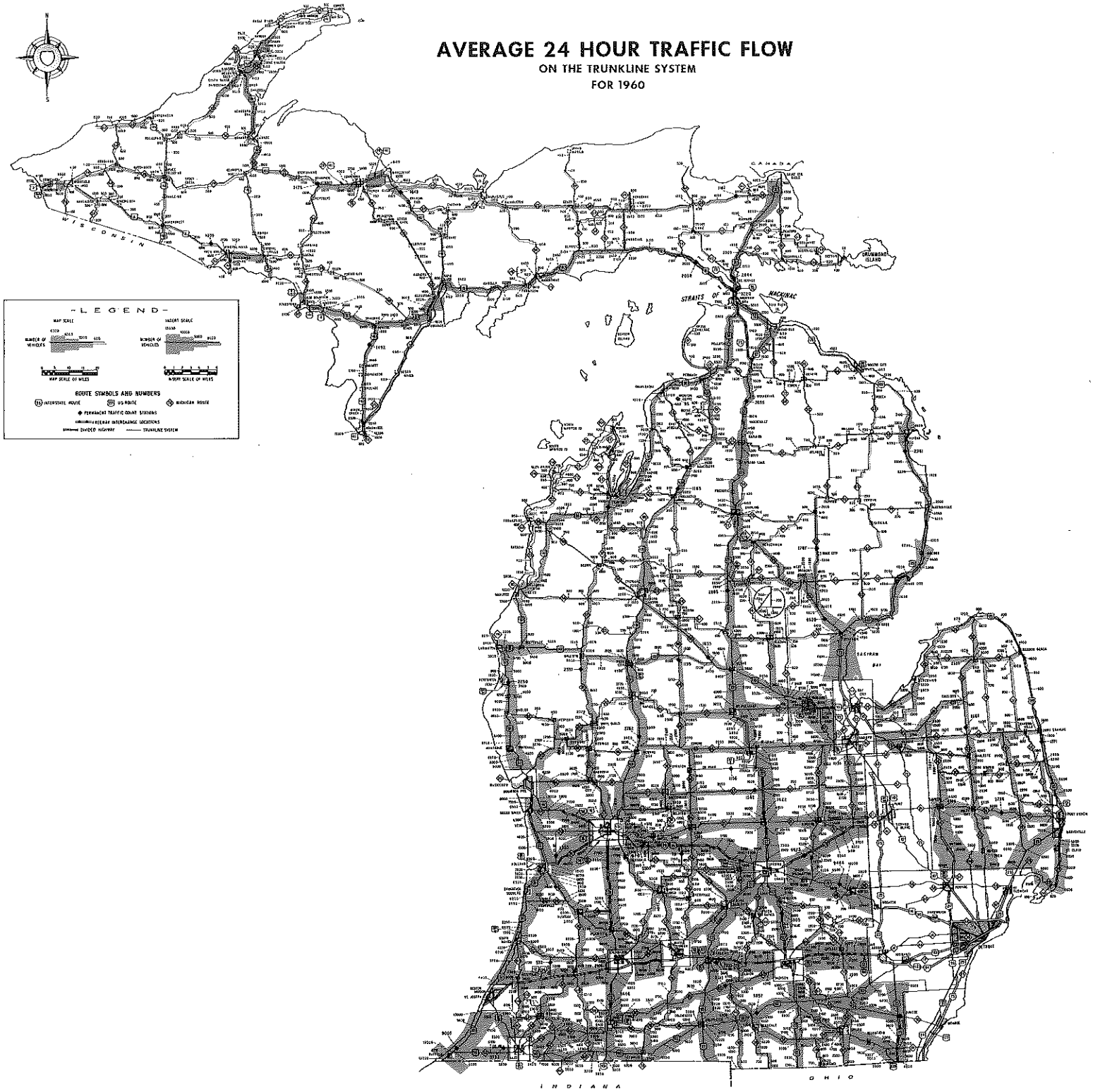
The next step was to discover the existing and future deficiencies of the roadways and bridges. These were located by comparing the inventory and traffic data for each location with the design tables.

For this purpose the anticipated increase in traffic volume and the life expectancy of the existing pavement or structure were utilized for each section. For those locations that were deficient, the nature and time of future deficiencies were estimated. In this way the sections needing work now or at designated periods were determined. However the initial timing of the improvements were altered to provide for continuity and integration with other plans.

AVERAGE 24 HOUR TRAFFIC FLOW

ON THE TRUNKLINE SYSTEM

FOR 1960



TYPE AND COST OF IMPROVEMENT

The time periods for needed improvements and the design standards having been established, the summary forms containing all pertinent data for each highway section were analyzed for cost.

An estimate was made of the construction costs, broken down into their various components, necessary to carry out the required improvement for each section. The estimates were based on actual costs of like work according to 1958 contract prices.

REVIEW AND TABULATION OF STUDY DATA

All the summary forms for highways within the ten districts were reviewed by the District Engineers. Any alterations that they suggested for change in future plans which were considered economically feasible were adopted. A general review of all results was then carried out to discover errors and inconsistencies and to guarantee uniformity of design and costs.

When the review was finished and the forms completed, the assembled information was transferred to business machine punch cards for convenient tabulation. This information includes mileage, deficiencies, needed improvements, and construction costs.

MAINTENANCE AND OTHER COSTS

The method of survey, thus far, was designed to measure needed permanent construction. In order to complete an estimated cost of developing an adequate transportation system, an appraisal was needed of the cost required for year-by-year work of maintaining the highway plant in an operating condition.

After a review of present and past maintenance expenditures within the districts, estimates were made of annual maintenance costs per mile for each type of pavement. All factors of routine work were included and allowances were made for snow removal.

In addition, administrative costs were included, as will be described later in this report.

PROGRAM DEVELOPMENT

A major objective of the study was to determine total costs of the several highway systems for various future periods. This required extensive tabulation and computation of the various cost data referred to in the previous section. A thorough analysis was made and a large number of charts and graphs were prepared for the basic information necessary. The results of this analysis are found in the section titled "Summaries of Program Costs and Various Alternative Programs".

CLASSIFICATION OF HIGHWAYS

The results of past classification studies were used. The existing trunkline system was broken down into three categories, "Principal Trunkline", "Other Major Trunkline", and "All Other Trunklines".

The "Principal System" is a network of highways most important to the economy of Michigan, and is to be planned for generally higher standards than the other two systems. This system serves all important traffic volumes and intercity desires. The "Other Major" system is identified as being of more than usual importance to the state as a whole. This type of highway connects interstate routes, serves major population centers, and provides access to important mining, forest, tourist areas and other areas of motorist attraction. "All Other Trunklines" serve smaller communities, moderate traffic volumes, minor development areas and act as feeder systems to the Principal and Major Trunklines. The map on page 24 portrays these classifications by routes.

Basic to all fiscal and engineering plans is the extent and nature of the road and street systems for which planning must be done. Development of properly classified road and street systems will permit the state and the municipalities to coordinate their plans more closely, arrange financing on a sounder footing and promote logical improvement programs.

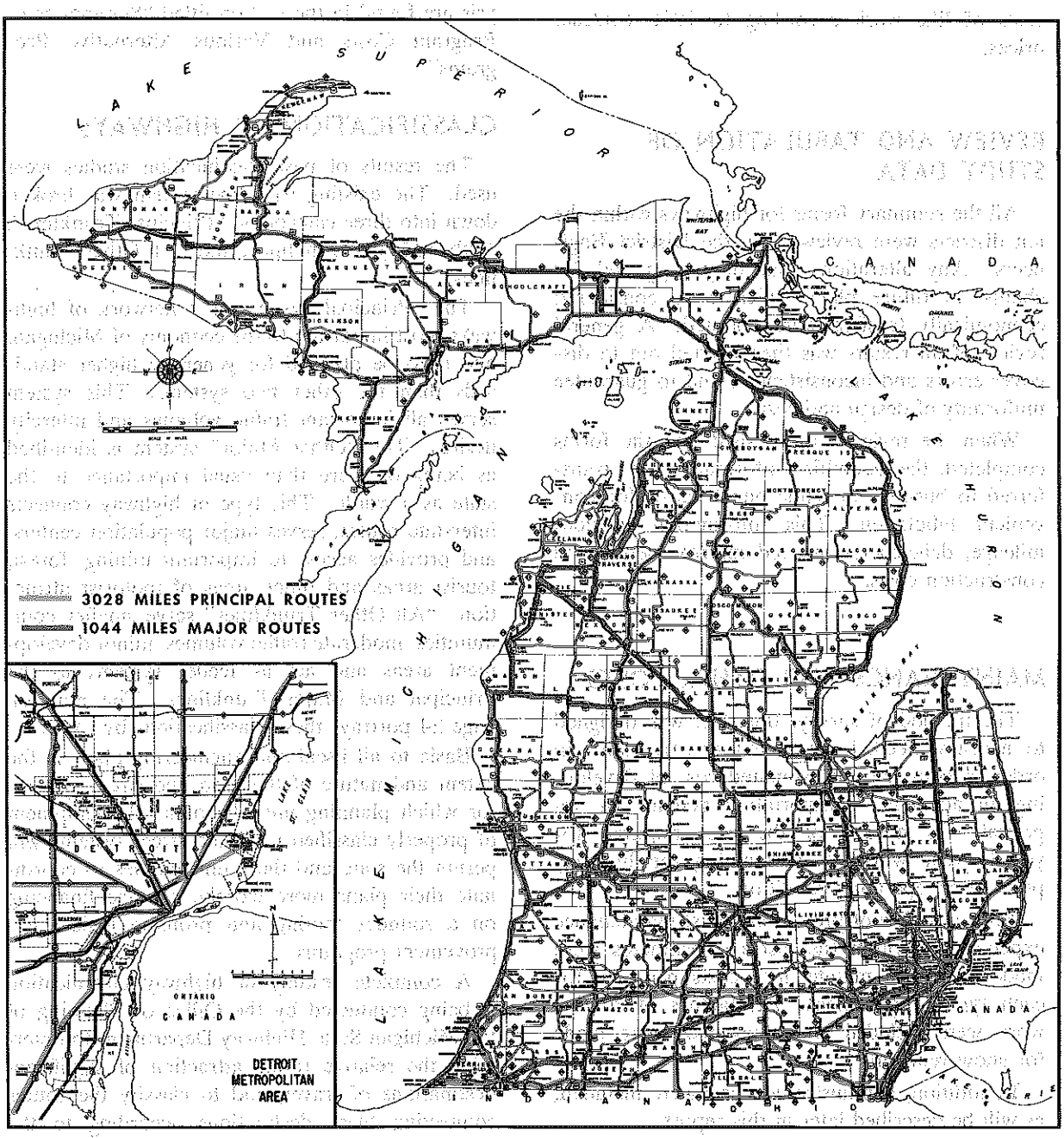
A complete restudy of highway classification is being conducted by the Office of Planning of the Michigan State Highway Department to determine the relative traffic attraction of significant destinations of travel, and to classify the routes connecting these destinations according to the

determined importance of the destination connected.

In such a re-examination, the goal should be not only adequacy of systems, but consistency of functions of the routes within each system. Moreover, the selected systems should be fixed or stabilized for a long period of time so planning can have a firm foundation.

For these reasons classification of systems is an essential element of an advanced planning process and in itself provides for priority in the scheduling of construction programs.

CLASSIFICATION MAP



DESIGN STANDARDS

Design standards define the kind of highway needed to meet particular traffic conditions. They were the basis for the highway improvement program, for they dictated what must be done to produce an adequate system. Given the conditions of future traffic demand as measured in highway classification, and of local terrain, it was essential to specify the kind of roadway or bridge that would provide adequate service throughout the life of the pavement at a reasonable cost. The general specifications governing bridge and highway design for Michigan highways have been reported in the appendix.

These design standards which provide for the different conditions likely to be met in practice were developed by nine members of the State Engineering Advisory Committee. They were based on recommendations of recognized highway research organizations with appropriate modifications to allow for conditions found in Michigan. They are an improvement upon previously accepted standards and demonstrate recognition of the need for safety and better service to traffic.

ROADWAY

Multi-lane divided roadways with highest standards of design are required on freeway highways. Wide roadways and high type pavement must be provided to serve safely and efficiently large volumes of long distance, high-speed traffic including many commercial vehicles. In order to protect the public investment in highways and to keep them adequate for increasing volumes of traffic, control of access and separated intersections are called for on all freeway locations.

Principal trunkline highways, having high traffic volumes, require standards similar to those of freeways particularly for new locations and where economically feasible.

Remaining trunkline highways have design standards suitable to their role as carriers of lower-speed, shorter-trip traffic. Accordingly, design standards commensurate with type and volume of traffic have been recommended for these highways.

STRUCTURE STANDARDS

Bridge standards are also tabled in the appendix. They prescribe that bridge roadway widths vary in accordance with the class of highway, traffic volume, and length of span. Also a uniformly high standard of load limit and vertical under clearance height is set for all bridges to serve the large and heavy vehicles that travel over all parts of the Michigan Highway System.

These standards will assure the construction of bridges having safe clearances and not requiring undue load limit restrictions.

RAILROAD CROSSING STANDARDS

Railroad crossing standards were adopted to guide reconstruction at railroad crossings. They provide for grade separation on multilane highways and on all other highways where train traffic causes accidents or serious delays. Signals and gates, at least, are called for on all Major Trunkline highways and on other heavily traveled highways having double track crossings; all other locations would have flashing signals.

NATURE OF TRUNKLINE DEFICIENCIES

Lack of adequate width to handle traffic characterize rural and urban Michigan State Highways. Another critical factor on the rural trunkline systems is alignment. All rural and urban trunklines were rated in the study on their present degree of adequacy to meet design standards with regard to five major factors:

1. Alignment (vertical and horizontal)
2. Capacity to handle traffic
3. Surface type
4. Structural Condition
5. Surface width

Rural, trunkline bridges were rated as to:

1. Load carrying ability and structural condition
2. Height and width clearances

Results of these ratings are summarized in the charts. A total of 8,358 miles and 1,363 structures on rural trunklines were appraised to determine their degree of adequacy.

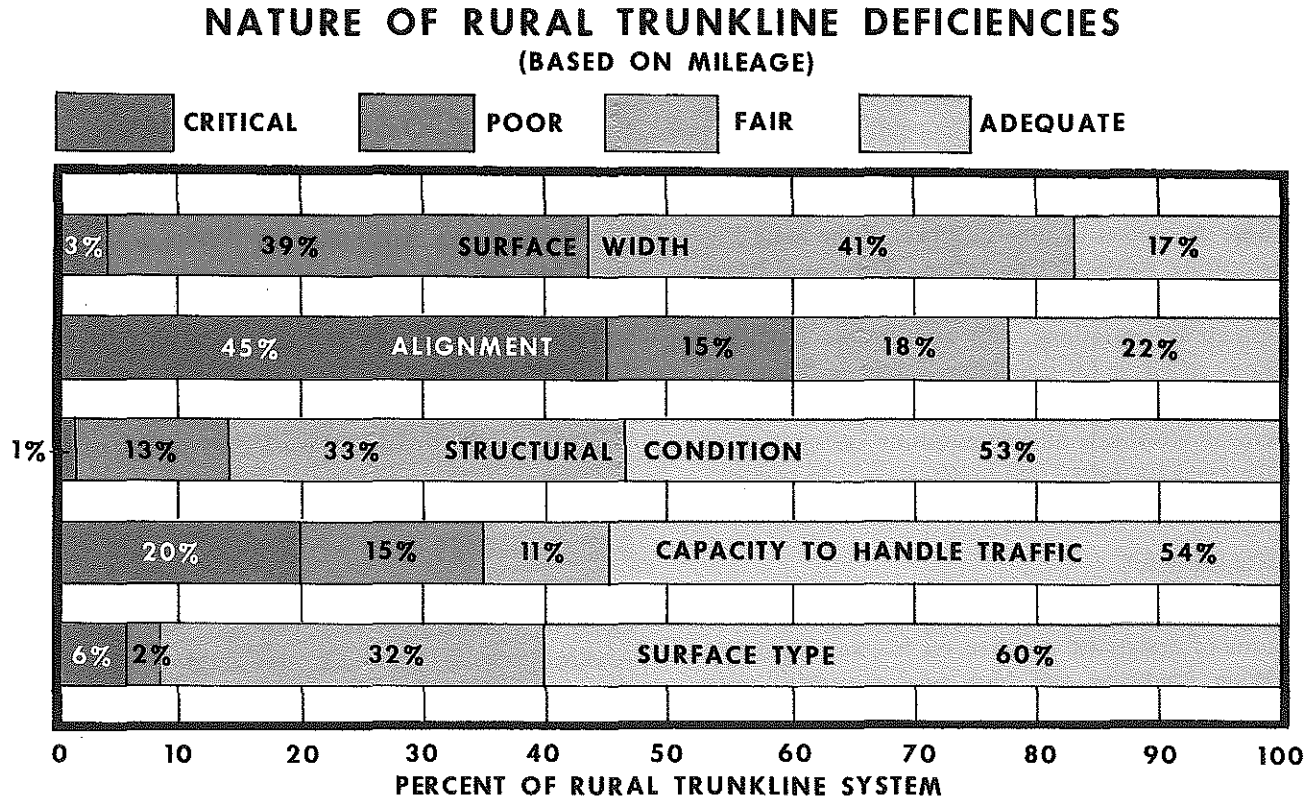
RURAL

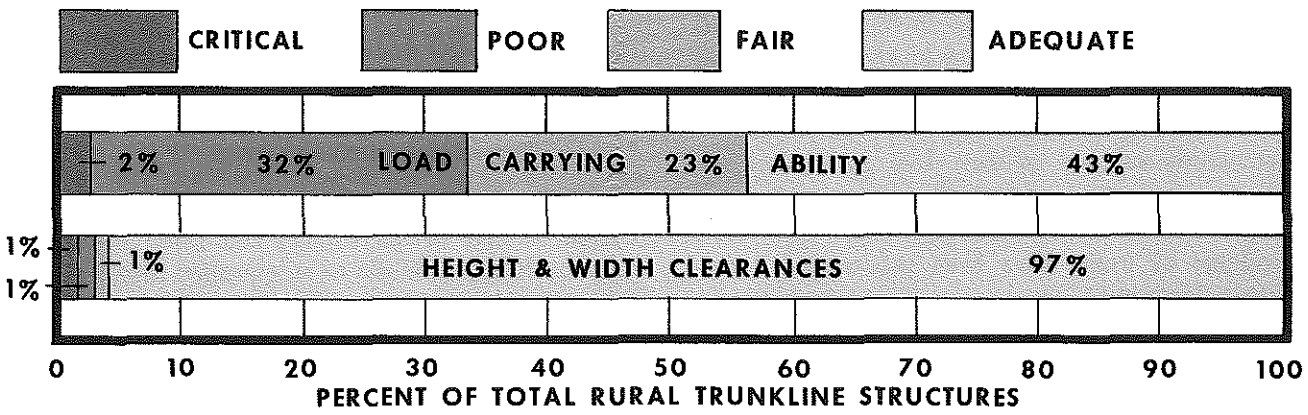
Road sections were rated critical or poor according to the following conditions:

- lane widths of less than 11 feet.
- 40 percent or more of the length restricted to 1,500-foot sight distance or less.
- remaining pavement life of less than 10 years.
- failure to meet traffic requirements by 1970.
- all gravel roads were rated as critical.

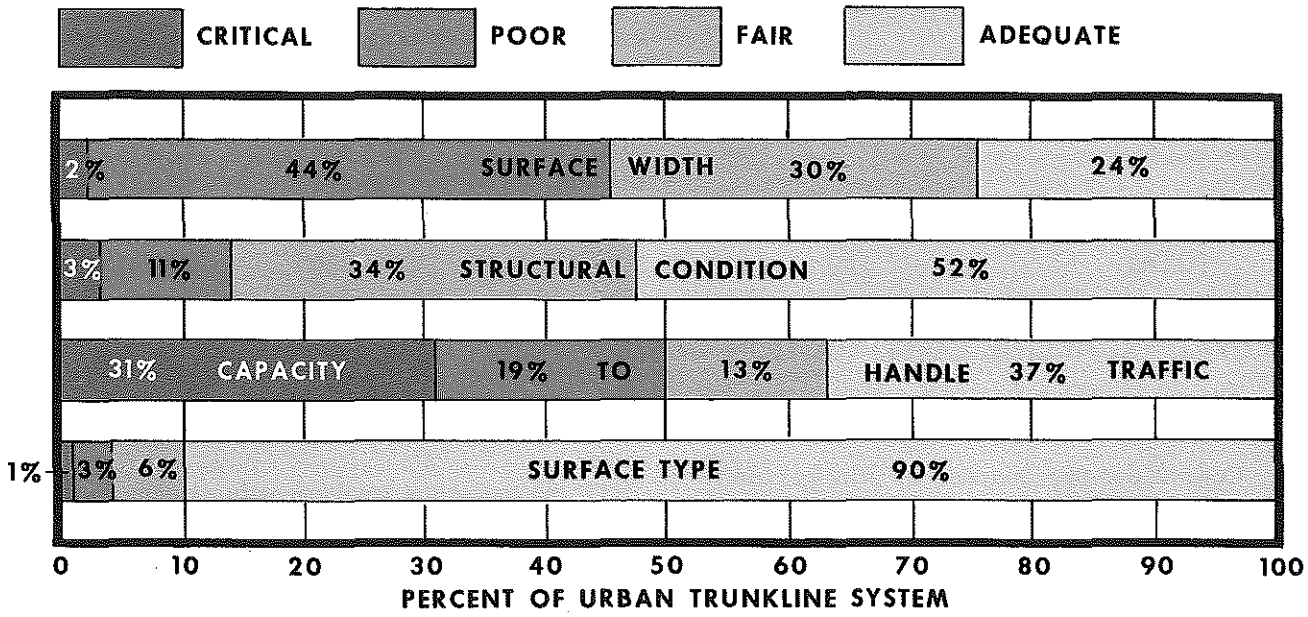
Many miles include more than one type of deficiency and the urgency of correction is thereby increased.

A total of 34 percent of the structures were rated critical or poor in load carrying ability and





NATURE OF URBAN TRUNKLINE DEFICIENCIES
(BASED ON MILEAGE)



structural condition while only 2 percent were rated critical or poor for clearances. In analyzing the existing condition of structures, many bridges which were classified as fair were programmed for improvement in later time periods.

There are 283 railroad crossings that are inadequate because of hazard of accident and call for improved protection ranging from signals to signals and gates. This figure does not include grade separations which are listed under structure deficiencies.

URBAN

The degree of adequacy of 1,120 miles as it was rated according to this study, is portrayed in the above chart.

To illustrate rating procedure for surface width: widths of lanes that were 9 feet or less were considered critical, 10 feet — poor, 11 feet — fair, 12 feet or more — adequate. As a result of this rating, 46 percent of the urban trunkline miles are rated critical or poor in surface width. Also the graph points out that 50 percent of the urban trunkline miles is rated as critical or poor in capacity to handle traffic.

It is evident that the critical factor of inadequacy is capacity to handle traffic. In some cities grid-type street development permitted solution to many congested problems by use of adjacent parallel streets as one-way pairs. This avoided expensive widening construction and damage to abutting property. Where it was not possible to match one-way pairs of streets, it was necessary to widen the existing streets to meet future traffic requirement. In some of the cities over 100,000 population, the development of freeways was the most economical and practical solution to meet future traffic requirements.

TRUNKLINE IMPROVEMENT COSTS

Total costs of construction needs, rural and urban, on the trunkline system by five-year intervals for the twenty-year period are shown later.

The breakdown by type of work of the $4.22 billion needed for approximately 12,500 miles of trunkline improvements follows on page 28.

The improvement costs in this table includes work to be done on trunklines prior to their turnback to city and county road systems.

20 YEAR CONSTRUCTION COSTS

In Thousands

	Rural	Urban	Total
Right of Way	$ 253,796	$ 476,290	$ 730,086
Grade and Drain	748,520	388,054	1,136,574
Base and Surface	928,517	245,309	1,173,826
Traffic and Lighting	145,006	36,434	181,440
Structures	506,801	495,753	1,002,554
TOTAL	$2,582,640	$1,641,840	$4,224,480

RURAL TRUNKLINE CONSTRUCTION COSTS

The $2.58 billion needed for construction on the rural trunklines are shown below.

Construction improvements on principal trunkline routes excluding Interstate involve 1,295 miles on new location and 894 miles of reconstruction on existing alignment, including resurfacing and widening.

Work on new locations includes 872 miles of freeways with full control of access on routes of the National System of Interstate Highways.

On other trunkline routes only 755 miles of construction on new location are needed. Surfacing and widening together with reconstruction on existing alignment will correct deficiencies on 4,204 miles.

Of the total rural trunkline improvement cost, $2.08 billion is for roadway and $507 million is for structures. Approximately 43 percent of the total rural structure cost is for highway and railroad separations and stream crossings on the Interstate System.

A breakdown of the construction costs revealed that 10 percent is needed for right of way, 65 percent for roadway, 20 percent for structures and 5 percent for lighting and signing.

	Miles	Percent	Cost	Percent
			In Thousands	
Principal Routes	2,189	27	$1,584,500	61
All Other Trunklines	5,831	73	998,140	39
Total Rural	8,020	100	$2,582,640	100

URBAN TRUNKLINE CONSTRUCTION COSTS

The cost estimate of $1.64 billion for trunkline construction within municipalities is shown below.

Improvement miles on urban trunkline routes, cover 218 miles of freeway construction, 45 miles of surface arterials on new location, and 53 miles of reconstruction of base and surface to correct structural deficiencies and overcome capacity deficiencies. Improvements needed on the remaining 648 miles of trunkline consist of resurfacing and widening on existing highways.

	Miles	Percent	Cost	Percent
			In Thousands	
Principal Routes	477	49	$ 958,560	58
All Other Trunklines	487	51	683,280	42
Total Urban	964	100	$1,641,840	100

MULTI-LANE REQUIREMENTS

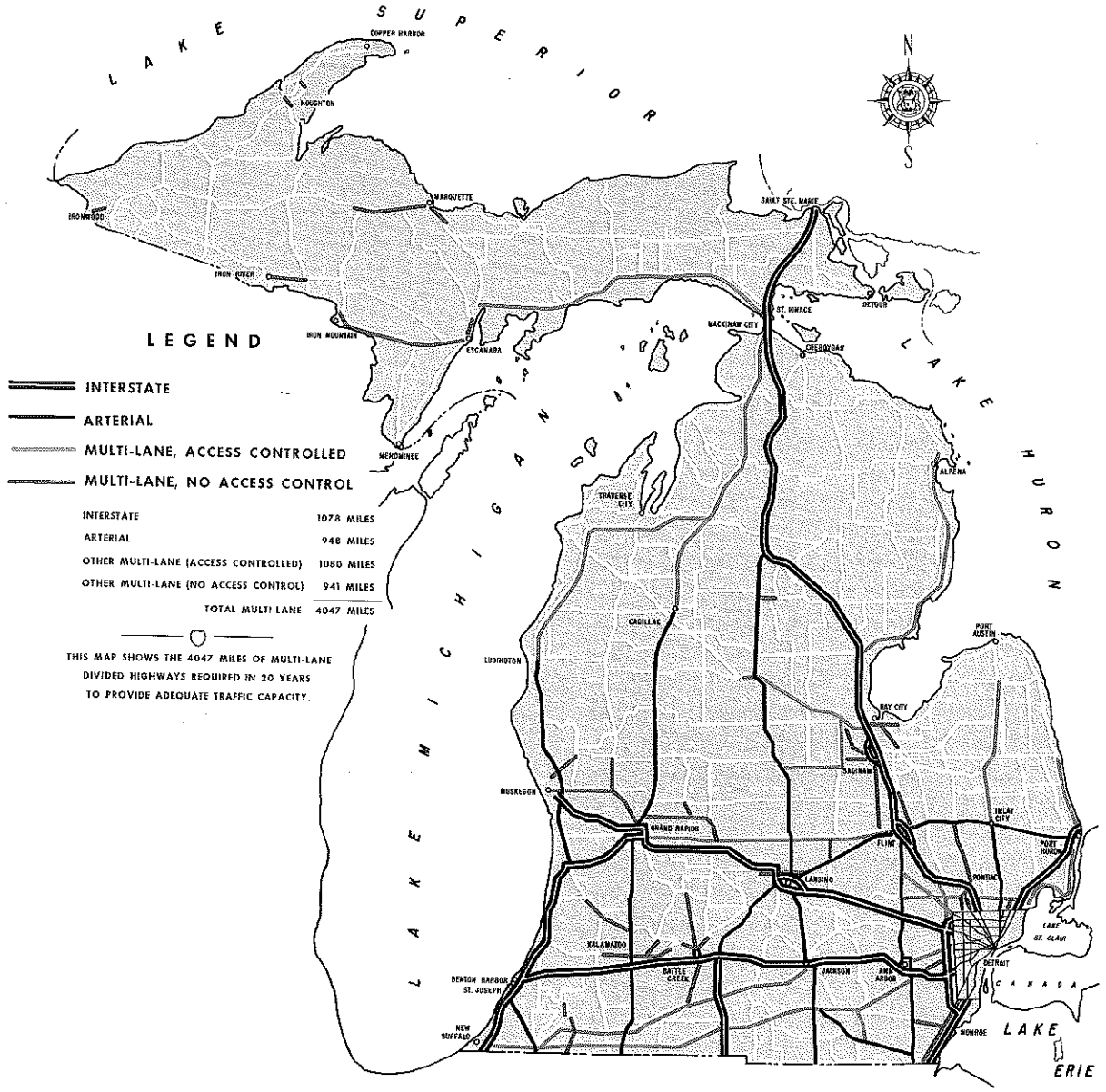
The next 20 years should see the development of 3,376 miles of rural divided multi-lane improvements of which 1,898 miles are needed now or within five years. Of this 3,376 miles, at least 2,516 should be full control access freeways with no intersections at grade, no traffic signals, and no direct access to abutting property.

The average cost per mile for freeway construction in urban areas approaches $15 million and $708,000 per mile in rural areas.

The average cost per mile for all other multi-lane highways in urban areas is $2.13 million and $544,000 per mile in rural areas.

Of the total rural facilities needed, 2,908 miles are divided four-lane, 433 miles divided six-lane, and 19 miles divided eight-lane.

MICHIGAN'S DIVIDED MULTI-LANE HIGHWAYS NEEDED BY 1980



AVERAGE ANNUAL STATE PROGRAM COSTS

INCLUDING MAINTENANCE AND ADMINISTRATION

In Thousands

	10 Year Program (Based on catching up in 10 years and meeting needs as they occur in the last 10 years.)		15 Year Program (Based on catching up in 15 years and meeting needs as they occur in the last 5 years.)		20 Year Program (Based on meeting needs within 20 years.)
	10 Year Period	2nd 10 Yr. Period	15 Year Period	Last 5 Yr. Period	20 Year Period
Construction					
Rural	$174,512	$ 83,752	$158,086	$ 42,270	$129,132
Urban	104,324	59,860	104,230	15,678	82,092
Total Construction	278,836	143,612	262,316	57,948	211,224
Maintenance	33,007	40,599	35,066	42,014	36,803
Administration	18,711	11,053	17,843	5,999	14,882
Total Annual Program Cost	$330,554	$195,264	$315,225	$105,961	$262,909

AVERAGE ANNUAL PROGRAMS

Each of the alternative programs shown in the table above represents a considerable increase in current state trunkline expenditures. That these needs are immediate is reflected in the following percentages: 63 percent is needed within 10 years, 90 percent is needed in 15 years.

It is estimated that required annual expenditures under the 20-year program would average $262,909,000 per year. However, the 20-year program contemplates that deficiencies would be corrected and needs would be met in a 20 year period. But there are many deficiencies which are critical and require early correction and it is obligatory that some important needs such as the Interstate routes be completed in a shorter time. Therefore, alternative programs are presented.

To overcome the backlog of present needs and provide for needs accruing in the next 10 years will require an average annual 10-year expenditure of $330,554,000. The remaining 10 years would require an average of $195,264,000 annual expenditure.

MAINTENANCE

Annual allowances for maintenance included in the three alternative programs are based upon cost experience in Michigan, an analysis of maintenance practices and standards and the character of improvements proposed in the 20-year study. These allowances include costs for roadside improvement, drainage, blading, patching, snow removal and dust control, and other traffic services.

Maintenance cost per mile figures by surface type that were used for the ten districts varied according to past records and future improvements. Also cost per mile for 2 lane high type ranged from $1,800 to $2,700 on rural highways and from $2,400 to $3,500 on urban portions depending on locality in the state.

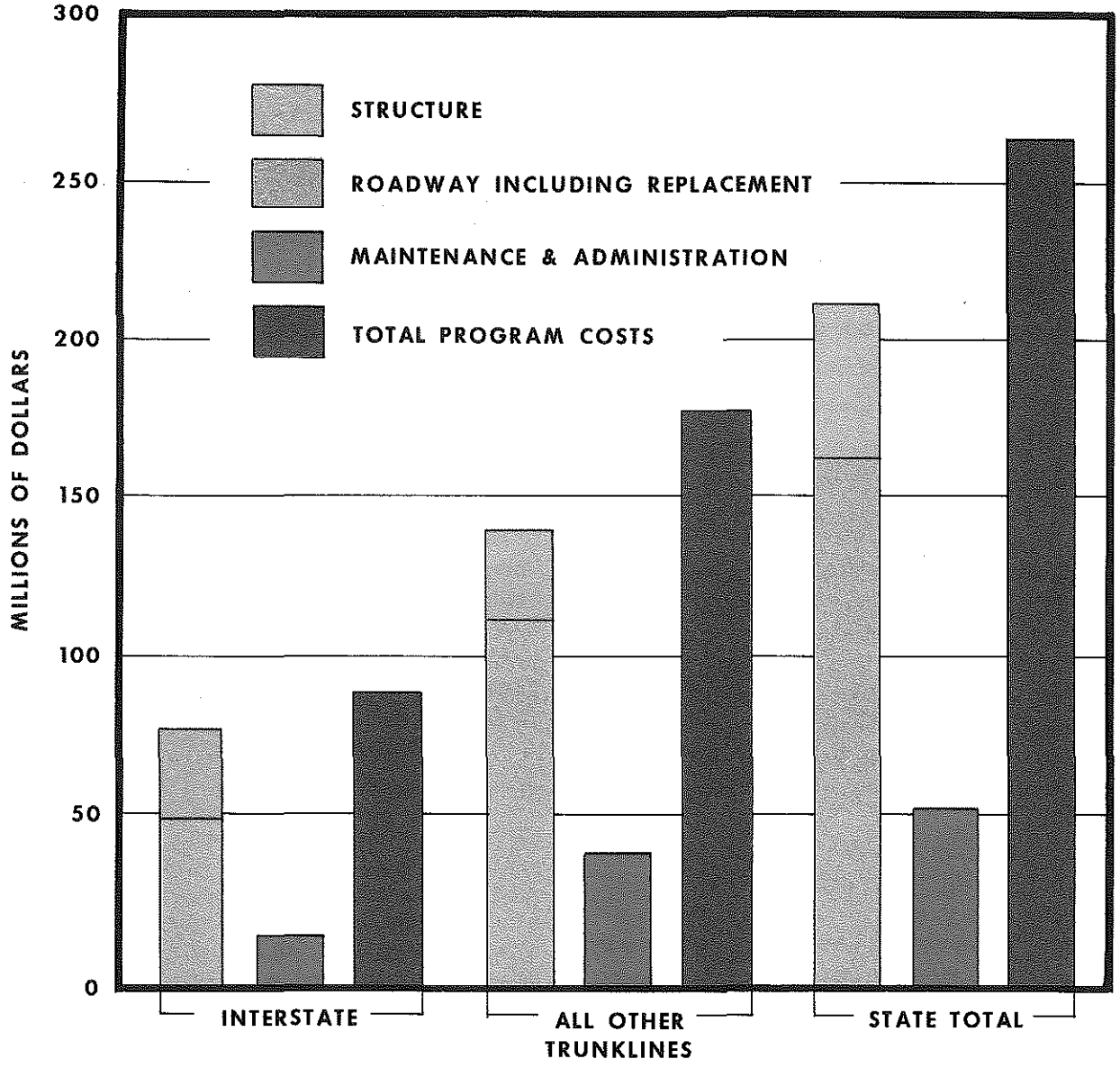
During the last four years, total maintenance expenditures exclusive of betterments by maintenance forces, have averaged $29 million annually. This is equivalent to about $3,100 per mile annually.

The increase in mileage of higher type surfaces, the wider right of way, roadway and surface

resulting from construction of needed 20-year improvements will cause a further increase in average per mile maintenance expenditure in the future. This is particularly true for the needed mileage of divided four-lane highways where maintenance costs will be approximately double those for high type two-lane surfaces.

It is estimated the effect of all of those factors will result in a total average annual maintenance cost of $37 million over the 20-year period. This is approximately $3,900 per mile, which is about 25 percent greater than that estimated now for full maintenance expenditures on existing state highways.

STATE TRUNKLINES
AVERAGE ANNUAL 20 YEAR PROGRAM COSTS



ADMINISTRATION

In this study, costs for construction, engineering and contingencies were included with the individual construction projects. Administration and engineering costs were included, however, to provide for overhead expense for general management, personnel, research, traffic and planning, and allied activities. The estimated amount used averaged six percent of the total estimated cost of construction and maintenance in each program period.

PRIORITY PROGRAM

Some of the factors to be considered in establishing a priority program are:

- amount of money available
- commitments, agreements, and completions
- consistent development of entire routes
- importance to economy and urban development
- traffic volumes benefited
- cost of improvements related to benefits
- distribution of work throughout the state
- planning, design, and right-of-way problems
- relative inadequacy of each road section

The current reappraisal affords a better foundation of data in developing work programs by providing more realistic estimates of costs, general standards needed for long term route development by indicating a better coordinated plan of transportation with municipal and county road systems and establishing better and more up-to-date measures of relative adequacy of individual road sections.

In addition to scientific elements of project priorities already listed, priority has been established by law. Part (f) of Section 10a of Act 51 as amended and supplemented by Acts 153 and 262 of 1957, provides that of the total amount actually expended by the highway department for the purposes specified in this subsection from the state trunk line highways, not less than 35 percent thereof shall be expended on the interstate highway system and on the following state trunk line highways:

- US-27 — from Indiana border to junction with M-76
- US-127 from Ohio border to Lansing
- US-23 from Ohio border to Flint
- US-223 from Ohio border to US-127
- US-131 from Indiana border to Cadillac
- US-31 from Indiana border to St. Joseph
- US-31 from Holland to Ludington
- M-53 from Detroit to Imlay City
- M-21 from Flint to Port Huron
- M-78 from Flint to Lansing

Subsequent to this Act, the portion of US-27 from the Indiana border to I-94 has been approved by the Bureau of Public Roads as part of the Interstate System.

For the purposes of this study the listed portions of these routes have been termed as "Arterials" and are shown on the map picturing multi-lane highways. There are 2,026 miles of Arterial Highways on the State System, of which, 1,078 miles are on the Interstate System.

Portions of these arterial routes have already been constructed according to interstate standards. Other portions of these routes have been programmed for freeway design.

The *1960 Highway Needs Study* reports the additional miles and cost to construct freeways needed by 1980.

As these systems were considered of more than usual importance in Michigan, most of the total 2,026 miles was included in the needs in the first 15 years.

SUFFICIENCY RATINGS

One of the best tools available in measuring adequacy of road sections is a Sufficiency Rating System. The theory of sufficiency ratings is extremely simple. A completely adequate section of highway rates 100. All road sections that have deficiencies of any kind in their structural condition, effectiveness in serving traffic or their safety are marked down from 100 according to specified formulae and procedures.

When the entire trunkline system has been rated, it is immediately evident which road sections should be given first priority for improvement. There is an indication, also, through the magnitude of the rating, of the degree of inadequacy on the specific road sections.

The *Sufficiency Rating Report* is published annually. This report graphically portrays the routes, the federal-aid systems, the control sections, the critical deficiencies and the total sufficiency rating. Interested groups and individuals, even though they have no familiarity with engineering, find that sufficiency ratings provide a readily understandable evaluation of the highway system.

Sufficiency ratings provide management with a number of effective administrative tools to implement sound engineering decisions, justify logical programs and expedite long-range planning.

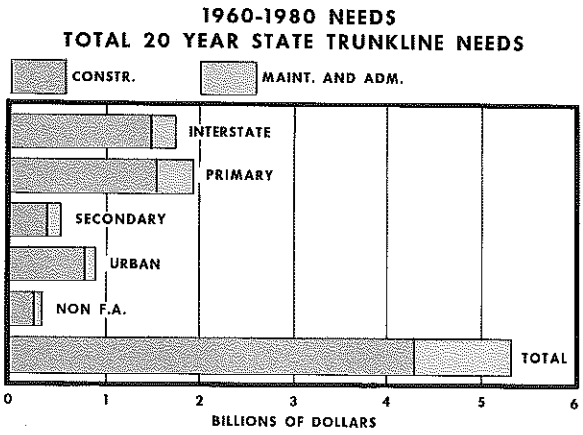
CONCLUSION

The Highway Department is continually studying and applying the best techniques possible in the planning and programming of future highways.

The data accumulated in this trunkline study provides basic sources of planning information. They will be kept reasonably up to date, and improved for better future planning of all facilities. Such facts are essential for an engineering analysis leading to conclusions that will produce facilities providing maximum services at least cost possible.

The projects that have been contemplated as needed will have significant effects on the economic and social well-being of all areas in the state. Therefore it is important that all relevant factors be included in the planning and design of these facilities.

Alternative program estimates showing yearly costs average over several periods of time provide a basis for making fiscal plans that will determine the rate of progress toward providing and maintaining adequate facilities in keeping with traffic needs. Regardless of which plan is used the total costs for the next 20 years on the trunkline system is $5,258,180,000.



Because the proposed state Trunkline System is the backbone of the state transportation system in both rural and urban areas, and will handle approximately 56 percent of the travel in the next 20 years, it requires very close attention from a statewide point of view.

State Tables

Table S-1

TOTAL CONSTRUCTION COSTS FOR INTERSTATE SYSTEM:

ITEMIZED BY ACCUMULATED TIME PERIODS

In Thousands

	Rural	Urban	Total
0-5 Year Period			
Right of Way	$ 51,310	$ 139,017	$ 190,327
Roadway	218,789	132,248	351,037
Structures	157,073	159,358	316,431
Lighting	21,643	12,002	33,645
Total	$ 448,815	$ 442,625	$ 891,440
0-10 Year Period			
Right of Way	69,369	240,471	309,840
Roadway	282,954	205,781	488,735
Structures	187,536	234,965	422,501
Lighting	36,127	19,711	55,838
Total	$ 575,986	$ 700,928	$1,276,914
0-15 Year Period			
Right of Way	73,984	268,841	342,825
Roadway	316,128	258,208	574,336
Structures	218,893	269,245	488,138
Lighting	38,695	24,602	63,297
Total	$ 647,700	$ 820,896	$1,468,596
0-20 Year Period			
Right of Way	73,984	268,841	342,825
Roadway	329,308	260,532	589,840
Structures	218,893	269,245	488,138
Lighting	38,695	24,602	63,297
Total	$ 660,880	$ 823,220	$1,484,100

Table S-2

TOTAL CONSTRUCTION COSTS FOR ALL OTHER TRUNKLINES

ITEMIZED BY ACCUMULATED TIME PERIODS

In Thousands

	Rural	Urban	Total
0-5 Year Period			
Right of Way	$ 78,077	$ 20,716	$ 98,793
Roadway	550,954	92,748	643,702
Structures	121,145	55,159	176,304
Lighting	20,207	2,958	23,165
Total	$ 770,383	$ 171,581	$ 941,964
0-10 Year Period			
Right of Way	114,745	79,661	194,406
Roadway	818,874	163,797	982,671
Structures	191,959	92,947	284,906
Lighting	43,575	5,916	49,491
Total	$1,169,153	$ 342,321	$1,511,474
0-15 Year Period			
Right of Way	167,250	187,301	354,551
Roadway	1,213,270	334,335	1,547,605
Structures	271,127	212,049	483,176
Lighting	71,942	8,874	80,816
Total	$1,723,589	$ 742,559	$2,466,148
0-20 Year Period			
Right of Way	179,812	207,449	387,261
Roadway	1,347,729	372,831	1,720,560
Structures	287,908	226,508	514,416
Lighting	106,311	11,832	118,143
Total	$1,921,760	$ 818,620	$2,740,380

Table S-3

TOTAL CONSTRUCTION COSTS FOR STATE TRUNKLINES:

ITEMIZED BY ACCUMULATED TIME PERIODS

In Thousands

	Rural	Urban	Total
0-5 Year Period			
Right of Way	$ 129,387	$ 159,733	$ 289,120
Roadway	769,743	224,996	994,739
Structures	278,218	214,517	492,735
Lighting	41,850	14,960	56,810
Total	$1,219,198	$ 614,206	$1,833,404
0-10 Year Period			
Right of Way	184,114	320,132	504,246
Roadway	1,101,828	369,578	1,471,406
Structures	379,495	327,912	707,407
Lighting	79,702	25,627	105,329
Total	$1,745,139	$1,043,249	$2,788,388
0-15 Year Period			
Right of Way	241,234	456,142	697,376
Roadway	1,529,398	592,543	2,121,941
Structures	490,020	481,294	971,314
Lighting	110,637	33,476	144,113
Total	$2,371,289	$1,563,455	$3,934,744
0-20 Year Period			
Right of Way	253,796	476,290	730,086
Roadway	1,677,037	633,363	2,310,400
Structures	506,801	495,753	1,002,554
Lighting	145,006	36,434	181,440
Total	$2,582,640	$1,641,840	$4,224,480

Table S-4

STATE TRUNKLINES — 20 YEAR TOTAL COSTS BY DISTRICTS

In Thousands

	1	2	3	4
INTERSTATE				
Construction:				
Rural	.....	$32,248	.....	$56,212
Urban (30,000 and over)	.....	.....	.....	.....
(5,000-30,000)	.....	10,530	.....	.....
(0- 5,000)	.....	.....	.....	52
Total Urban	.....	10,530	.....	52
Total Construction	.....	42,778	.....	56,264
Maintenance and Administration	.....	10,416	.....	17,410
TOTAL INTERSTATE	.....	53,194	.....	73,674
PRIMARY SYSTEM				
Construction:				
Rural	$104,839	91,375	$158,222	98,984
Urban (30,000 and over)	.....	.....	.....	.....
(5,000-30,000)	11,286	3,538	3,155	3,579
(0- 5,000)	23,414	1,567	4,288	1,957
Total Urban	34,700	5,105	7,443	5,536
Total Construction	139,539	96,480	165,665	104,520
Maintenance and Administration	42,240	27,820	53,020	34,200
TOTAL PRIMARY	181,779	124,300	218,685	138,720
SECONDARY SYSTEM				
Construction:				
Rural	31,749	29,215	29,773	34,037
Urban (30,000 and over)	.....	.....	.....	.....
(5,000-30,000)	37	498	260	.....
(0- 5,000)	1,679	914	7,678	3,969
Total Urban	1,716	1,412	7,938	3,969
Total Construction	33,465	30,627	37,711	38,006
Maintenance and Administration	11,960	15,020	22,420	18,700
TOTAL SECONDARY	45,425	45,647	60,131	56,706
NON FEDERAL AID				
Construction:				
Rural	8,475	17,233	12,465	13,123
Urban (30,000 and over)	.....	.....	.....	.....
(5,000-30,000)	161	230	158	425
(0- 5,000)	251	405	836	438
Total Urban	412	635	994	863
Total Construction	8,887	17,868	13,459	13,986
Maintenance and Administration	497	1,004	766	781
TOTAL NON FEDERAL AID	9,384	18,872	14,225	14,767
GRAND TOTAL	$236,588	$242,013	$293,041	$283,867

Table S-4

STATE TRUNKLINES — 20 YEAR TOTAL COSTS BY DISTRICTS

In Thousands

5	6	7	8	9	10	Total
$70,113	$89,580	$122,828	$83,456	$127,594	$ 78,849	$660,880
53,484	51,248	3,354	20,544	79,393	460,385	668,408
.....	.....	.....	.....	103,992	25,763	140,285
.....	.....	.....	.....	13,813	662	14,527
53,484	51,248	3,354	20,544	197,198	486,810	823,220
123,597	140,828	126,182	104,000	324,792	565,659	1,484,100
27,482	22,261	38,205	22,453	55,141	90,212	283,580
151,079	163,089	164,387	126,453	379,933	655,871	1,767,680
263,294	206,008	193,152	226,765	103,011	81,020	1,526,670
36,560	28,869	9,299	11,395	39,543	431,137	556,803
7,943	10,897	13,175	10,231	35,950	11,468	111,222
5,269	6,895	3,361	4,534	3,183	597	55,065
49,772	46,661	25,835	26,160	78,676	443,202	723,090
313,066	252,669	218,987	252,925	181,687	524,222	2,249,760
106,940	75,500	59,900	61,060	47,640	83,040	591,360
420,006	328,169	278,887	313,985	229,327	607,262	2,841,120
21,832	29,382	31,709	16,357	26,856	.....	250,910
1,036	104	173	4,645	.....	.....	5,958
1,435	1,527	2,470	256	2,675	.....	9,158
2,488	7,259	4,803	2,419	2,886	129	34,224
4,959	8,890	7,446	7,320	5,561	129	49,340
26,791	38,272	39,155	23,677	32,417	129	300,250
17,280	20,020	20,100	10,500	10,600	1,540	148,140
44,071	58,292	59,255	34,177	43,017	1,669	448,390
18,816	25,250	19,711	16,783	8,146	4,178	144,180
719	1,660	594	1,413	823	22,282	27,491
440	790	1,508	393	198	1,152	5,455
2,990	2,292	1,838	2,833	1,264	97	13,244
4,149	4,742	3,940	4,639	2,285	23,531	46,190
22,965	29,992	23,651	21,422	10,431	27,709	190,370
1,284	1,678	1,322	1,198	583	1,507	10,620
24,249	31,670	24,973	22,620	11,014	29,216	200,990
$639,405	$581,220	$527,502	$497,235	$663,291	$1,294,018	$5,258,180

Table S-5

TOTAL STATE TRUNKLINE NEEDS

In Thousands

	Construction	Maintenance	Administration	Total
Interstate — Rural	$ 660,880	$103,980	$ 45,880	$ 810,740
— Urban	823,220	79,540	54,180	956,940
Other — Rural	1,921,760	422,780	140,680	2,485,220
— Urban	818,620	129,760	56,900	1,005,280
Total	$4,244,480	$736,060	$297,640	$5,258,180

Table S-6

TOTAL STATE TRUNKLINE NEEDS

BY 5 YEAR TIME PERIODS

In Thousands

	0–5	6–10	11–15	16–20
CONSTRUCTION				
Rural	$1,219,190	$ 525,930	$ 626,170	$211,350
Urban	614,200	429,040	520,210	78,390
TOTAL CONSTRUCTION	1,833,390	954,970	1,146,380	289,740
MAINTENANCE	154,190	175,880	195,920	210,070
ADMINISTRATION	119,260	67,850	80,535	29,995
TOTAL COST	$2,106,840	$1,198,700	$1,422,835	$529,805

Table S-7

STATE TRUNKLINE CONSTRUCTION COSTS

BY TYPE OF WORK

In Thousands

Item	Rural	Urban	Total
Right of Way	$ 253,796	$ 476,290	$ 730,086
Grade and Drain	748,520	388,054	1,136,574
Base and Surface	928,517	245,309	1,173,826
Traffic and Lighting	145,006	36,434	181,440
Structures	506,801	495,753	1,002,554
TOTAL	$2,582,640	$1,641,840	$4,224,480

Table S-8

INTERSTATE CONSTRUCTION COSTS

BY TYPE OF WORK

In Thousands

Item	Rural	Urban	Total
Right of Way	$ 73,984	$ 268,841	$ 342,825
Grade and Drain	169,325	204,907	374,232
Base and Surface	159,983	55,625	215,608
Traffic and Lighting	38,695	24,602	63,297
Structures	218,893	269,245	488,138
TOTAL	$ 660,880	$ 823,220	$1,484,100

Table S-9

STATE TRUNKLINE CONSTRUCTION COSTS EXCLUDING INTERSTATE

BY TYPE OF WORK

In Thousands

Item	Rural	Urban	Total
Right of Way	$ 179,812	$ 207,449	$ 387,261
Grade and Drain	579,195	183,147	762,342
Base and Surface	768,534	189,684	958,218
Traffic and Lighting	106,311	11,832	118,143
Structures	287,908	226,508	514,416
TOTAL	$1,921,760	$ 818,620	$2,740,380

DISTRICT OUTLINE MAP

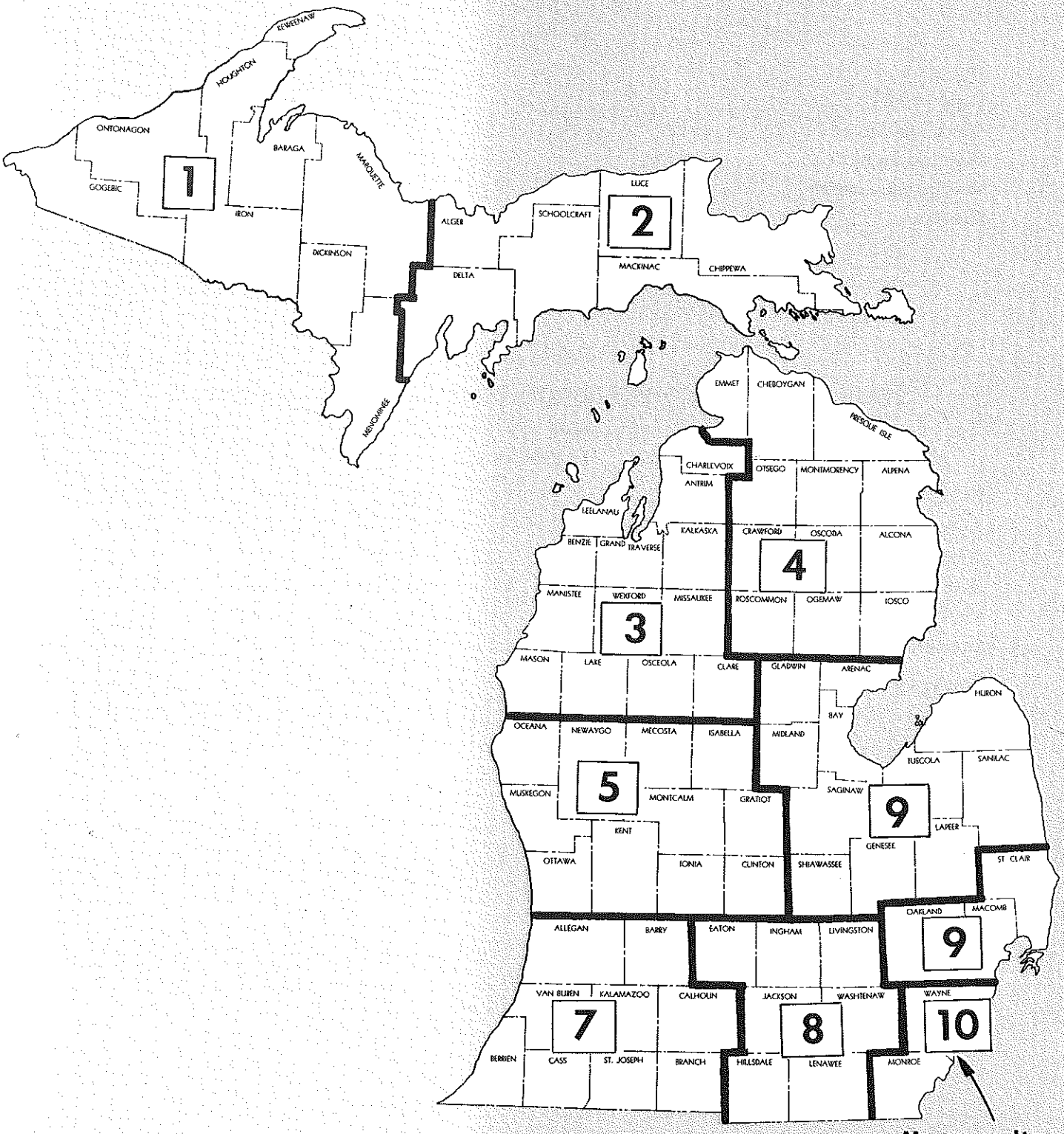


Table S-10

URBAN TRUNKLINE CONSTRUCTION COSTS: TOTAL

BY POPULATION GROUP AND HIGHWAY DEPARTMENT DISTRICTS

In Thousands

Population Group	DISTRICT 1	2	3	4	5	6	7	8	9	10	Total
50,000 & Over	–	–	–	–	$ 73,625	$ 81,881	$ 4,434	$37,993	$ 63,107	$896,604	$1,157,644
40,000–49,999	–	–	–	–	18,174	–	8,986	–	53,358	5,844	86,362
30,000–39,999	–	–	–	–	–	–	–	–	3,294	11,354	14,648
10,000–29,999	$ 5,207	$13,378	$ 2,159	$ 815	5,745	12,306	10,730	6,556	120,849	35,915	213,660
5,000– 9,999	6,277	1,418	1,414	3,189	4,073	908	6,423	4,324	21,966	2,597	52,589
1,000– 4,999	23,421	2,472	4,386	4,108	7,242	9,907	7,071	7,646	19,810	1,289	87,352
1– 999	1,923	414	8,422	2,308	3,505	6,539	2,931	2,140	1,336	67	29,585
TOTAL	$36,828	$17,682	$16,381	$10,420	$112,364	$111,541	$40,575	$58,659	$283,720	$953,670	$1,641,840

Table S-11

URBAN TRUNKLINE CONSTRUCTION COSTS: INTERSTATE

BY POPULATION GROUP AND HIGHWAY DEPARTMENT DISTRICTS

In Thousands

Population Group	DISTRICT 1	2	3	4	5	6	7	8	9	10	Total
50,000 & Over	–	–	–	–	$51,599	$51,248	$1,095	$20,544	$ 26,742	$449,130	$600,358
40,000–49,999	–	–	–	–	1,885	–	2,259	–	52,256	5,374	61,774
30,000–39,999	–	–	–	–	–	–	–	–	395	5,881	6,276
10,000–29,999	–	$10,530	–	–	–	–	–	–	82,090	24,621	117,241
5,000– 9,999	–	–	–	–	–	–	–	–	21,902	1,142	23,044
1,000– 4,999	–	–	–	–	–	–	–	–	13,813	662	14,475
1– 999	–	–	–	$52	–	–	–	–	–	–	52
TOTAL	–	$10,530	–	$52	$53,484	$51,248	$3,354	$20,544	$197,198	$486,810	$823,220

Table S-12

URBAN TRUNKLINE CONSTRUCTION COSTS: EXCLUDING INTERSTATE

BY POPULATION GROUP AND HIGHWAY DEPARTMENT DISTRICTS

In Thousands

Population Group	DISTRICT 1	2	3	4	5	6	7	8	9	10	Total
50,000 & Over	–	–	–	–	$22,026	$30,633	$ 3,339	$17,449	$36,365	$447,474	$557,286
40,000–49,999	–	–	–	–	16,289	–	6,727	–	1,102	470	24,588
30,000–39,999	–	–	–	–	–	–	–	–	2,899	5,473	8,372
10,000–29,999	$ 5,207	$2,848	$ 2,159	$ 815	5,745	12,306	10,730	6,556	38,759	11,294	96,419
5,000– 9,999	6,277	1,418	1,414	3,189	4,073	908	6,423	4,324	64	1,455	29,545
1,000– 4,999	23,421	2,472	4,386	4,108	7,242	9,907	7,071	7,646	5,997	627	72,877
1– 999	1,923	414	8,422	2,256	3,505	6,539	2,931	2,140	1,336	67	29,533
TOTAL	$36,828	$7,152	$16,381	$10,368	$58,880	$60,293	$37,221	$38,115	$86,522	$466,860	$818,620

Table S-13

AVERAGE ANNUAL STATE TRUNKLINE PROGRAM COSTS: TOTAL

In Thousands

	AVERAGE ANNUAL PROGRAM COSTS				
	10-Year Program (Based on catching up in 10 yrs. and meeting needs as they occur in last 10 yrs.)		15-Year Program (Based on catching up in 15 yrs. and meeting needs as they occur in last 5 yrs.)		20-Year Program (Based on catching up the needs within 20 yrs.)
	10 Year Period	2nd 10 Yr. Period	15 Year Period	Last 5 Yr. Period	20 Year Period
CONSTRUCTION					
Rural					
Principal Routes	$119,358	$39,094	$101,481	$ 12,461	$ 79,266
All Other Trunklines	55,154	44,658	56,605	29,809	49,906
Total Rural	174,512	83,752	158,086	42,270	129,132
Urban					
Principal Routes	80,914	14,942	63,371	1,599	47,928
All Other Trunklines	23,410	44,918	40,859	14,079	34,164
Total Urban	104,324	59,860	104,230	15,678	82,092
TOTAL CONSTRUCTION	278,836	143,612	262,316	57,948	211,224
MAINTENANCE & ADMINISTRATION	51,718	51,652	52,909	48,013	51,685
TOTAL ANNUAL PROGRAM	$330,554	$195,264	$315,225	$105,961	$262,909

Table S-14

AVERAGE ANNUAL STATE TRUNKLINE PROGRAM COSTS: INTERSTATE

In Thousands

	AVERAGE ANNUAL PROGRAM COSTS				
	10-Year Program (Based on catching up in 10 yrs. and meeting needs as they occur in last 10 yrs.)		15-Year Program (Based on catching up in 15 yrs. and meeting needs as they occur in last 5 yrs.)		20-Year Program (Based on catching up the needs within 20 yrs.)
	10 Year Period	2nd 10 Yr. Period	15 Year Period	Last 5 Yr. Period	20 Year Period
CONSTRUCTION					
RURAL	$ 57,598	$ 8,490	$ 43,180	$ 2,636	$33,044
URBAN	70,092	12,230	54,726	466	41,161
TOTAL	127,690	20,720	97,906	3,102	74,205
MAINTENANCE & ADMINISTRATION	16,136	12,222	15,124	11,344	14,179
TOTAL ANNUAL PROGRAM COSTS	$143,826	$32,942	$113,030	$14,446	$88,384

Table S-15

AVERAGE ANNUAL STATE TRUNKLINE PROGRAM COSTS: EXCLUDING INTERSTATE

In Thousands

	AVERAGE ANNUAL PROGRAM COSTS				
	10-Year Program (Based on catching up in 10 yrs. and meeting needs as they occur in last 10 yrs.)		15-Year Program (Based on catching up in 15 yrs. and meeting needs as they occur in last 5 yrs.)		20-Year Program (Based on catching up the needs within 20 yrs.)
	10 Year Period	2nd 10 Yr. Period	15 Year Period	Last 5 Yr. Period	20 Year Period
CONSTRUCTION					
Rural					
Principal Routes	$ 61,760	$ 30,604	$ 58,301	$ 9,825	$ 46,182
All Other Trunklines	55,154	44,658	56,605	29,809	49,906
Total Rural	116,914	75,262	114,906	39,634	96,088
Urban					
Principal Routes	10,822	2,712	8,645	1,133	6,767
All Other Trunklines	23,410	44,918	40,859	14,079	34,164
Total Urban	34,232	47,630	49,504	15,212	40,931
TOTAL CONSTRUCTION	151,146	122,892	164,410	54,846	137,019
MAINTENANCE & ADMINISTRATION	35,582	39,430	37,785	36,669	37,506
TOTAL ANNUAL PROGRAM COSTS	$186,728	$162,322	$202,195	$91,515	$174,525

Table S-16

ESTIMATED CONSTRUCTION COSTS USED FOR STATE TRUNKLINE IMPROVEMENTS

URBAN AREAS

Item of Work	Unit	Unit Cost Range
Light Grading (2′ to 4′)	Sq. Yd.	$ 1.25 to $ 1.75
Earth Excavation	Cu. Yd.	0.75 to 1.50
Drainage —		
12″ to 48″ Class A Culvert	Lin. Ft.	3.00 to 15.00
12″ to 48″ Class B Culvert	Lin. Ft.	4.00 to 20.00
12″ to 48″ Sewer	Lin. Ft.	3.50 to 17.00
6″ Sewer	Lin. Ft.	1.00 to 1.20
Manholes	Each	$35/ft. of depth
Catch Basins	Each	$30/ft. of depth
Inlets	Each	$30/ft. of depth
Aggregate Base Course (6″ to 8″)	Sq. Yd.	0.45 to 0.65
Sub-base Material (12″ to 28″)	Sq. Yd.	0.85 to 2.25
Bituminous Aggregate Surface (1″ to 2½″)	Sq. Yd.	0.50 to 1.70
Bituminous Concrete Surface (1″ to 2½″)	Sq. Yd.	1.35 to 1.80
Bituminous Concrete Surface (2½″ to 4″)	Sq. Yd.	1.80 to 3.50
Concrete Pavement —		
7″ Uniform (no reinforcement)	Sq. Yd.	3.50 to 4.25
Reinforcement	Sq. Yd.	0.65 to 0.75
8″ Uniform (including reinforcement)	Sq. Yd.	5.00 to 5.50
9″ Uniform (including reinforcement)	Sq. Yd.	5.25 to 5.75
10″ Uniform (including reinforcement)	Sq. Yd.	5.50 to 6.00
Curb and Gutter	Lin. Ft.	2.50 to 3.50
Sidewalk (4″ to 7″)	Sq. Ft.	0.50 to 0.75
Structures —		
New Construction	Sq. Ft.	20.00 to 35.00
Widening	Sq. Ft.	30.00 to 40.00
R.R. Flashing Light Signal (single track)		10,000.00
R.R. Flashing Light Signal and short arm gates		25,000.00

Right of Way —

If costs are not available when right-of-way acquisition is necessary, estimate right-of-way as 20% to 25% of construction costs.

Engineering and Contingencies —

To the estimated construction costs add 5% for preliminary engineering and 10% for construction engineering and contingencies.

Estimates—

It is suggested that the above cost ranges be used for estimating unless other costs are justifiable. If higher costs are used, a report to that effect should be submitted showing costs and reasons for change.

Table S-17

ESTIMATED CONSTRUCTION COSTS USED FOR STATE TRUNKLINE IMPROVEMENTS

RURAL AREAS

Item of Work	Average Cost Per Mile
G & DS & 22′ Concrete Pavement, 8″ Uniform	$115,000.00
G & DS & 22′ Concrete Pavement, 9″ Uniform	120,000.00
G & DS & 24′ Concrete Pavement, 9″ Uniform	131,000.00
G & DS & Dual 22′ Concrete Pavement, 9″ Uniform	320,000.00
G & DS & Dual 24′ Concrete Pavement, 9″ Uniform	345,000.00
Widen Existing 20′ Concrete Pavement to 24′ with Concrete Base Course & Resurface with 250# of Bituminous Concrete	43,400.00
Widen Existing 20′ Concrete Pavement to 22′ with Concrete Base Course & Resurface with 250# of Bituminous Concrete	35,000.00
Widen Existing 20′ Aggregate Surface to 22′ with Aggregate Base Course & Resurface with 250# of Bituminous Concrete	24,800.00

The above costs are average costs for recent construction, and as such should be adjusted to reflect soil type, terrain type, labor rates, availability of materials, and other special conditions existing within the area where work is necessary to correct deficiencies.

Unit prices for earth excavation, subbase material, and drainage structures will be estimated by geographic area to reflect terrain type, overhaul, and soil conditions.

Structures —

New Construction — Cost per Sq. Ft.	$20.00 to 35.00
Widening — Cost per Sq. Ft.	30.00 to 40.00
R.R. Flashing Light Signal (single track)	10,000.00
R.R. Flashing Light Signal and short arm gates	25,000.00

Right of Way —

If costs are not available when right-of-way acquisition is necessary, estimate right-of-way as 10% to 15% of construction costs.

Engineering and Contingencies —

To the estimated construction costs add 5% for preliminary engineering and 10% for construction engineering and contingencies.

Table S-18

DESIGN STANDARDS FOR RURAL STATE TRUNKLINES

			PRINCIPAL SYSTEM		ALL OTHER STATE TRUNKLINES							
			2 Lane	Multi-Lane Divided	2 Lane							Multi-Lane Divided
1980 Average Daily Traffic (A.D.T.)					Under 1000		1000-2000		2000-3000		3000-5000[1]	
Terrain			All	All	Flat	Rolling	Flat	Rolling	Flat	Rolling	All	All
Design Speed, M.P.H.			70	70	60	50	70	60	70	60	70	70
Operating Speed, M.P.H.			50-55	50-55	45-50	40-45	45-50	45-50	45-50	45-50	45-50	45-50
Maximum DHV Equivalent Pass. Vehicles	Percent 1500′ Sight Distance Available Per Mile	100%	600 Total	1000 Per Lane with Access Control	Not Applicable		Not Applicable		900 Total		900 Total	1200 Per Lane with Access Control
		80%	580 Total						860 Total		860 Total	750 Per Lane without Access Control
		60%	530 Total						800 Total		800 Total	
Curvature Maximum Degree			3	3	4	6	3	4	3	4	3	3
Gradient Maximum-Percent			3	3	4	6	3	4	3	4	3	3
Stopping Sight Distance-Feet			700	700	475	350	600	475	700	600	700	700
Passing Sight Distance-Feet			2300	Not Applicable	2000	1700	2300	2000	2300	2000	2300	Not Applicable
Surface Type			High (F)	High (F)	Intermediate (E)		Intermediate (E)		High (F)		High (F)	High (F)
Lane Width-Feet			12	12	11		12		12		12	12
Shoulder Width-Feet			2@8	2@10 Rt. 8 Lt.	2@8		2@8		2@8		2@10	2@10 Rt. 8 Lt.
Right of Way-Minimum Width-Ft.			150	300[2]	120		120		120		150	300′[2]
Bridges	Design Load		← H-20 S-16 →									
	Clearance Width, Feet		Under 200′ long, full roadway Over 200′ long, pavement plus 6′		30		30		30		Under 200′ long, full roadway Over 200′ long, pavement plus 6′	
	Vertical Clearance		← 14.5′ Minimum →									
Grade Separations Basic Design for Bridges			← Special Study for Warrants →		← None Required →						← Special Study for Warrants →	

Design—Subbase required when soil is of fair or poor type; if soil type is good, no subbase required.

AXLE LOADS	OVER 2000 A.D.T.		
Light 4-10	8″ Reinf. Concrete 3″ Base 11″ Subbase	or	3″ Bit. Conc. Surf. 7″ Base 18″ Subbase
Medium 10-18	9″ Reinf. Concrete 3″ Base 11″ Subbase	or	3″ Bit. Conc. Surf. 8″ Base 18″ Subbase
Heavy 18-22	9″ Reinf. Concrete 3″ Base 11″ Subbase	or	4½″ Bit. Conc. Surf. 8″ Base 28″ Subbase

[1] For volumes in this range, capacity studies may indicate need for 4 lanes.
[2] Desirable median width from edge of pavement to edge of pavement—46′ for 6 lane highway and 70′ for 4-lane highway.

Table S-19

DESIGN STANDARDS FOR URBAN STATE TRUNKLINES

Design Features	All Cities			Cities of over 5,000 population			Cities of under 5,000 population		
	Controlled Access[1]			Free Access			Free Access		
				Downtown area	Intermed. area	Outlying area	Downtown area	Intermed. area	Outlying area
1980 Design Hour Traffic Volume Total for No. of Lanes Shown	7200 to 9000	Up to 6000	State trunkline by-passes only under 750[2]	SEE BELOW					
Surface Type[9]	F			F	F or E[3]		F	F or E[3]	
Number of Lanes	6[4]	4[4]	2[4]	Controlled by anticipated 1980 traffic volumes and operating conditions determine required street width by consulting hourly capacity tables[5]					
Surface Width	72′	48′	24′						
Curbs and Sidewalks	Not required: Pedestrians not permitted Pedestrian Crossings to be provided where needed			Yes	Yes	Only as required	Yes	Yes	Only as required
Shoulder Width	12′	12′	10′	——	——	8′	——	——	8′
Median Width	20′		——	For two-way streets requiring four lanes, 20′ median should separate directions of travel					
Parking	Not Permitted Except on Frontage Roads			For streets having a design hour traffic volume exceeding 750, parking generally to be discouraged, with the parallel parking permitted only during off-peak hours. Parallel parking permitted for lesser traffic volumes.					
Illumination	Continuous		at Intersec.	Continuous	At intersections		Continuous	At intersections	
Intersection Treatment 10% or more of Traffic on Intersecting Street	Full Access Control		(6)	Progressive traffic signal system or fixed time signal where warranted Stop sign control for lower traffic volumes					
Less than 10% of traffic on Intersecting Street			(7)	Traffic or pedestrian actuated signals where warranted or stop sign control.					
Structures Width	Under 200′ long—full roadway width over 200′ long—pavement width[8] plus 6′ plus width			Pavement plus sidewalks					
Vertical Clearance	14.5′			14.5′					
Loading	H-20 - S-16			H-20 - S-16					
Railroad Crossing Separation	At all Railroad Crossings			Main Line crossings on streets carrying heavy traffic volume where practical and economically feasible.					
Railroad Grade Crossing Protection	——			Flashing light signals and gates where ADT times number of trains=3,500 or more. RR grade separation where ADT times number of trains=70,000 or more and on all 4 lane highways regardless of number of trains. At all other crossings, flashing light signals where there is no watchman or flagman.					

[1] Standards for controlled access arterials based on 40 m.p.h. operating speed. Access permitted only at interchanges and intersections with other arterials. Access from abutting property by frontage streets where required.
[2] Applies specifically to new locations of 2-lane state trunkline routes by-passing business areas of municipalities.
[3] Character and amount of traffic should determine the type of surface required.
[4] 12 foot traffic lanes.
[5] Street width chosen should be divisible into even numbers of 11′ or 12′ lanes, except where one-way operation is planned.
[6] Grade separations where warranted and feasible otherwise channelized and signalized intersection at grade.
[7] Channelized and signalized intersection at grade.
[8] Includes shoulders of approaches.
[9] F (High), E (Intermediate)

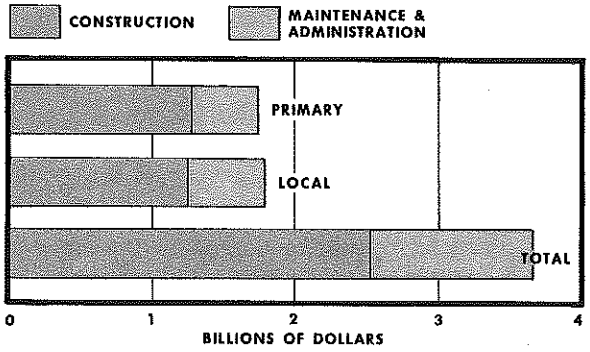
County Needs

In order to properly evaluate the needs, it was necessary that each county review its existing system of county primary roads. Primary roads are those of greatest importance to the county and conform with the uniform standards and specifications adopted by the State Highway Commissioner according to Act 51.

In most instances, the existing primary road system, as established under Act 51, was adequate in scope to serve anticipated development for the 20-year period.

The primary system consists of 22,735 miles in rural areas, 548 miles in urban areas and 2,509 structures. The local system consists of 62,542 miles and 3,814 structures. In order to provide a road system adequate to serve traffic through 1980, $3.66 billion is required. Needed expenditures for construction maintenance and administration are shown in the following graph.

1960-1980 NEEDS
TOTAL 20 YEAR COUNTY ROAD NEEDS



PRIMARY SYSTEM APPRAISAL

Each road was appraised section by section. A section is continuous, of generally uniform characteristics and traffic, and requires the same standard of improvement in the same time period.

Construction was defined as the building of a road and pavements, and the improvement of an existing road by new gradients, drainage structures, roadway width, alignment, or surface. It includes the building of bridges or other road structures, and the repair of such structures by strengthening, widening, and reconstruction of piers and abutments. It also includes the initial signing of newly constructed roads, major resigning projects, and the installation, replacement or improvement of traffic signals.

Construction needs were based on a comparison of geometrics and physical features with the approved design standards of the manual of Procedures and Instructions. A copy of these standards appears at the end of the tables in this chapter. The engineers who made the study were requested to use sound engineering judgment and also to be practical.

Maintenance of roads and bridges was defined as the routine work items and repair materials necessary to maintain the roadbed and surface adequately to serve the number and type of vehicles desiring to use the facility. The repair of drainage ditches and cross drains is necessary to prevent damage by water and weathering to roadbed and surface.

A study of maintenance costs was made. This was broken down by surface type and type of work. Surface types were unimproved earth, graded and drained earth, gravel, bituminous surface treated, bituminous aggregate, bituminous concrete and cement concrete. The type of work was as follows: snow removal; routine surface operation covering patching and blading; special surface operation covering dust palliatives, gravel resurfacing, and bituminous resealing; shoulder repair; drainage and roadsides covering ditches and structures, grass and weed cutting, and roadside clean-up; traffic services covering markers and signs and pavement marking. The state was broken down into five areas with Wayne County being studied separately. The five areas were Upper Peninsula, Northern Lower Peninsula, Southern Agricultural, Southern Industrial—light, Southern Industrial—heavy. Representative counties in each area were asked to give their costs per mile for each item of work according to their records. These were studied and reviewed with the County Engineering Advisory Committee. Final costs were arrived at on a cost per mile by surface type, by area basis.

The determination of the improvement needs involved four basic steps:

1. Identification of each road section including the bridges and railroad crossings on a work map.
2. Inventory of the special characteristics and existing condition of each road section, bridge and railroad crossing.
3. Determination of the character and degree of the existing and future deficiencies and estimating the time period in which the improvement should be made.
4. Determination of the type of improvement and estimated cost to correct the deficiencies and bring the road or bridge to standards commensurate with anticipated future traffic.

Step 1 Identification. Each road section was indicated on a map by number. This was done to insure complete coverage and to assist in reviewing the data submitted. Bridges and railroad crossings were numbered with either a B or a X prefix.

Step 2 Inventory. This covers information in regard to special services performed by a route, road inventory and traffic data. This information provided a measure of the importance of the route and, together with the deficiency data, assisted the engineer in determining the time period when an improvement should be made to bring the route to proper standards.

Step 3 Character of Deficiencies and the period in which they will become critical. Each mile of road, bridge, and railroad crossing was appraised to determine the improvements required to bring the system up to a standard to serve 1980 traffic.

This appraisal and determination of improvement was based upon an adequate financial plan. While the financial plan was outside the scope of the Engineering Phase of the Needs Study, each county was requested that they indicate the degree of urgency of the proposed improvement in one of four time periods. The determination of the time period was based on the existing degree of inadequacy, such as, remaining surface life, or year capacity exceeded.

Surface width or surface type of a road, design load or clear width on a bridge might call for replacement or improvement. On the other hand, inadequate shoulder width, excessive curvature, poor drainage conditions, and inadequate right-of-way are of lesser importance. However, the existence of two or more deficiencies of these types might require critical attention. If minor deficiencies could be reasonably corrected through better maintenance, or if they could be corrected for less than $1,000 per mile, the road section was not included as a construction item for purposes of this study, until such time as a major improvement was needed.

The basic factor in determining deficiencies was traffic requirement by 1980. However, a new industry, large housing project, or development of a large recreation area, that would generate traffic out of proportion to normal trends was considered in determining traffic volume. Furthermore, the improvement of primary roads would tend to induce traffic from local roads and so the amount of new or induced traffic was based substantially on the character of the new development and present and future land uses. In other areas,

where the general economy was rising or declining, the improvement of a road or bridge was adjusted according to the expected traffic trends taking these conditions into consideration.

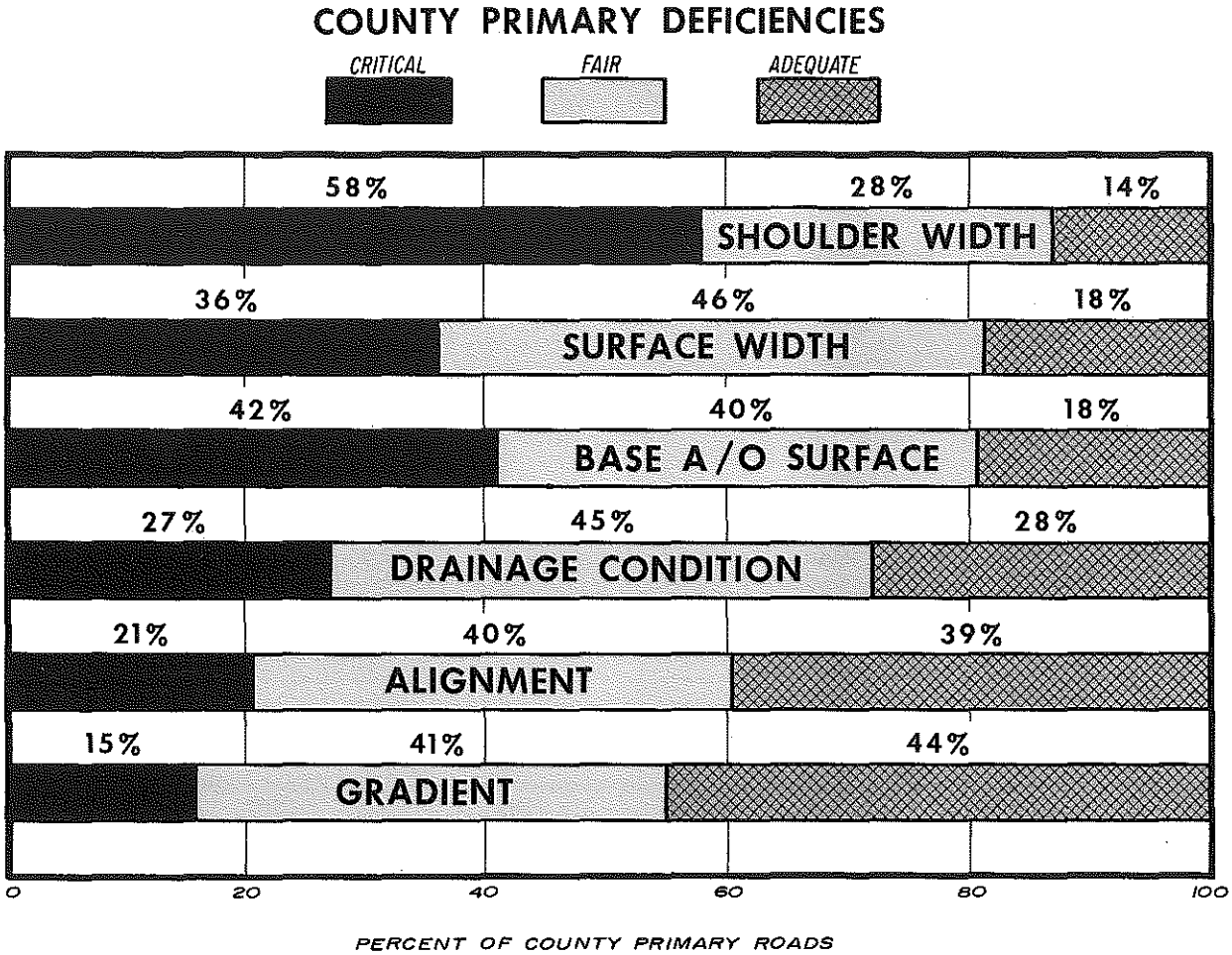
For example, a road might be deficient at the time of the study but the depletion of a mining or lumbering enterprise would make the road no longer deficient for the service it was likely to provide in the future.

In some cases, where reconstruction or resurfacing of an existing two-lane road was scheduled early in the 20-year period, traffic growth required an additional pair of lanes in the third or fourth 5-Year Period; this was reported separately. A new bituminous aggregate wearing surface of 2-inch thickness on a good base with good sub-soil has a life expectancy of 15 years. A pavement of this type was shown as adequate for 20 years because in most cases a seal coat or repair under maintenance would suffice for the additional 5 years.

In determining the schedule of improvements, economic trends as well as engineering judgment were taken into consideration. Some of these conditions were general economy, traffic growth, local demand, remaining surface life, and the year capacity would be exceeded.

All of the above was spelled out in the Manual of Procedures and Instructions. As practical and realistic evaluation as possible was made.

Step 4—Determining Type of Improvement Needed and Estimated Cost. The nature of the proposed improvement was based on the design standards in the manual. The design was to be satisfactory to serve anticipated traffic in 1980. The engineer estimated the traffic that would use the road or bridge, using the tables in the



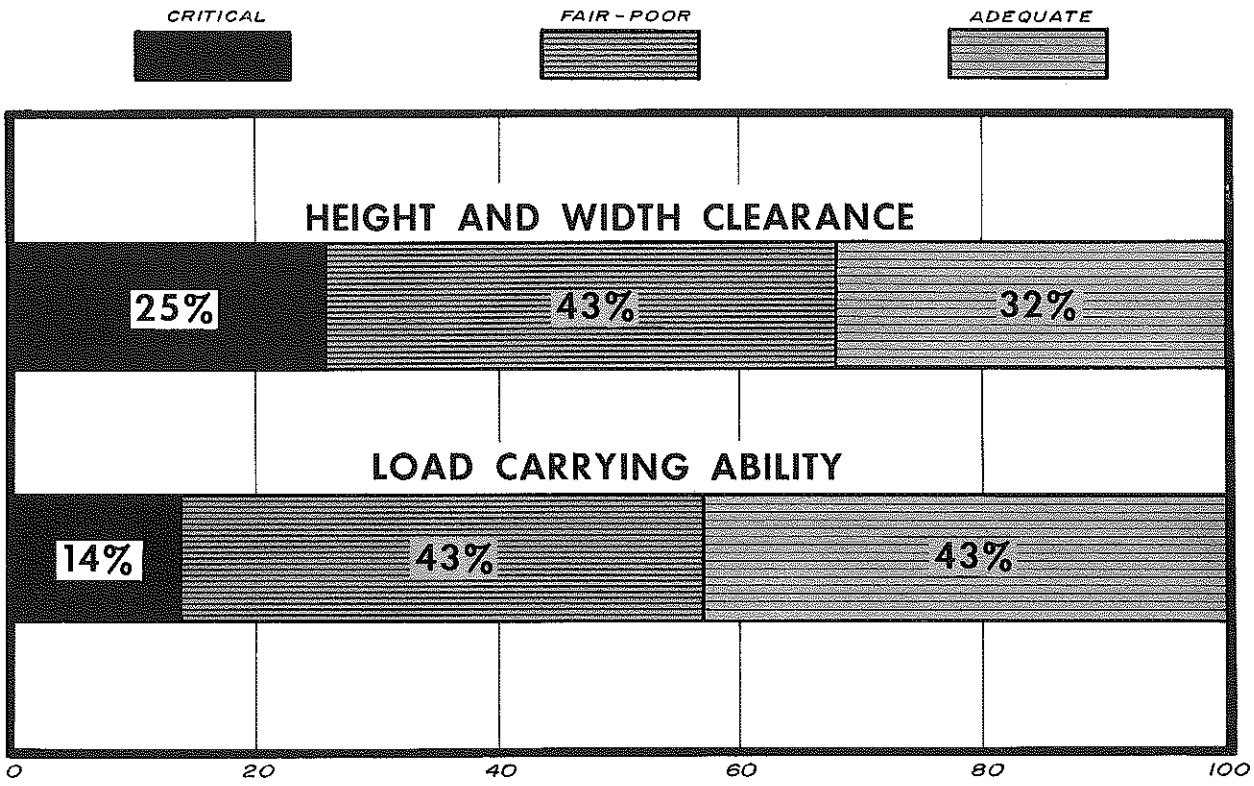
manual as a guide, but modified to take into account possible changes in land use. Any substantial changes were qualified in the remarks. Cost estimates were based on 1958 contract prices. Construction cost estimates include preliminary engineering and direct project engineering. Average 1958 costs per mile for the various types of work and bridge costs per square foot were given in the manual. Where conditions, such as exceptional soil conditions warranted, allowances were made and so noted on the work sheets on file as part of the study. The same was true for bridges, such as high or difficult to build structures. Work normally charged to maintenance was not included.

LOCAL ROAD SYSTEM APPRAISAL

The same procedure was used as for the Primary System Appraisal except for the elimination of four items from the work sheet form that were not applicable. Also subdivision streets were kept separate from all other local roads. Subdivision streets within the same subdivision, having the same characteristics and requiring similar treatment during the same time period were grouped.

Design standards for local county roads were included in the manual and used for determining design. The same is true for determining deficiencies and estimated cost. Copies of standards used appear at the end of this chapter.

NATURE OF COUNTY PRIMARY STRUCTURAL DEFICIENCIES



COUNTY PRIMARY DEFICIENCIES

On page 53 are shown the deficiencies on the county primary system—existing or that will occur during the 20-year time period. Of the 23,283 miles of county primary roads only about 215 miles or one-percent were considered adequate for twenty years. The percent of mileage critically deficient in the various categories are:

58% critically deficient in shoulder width
36% critically deficient in surface width
42% critically deficient in base and/or surface condition
27% critically deficient because of drainage
21% critically deficient in alignment
15% critically deficient in gradient

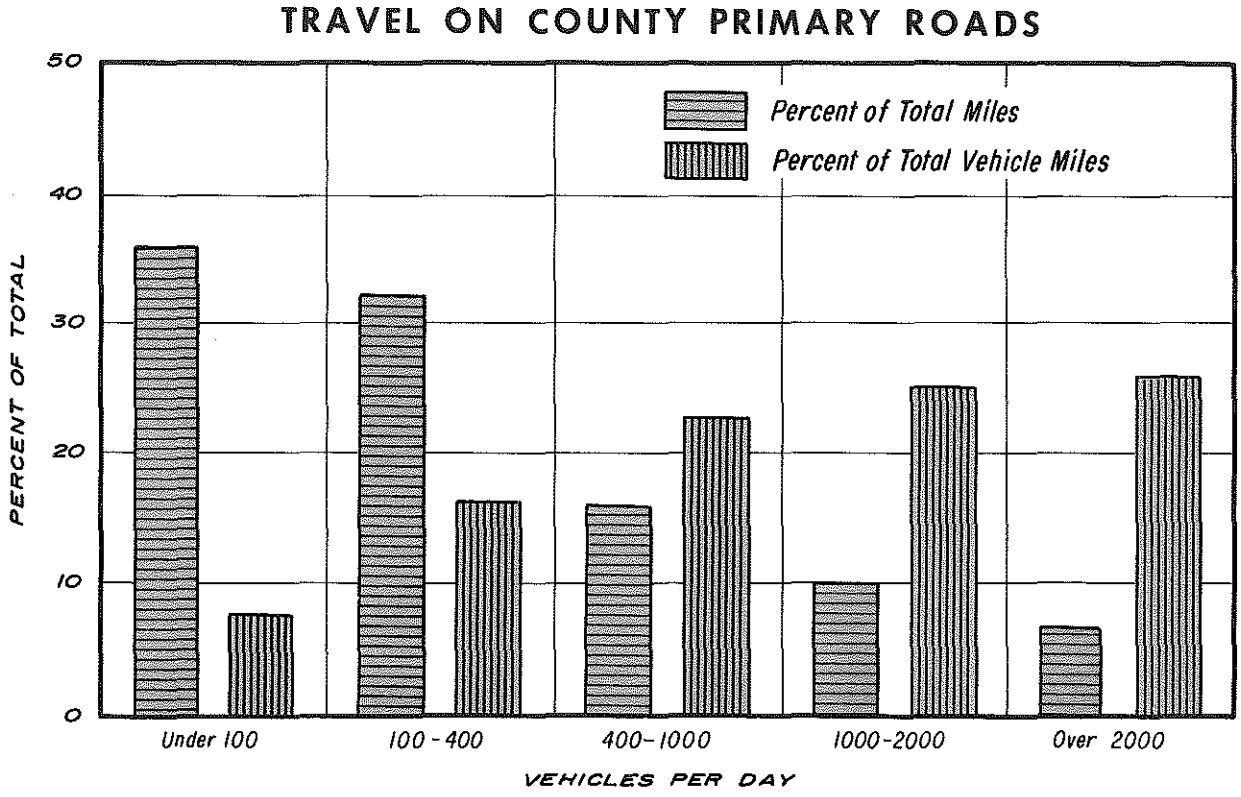
NATURE OF COUNTY PRIMARY STRUCTURE DEFICIENCIES

The deficiencies in the structures is shown on the previous page. Of the 2,509 structures on the county primary road system:

	Critical	Fair-Poor	Deficient	Adequate
Height and Width Clearance	25%	43%	68%	32%
Load Carrying Ability	14%	43%	57%	43%

Many sections of roads were deficient in more than one category.

Capacity deficiencies occur in the counties with high density population where the volume of traffic is high. This is illustrated in the chart on "Travel on County Primary Roads". The chart shows that about 7% of the total primary road mileage has about 26% of the vehicle miles and this occurs on those roads with over 2,000 vehicles per day. Also another 10% of the total primary road mileage has about 25% of the vehicle miles and this occurs on those roads carrying 1,000 to 2,000 vehicles per day. Thus 51% of the vehicle miles occurs on 17% of the primary road mileage and is on those roads carrying over 1,000 vehicles per day.



In rural outstate counties most deficiencies are narrow roadways, surfaces and surface types that are inadequate for the traffic served.

In suburban areas near large metropolitan areas there is critical need for storm drains, curb and gutter, and paved streets. This need is continuing to increase.

There are 1,678 structures that need improvement on the county primary road system in the next twenty years. The type of improvement needed is as follows:

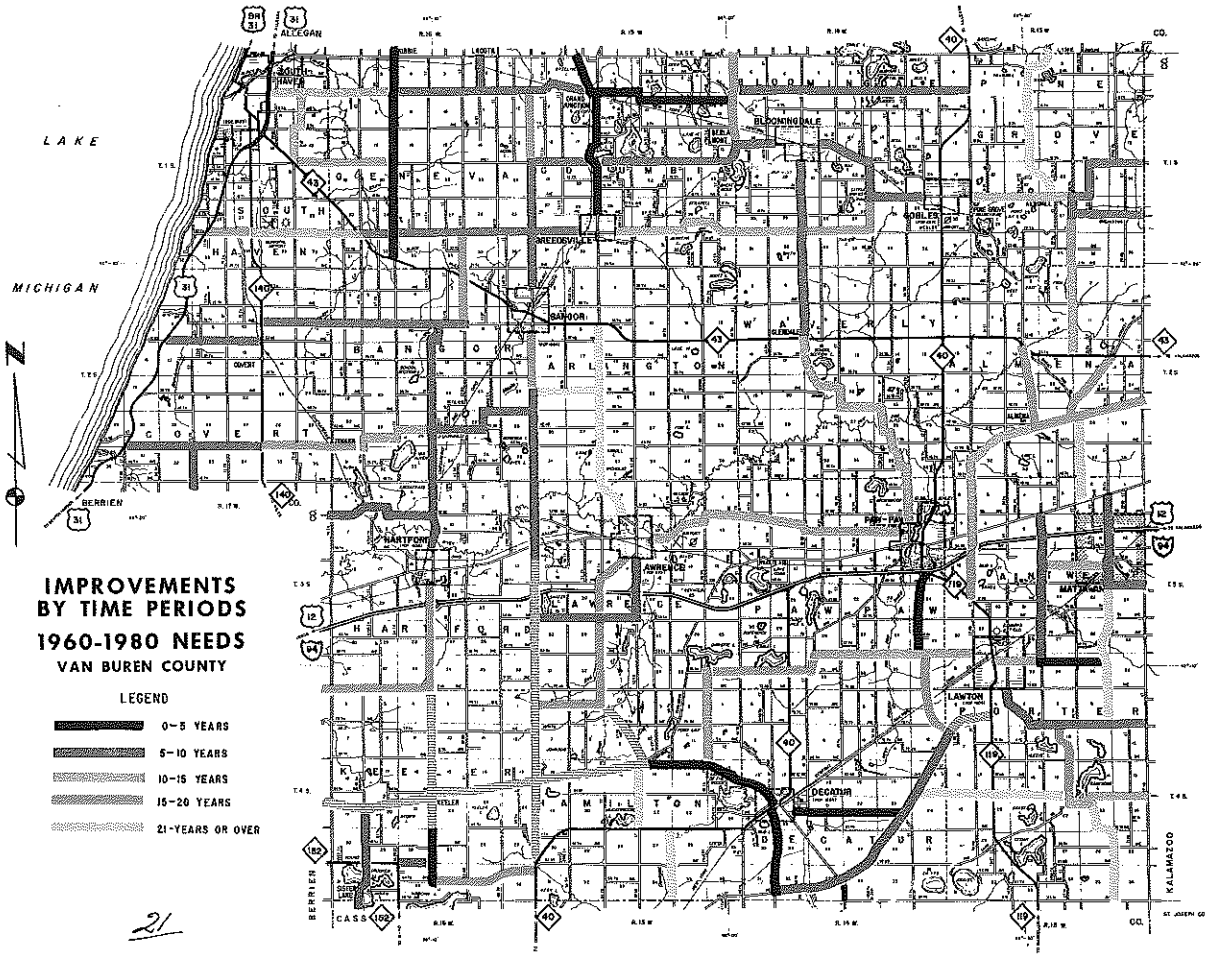
Type of Work	*Number of Structures*
Reflooring	17
Reconstruction	373
Replacement	882
New Structures	302
Other	104
Total	1,678

By 1980 there will be 27,409 miles of primary county roads as compared to 23,283 miles in 1960. Of the 27,409 miles a total of 24,197 miles will need improvement or new construction.

COUNTY PRIMARY IMPROVEMENT COSTS

The total miles of each type of improvement needed in the twenty year study are:

Surface Type	Miles
Gravel	898
Bituminous Surface Treated	3,730
Intermediate Type	16,443
High Type, 2 Lanes	1,715
High Type, Multilanes	1,411
Total	24,197



Of the $1,242 million total county primary road construction needs, approximately 14% or $173 million are needed for county primary road extensions in municipalities.

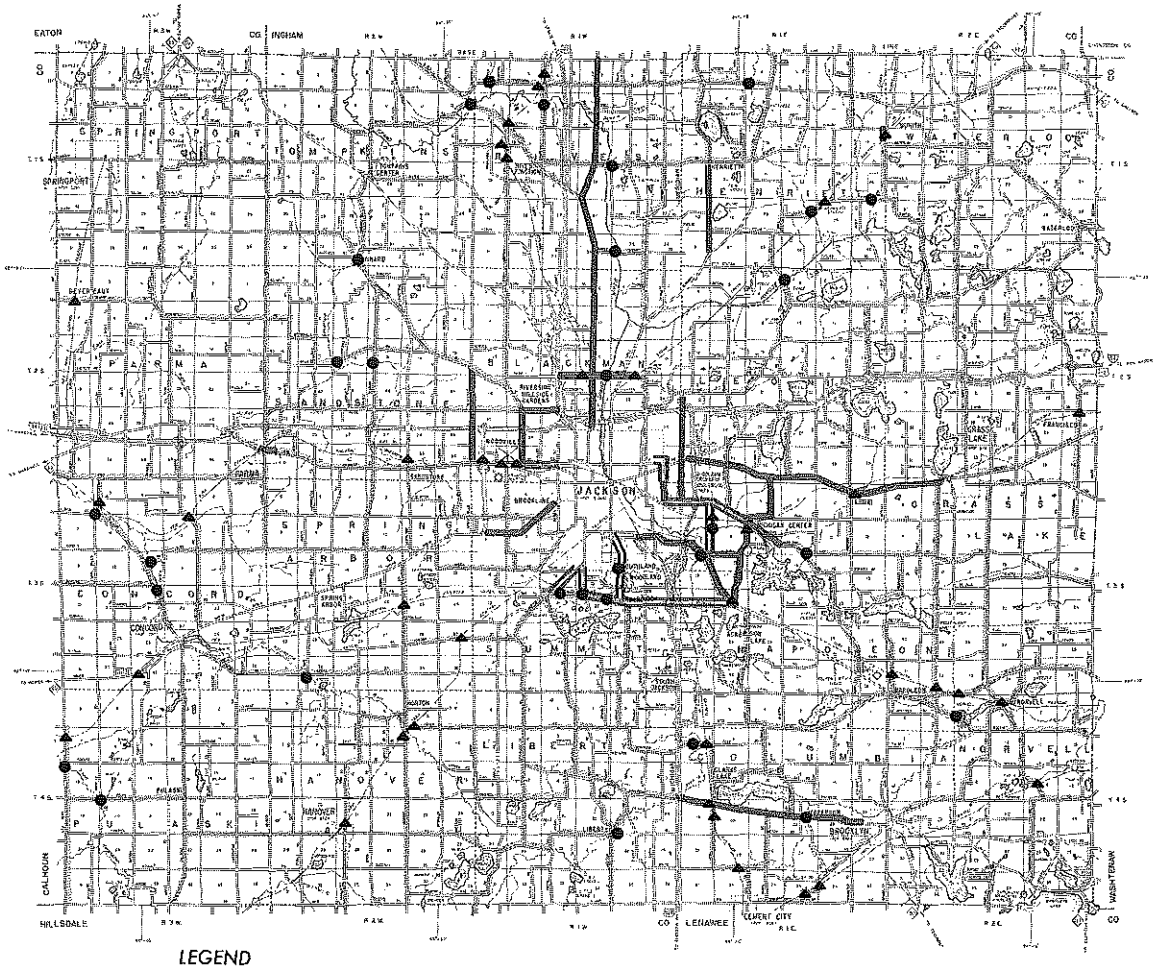
The urgency of the total primary construction needs is pointed out by the fact that 71% or $879 million is needed in the first 10 years. If the county primary needs could be met in the 20 year period, it would mean that nearly all county primary roads would be paved. The following table gives the mileage and percent of mileage paved in 1960. It also shows the mileage and percent of total county primary mileage that would be paved by 1980.

CONSTRUCTION NEEDS COUNTY PRIMARY ROADS

Rural and Urban

(In Thousands)

Period	Roadway	Structures	Total
0-5 years	$ 499,980	$ 69,440	$ 569,420
0-10 years	778,270	100,770	879,040
0-15 years	974,750	117,290	1,092,040
0-20 years	$1,114,710	$127,650	$1,242,360



LEGEND

BITUMINOUS AGGREGRATE
CONCRETE, 2 LANE
CONCRETE, 4 LANE
R.R. IMPROVEMENT
STRUCTURE IMPROVEMENT

JACKSON COUNTY IMPROVEMENTS 1960-1980 TO MEET PRIMARY ROADS NEEDS

A COMPARISON OF DUST FREE MILES OF SURFACE

	Miles	% of Total Mileage
1960	14,029	60
1980	26,572	97

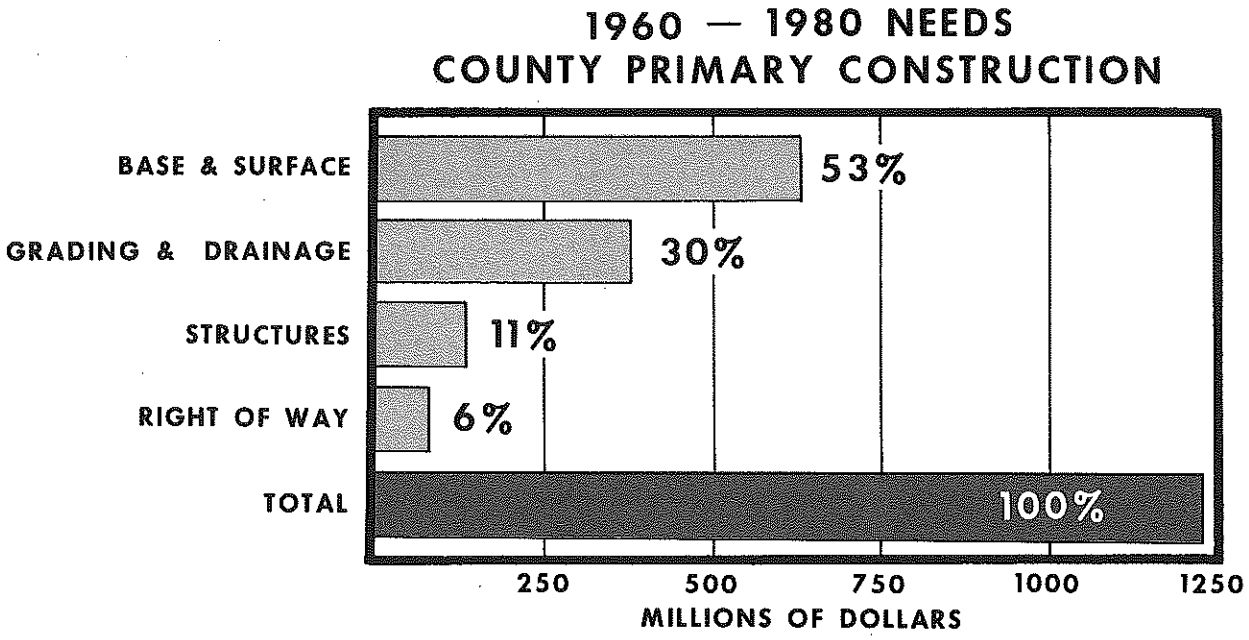
A break down of the construction cost by type of work on county primary roads is as follows:

Type of Work	Miles	Cost *(In Thousands)*
Resurfacing & Widening	9,131	$ 355,114
Reconstruction	13,517	605,539
New Construction	1,532	119,663
Freeways	17	34,394
Structures (1,678)	—	127,650
Total	24,197	$1,242,360

Of these totals 6% is for right of way, 28% for grading and drainage, and 56% for base and surface. The largest portion of this work is resurfacing or widening and reconstruction.

About $128 million or 10% of the total is needed for structures and railroad protection. Of the $128 million, a total $124 million is for structures. The balance of $4 million is needed for railroad protection facilities such as signals and gates.

The 20-year primary road needs in ten of the heaviest populated counties of the state total $862 million or 48 percent of the statewide total.



Multi-Lane Improvements

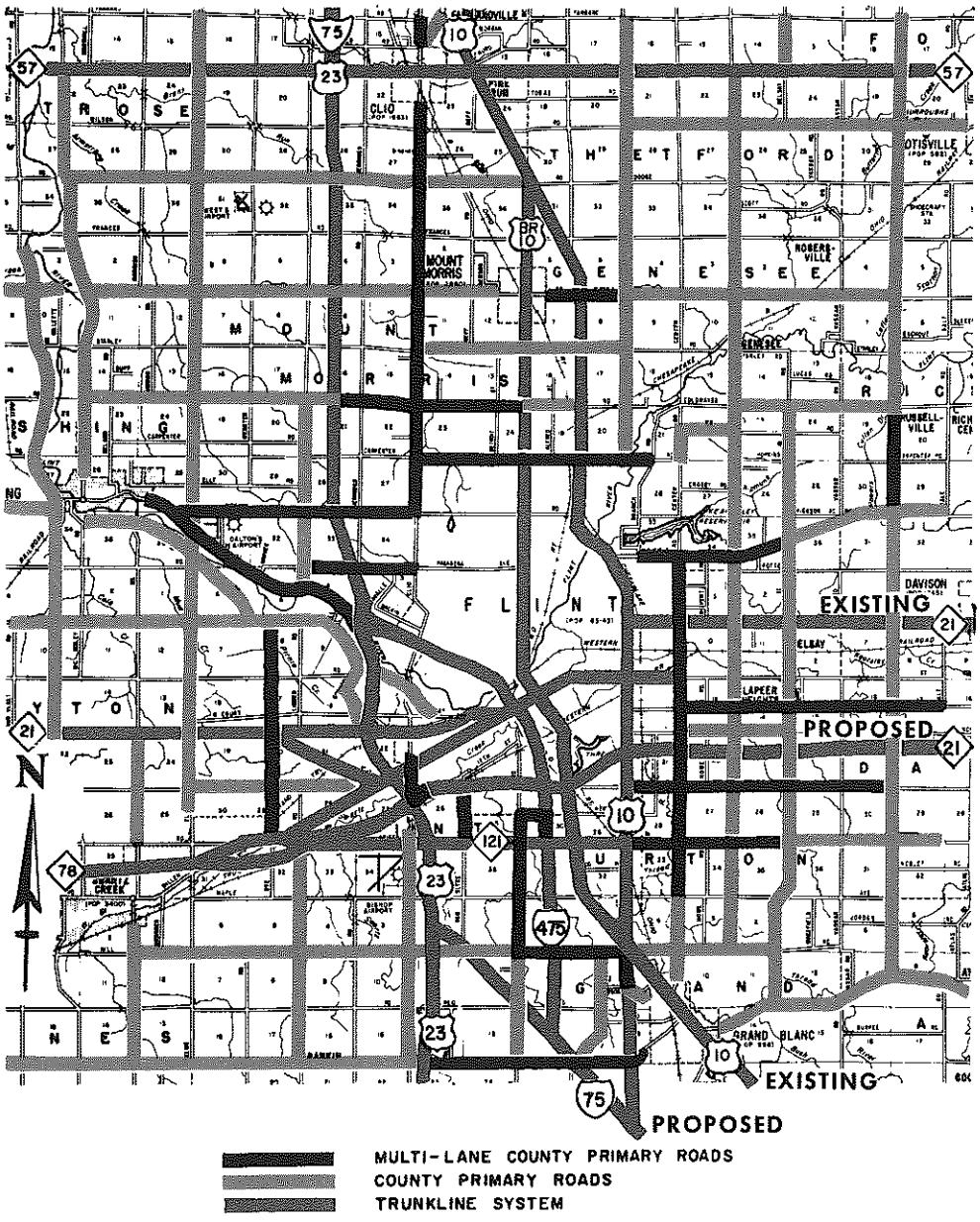
Twenty-two counties listed improvements on 1,411 miles of multi-lane county primary roads. Of this total 1,103 miles are four-lane, 286 miles are six-lane and 22 miles eight-lane. In eleven counties the multi-lane requirements are:

County	Miles
Berrien	27
Genesee	80
Ingham	52
Jackson	13
Kalamazoo	44
Kent	36
Macomb	128
Muskegon	21
Oakland	294
Saginaw	11
Wayne	664
Total	1,370

The remaining 41 miles are scattered in 11 other counties. About 86 percent of the multi-lane requirements, 1,218 miles is in Genesee, Ingham,

GENESEE COUNTY

PROPOSED 1960-1980 RURAL MULTI-LANE ROADS



Macomb, Oakland and Wayne counties. These counties, metropolitan in character, are the most heavily populated in the state.

Included in the multi-lane requirements are 17 miles of freeways with full control of access which are integrated in the Detroit Area Expressway Plan and are required for adequate service in the rapidly developing suburban area around Detroit.

Pictured are the multi-lane needs in Genesee County. These roads fit an integrated pattern serving the outlying areas in close proximity to metropolitan Flint and also serve to coordinate traffic movement on the trunkline system entering Flint or circumventing the city.

Average Cost Per Mile

The average cost per mile for 2-lane construction excluding structures and future replacement is:

Type of Surface	Cost Per Mile
Gravel	$16,900
Bituminous Surface Treated	$24,400
Intermediate Type	$29,300
High Type	$92,900

There are 24,197 miles of primary roads and 1,678 structures which will need improvement. The total construction cost excluding maintenance and administration is $1.24 billion. Maintenance and administration needs are $570 million bringing the total County Primary Road needs to $1.81 billion.

Though this amount is a formidable one it represents what is needed to meet the demands of the future.

COUNTY LOCAL ROADS IMPROVEMENT COST

County local roads vary in deficiencies such as narrow roadways, poor drainage and lack of stabilized surfaces for year-round service. Because these roads do not carry large volumes of traffic, they have not received as much engineering and planning attention as has been given to primary roads. These roads do, however, provide service for outlying areas such as transporting school children, moving of goods and people to mining, logging, industrial, recreational and park areas. They also provide access to local residences for business and social activities. Demands for increased design standards are mounting for these roads, especially in suburban areas.

Problems on county local roads brought to focus in this survey of needs, although different in many respects than on the more traveled routes, are a detriment to the economy of the outlying areas.

There are 62,542 miles of county local roads of which 54,331 miles need improvement. There are 3,436 deficient structures on the local road system. The cost to improve these structures and also to provide adequate protection at railroad crossings is $95 million. The cost of improvements on the roadway is $1.13 billion. A breakdown of these costs by surface type is as follows:

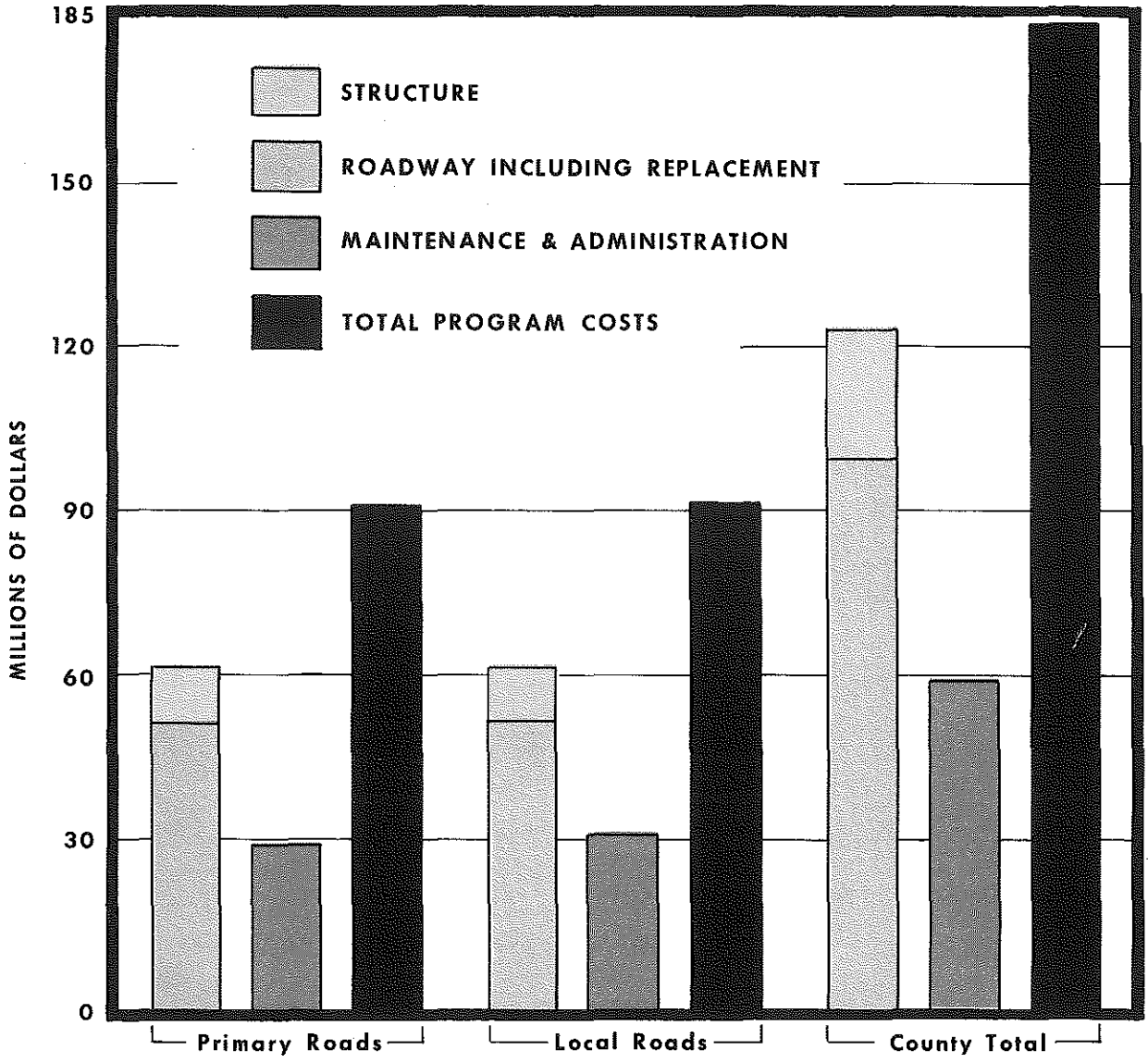
CONSTRUCTION COSTS COUNTY LOCAL ROADS

Type of Surface	Miles	Cost	Cost Per Mile
		(In Thousands)	
Gravel	32,326	$ 534,220	$ 17
Bit. Surf. Treatment	14,368	297,018	21
Intermediate Type	7,004	220,621	31
High Type	633	80,276	127
Structures & R.R. Protection	...	94,665	
Total	54,331	$1,226,800	

The bulk of the needed expenditure is for standard gravel and bituminous surface treatment, $831 million. Right-of-way is $4.6 million, amounting to only 0.4 of 1 percent. The cost of grading and drainage is $473 million or 39 percent of the total cost. This points out the need of raising grades for better drainage and also the widening of surfaces and shoulders.

The average cost per mile ranges from $17,000 for minimum gravel to $31,000 for intermediate type of surface. The design standards for county local roads are based on service and traffic. In more densely populated areas where a high type of surface design is needed due to the higher and heavier nature of traffic volumes the cost per mile is increased to $127,000.

COUNTY ROADS
AVERAGE ANNUAL 20 YEAR PROGRAM COSTS



It is evident that if local roads are brought up to the design standards called for in this study, more serious attention must be given to improved planning, engineering, materials and methods.

COUNTY ANNUAL PROGRAM COSTS

Alternate programs have been developed for proposed county road system based upon overcoming the backlog of existing needs in 10 years, in 15 years, and in 20 years. All three programs provide also for meeting future needs as they occur including maintenance and administration.

The elements of these programs are as follows:

Identified Projects—improvements including replacement costs needed in the future because of structural deterioration or traffic inceases.

Maintenance—maintenance of roads and bridges to keep traffic moving and to eliminate traffic hazards.

Administration—engineering and business management.

In order to overcome the backlog of needs and take care of future needs including maintenance and administration it will require $183 million annually over a 20-year period; $208 million annually, if accomplished in a 15 year period; and $245 million annually, if done in a 10 year period.

A breakdown of alternate program costs by counties for each system is included at the end of this section.

The first 10-year annual program cost provides for catching up on all existing deficiencies and meeting new needs as they occur in the first 10-year period. The second 10-year annual program cost is much less since only the needs that occur in this second 10-year period have to be met.

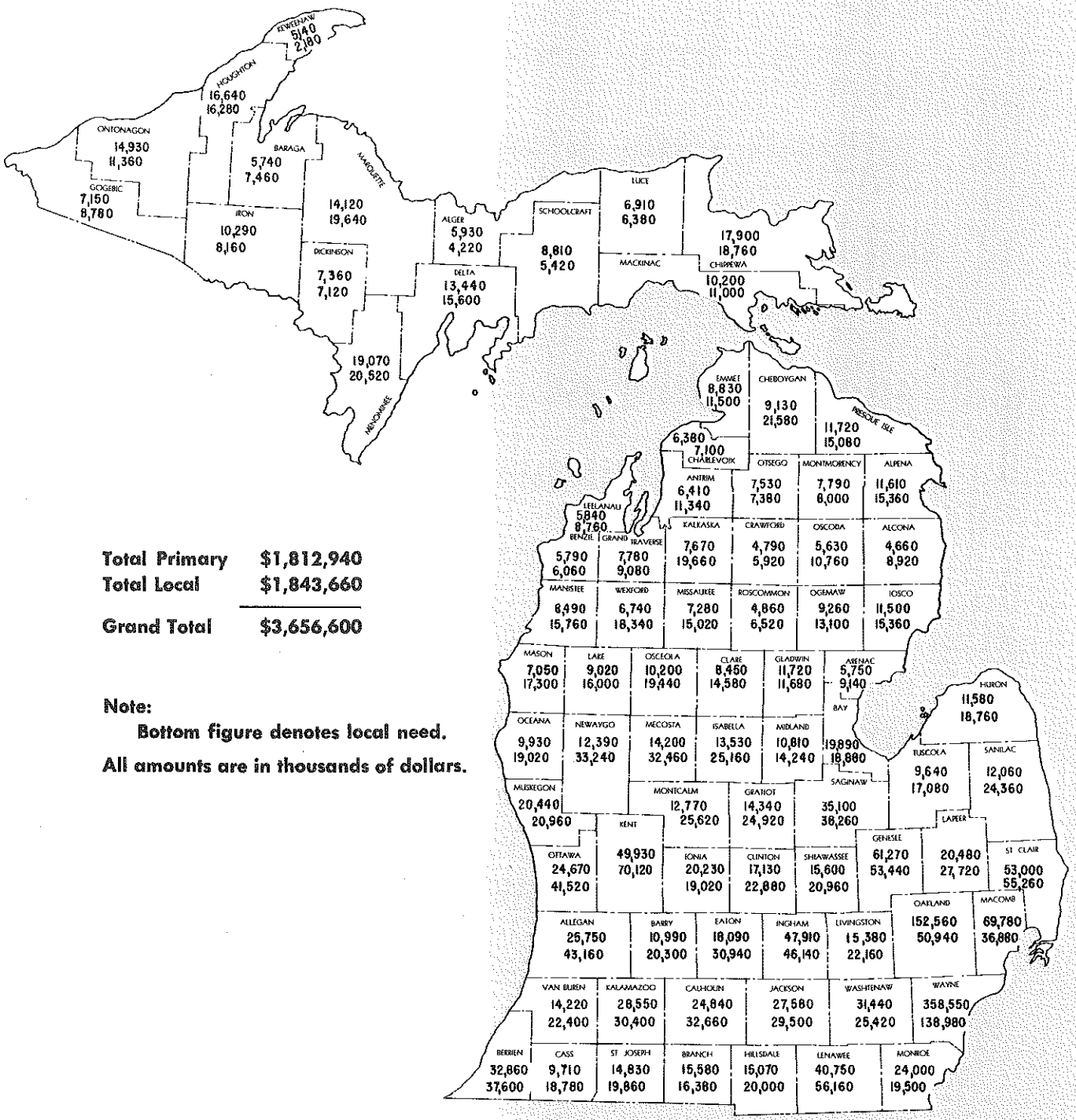
The preceding graph illustrates average annual program cost requirements for the 20-year period for roadway, structures, maintenance, and engineering and administration.

AVERAGE ANNUAL COUNTY PROGRAM COSTS
(In Thousands)
(Including Maintenance & Administration)

	10-Year Program (Based on catching up in 10 yrs. and meeting needs as they occur in last 10 yrs.)		15-Year Program (Based on catching up in 15 yrs. and meeting needs as they occur in last 5 yrs.)		20-Year Program (Based on catching up the needs within 20 yrs.)
	1st 10-Year Period	2nd 10-Year Period	1st 15-Year Period	Last 5-Year Period	20-Year Period
PRIMARY ROADS					
Construction	$ 87,904	$ 36,332	$ 72,803	$ 30,063	$ 62,118
Maint. & Admin.	27,536	29,522	28,065	29,921	28,529
Annual Program Cost	$115,440	$ 65,854	$100,868	$ 59,984	$ 90,647
LOCAL ROADS					
Construction	$ 98,818	$ 23,862	$ 76,649	$ 15,413	$ 61,340
Maint. & Admin.	31,072	30,614	30,916	30,624	30,843
Annual Program Cost	$129,890	$ 54,476	$107,565	$ 46,037	$ 92,183
TOTAL PRIMARY AND LOCAL ROADS					
Construction	$186,722	$ 60,194	$149,452	$ 45,476	$123,458
Maint. & Admin.	58,608	60,136	58,981	60,545	59,372
Annual Program Cost	$245,330	$120,330	$208,433	$106,021	$182,830

County Tables

COUNTY ROAD NEEDS
1960-1980



Total Primary	**$1,812,940**
Total Local	**$1,843,660**
Grand Total	**$3,656,600**

Note:

Bottom figure denotes local need.

All amounts are in thousands of dollars.

Table C-1

PROGRAM COSTS BY COUNTIES

In Thousands

	PRIMARY ROADS												LOCAL ROADS		
	0-10			11-20			0-15			0-20			0-20		
	Const.	Maint. and Admin.	Average Annual Program	Const.	Maint. and Admin.	Average Annual Program	Const.	Maint. and Admin.	Average Annual Program	Const.	Maint. and Admin.	Average Annual Program	Const.	Maint. and Admin.	Average Annual Program
Alcona	$ 170	$ 93	$ 263	$ 48	$ 88	$ 136	$ 132	$ 92	$ 224	$ 109	$ 90	$ 199	$ 238	$ 208	$ 446
Alger	276	128	404	36	126	162	193	128	321	156	129	285	78	133	211
Allegan	1,554	381	1,935	181	351	532	1,097	369	1,466	868	364	1,232	1,515	643	2,158
Alpena	779	166	945	57	150	207	536	160	696	418	158	576	557	211	768
Antrim	217	143	360	127	143	270	191	143	334	172	143	315	287	280	567
Arenac	219	81	300	114	84	198	195	82	277	166	83	249	280	177	457
Baraga	292	104	396	77	100	177	233	103	336	184	103	287	212	161	373
Barry	379	217	596	276	216	492	333	217	550	327	216	543	691	324	1,015
Bay	1,105	304	1,409	269	290	559	820	301	1,121	687	298	985	597	347	944
Benzie	154	119	273	164	121	285	153	119	272	164	121	285	174	129	303
Berrien	1,660	509	2,169	423	497	920	1,219	502	1,721	1,040	504	1,544	1,368	512	1,880
Branch	780	228	1,008	291	215	506	670	226	896	536	221	757	524	295	819
Calhoun	1,069	421	1,490	472	415	889	893	422	1,315	771	420	1,191	1,128	505	1,633
Cass	207	180	387	355	184	539	275	182	457	281	183	464	596	343	939
Charlevoix	193	131	324	176	134	310	194	132	326	184	132	316	122	233	355
Cheboygan	421	146	567	146	150	296	356	147	503	284	148	432	692	387	1,079
Chippewa	1,072	237	1,309	107	219	326	747	233	980	589	229	818	555	383	938
Clare	439	131	570	102	132	234	320	131	451	271	132	403	481	248	729
Clinton	1,070	233	1,303	156	216	372	777	229	1,006	613	225	838	726	418	1,144
Crawford	127	102	229	96	109	205	116	103	219	112	105	217	197	99	296
Delta	767	222	989	134	209	343	568	221	789	450	215	665	530	250	780
Dickinson	281	107	388	198	111	309	256	107	363	240	109	349	190	166	356
Eaton	934	229	1,163	376	222	598	765	229	994	655	225	880	1,192	355	1,547
Emmet	404	158	562	124	157	281	331	158	489	264	157	421	318	257	575
Genesee	3,669	794	4,463	654	773	1,427	2,769	789	3,558	2,162	784	2,946	2,042	630	2,672
Gladwin	696	156	852	115	147	262	509	152	661	405	150	555	374	210	584
Gogebic	211	184	395	81	180	261	182	183	365	146	182	328	238	201	439
Grand Traverse	259	174	433	122	173	295	223	175	398	191	174	365	234	220	454
Gratiot	771	244	1,015	166	233	399	570	241	811	468	239	707	857	389	1,246
Hillsdale	666	241	907	220	231	451	546	237	783	443	235	678	630	370	1,000
Houghton	795	307	1,102	245	304	549	637	305	942	520	304	824	458	356	814
Huron	548	217	765	165	209	374	424	213	637	356	212	568	346	592	938
Ingham	2,717	600	3,317	863	586	1,449	2,238	598	2,836	1,790	584	2,374	1,783	524	2,307
Ionia	1,286	265	1,551	185	243	428	935	259	1,194	735	255	990	619	332	951
Iosco	585	150	735	217	148	365	439	149	588	401	148	549	564	204	768
Iron	615	168	783	79	154	233	435	164	599	347	163	510	215	193	408
Isabella	732	208	940	160	199	359	542	205	747	446	204	650	898	360	1,258
Jackson	1,094	492	1,586	613	490	1,103	943	494	1,437	854	493	1,347	981	494	1,475
Kalamazoo	1,569	405	1,974	440	402	842	1,259	403	1,662	1,004	405	1,409	993	527	1,520

Kalkaska	390	147	537	56	142	198	276	146	422	223	146	369	699	284	983
Kent	1,985	837	2,822	1,074	839	1,913	1,862	842	2,704	1,529	838	2,367	2,575	931	3,506
Keweenaw	234	81	315	115	77	192	200	80	280	175	79	254	66	43	109
Lake	448	164	612	102	162	264	337	163	500	275	163	438	494	306	800
Lapeer	1,201	242	1,443	305	224	529	895	238	1,133	753	234	987	999	387	1,386
Leelanau	197	129	326	119	125	244	183	128	311	158	127	285	234	204	438
Lenawee	2,921	407	3,328	323	344	667	2,101	384	2,485	1,621	372	1,993	2,290	518	2,808
Livingston	684	224	908	291	218	509	606	223	829	487	222	709	768	340	1,108
Luce	326	91	417	152	90	242	296	91	387	239	91	330	198	121	319
Mackinac	394	165	559	148	162	310	333	164	497	271	163	434	345	205	550
Macomb	3,177	619	3,796	2,322	731	3,053	3,370	660	4,030	2,748	675	3,423	1,377	467	1,844
Manistee	412	156	568	120	152	272	328	152	480	266	152	418	500	288	788
Marquette	697	246	943	149	237	386	537	242	779	424	242	666	468	514	982
Mason	275	128	403	159	127	286	249	129	378	217	127	344	558	307	865
Mecosta	847	203	1,050	123	187	310	600	197	797	485	195	680	1,210	413	1,623
Menominee	1,047	245	1,292	357	230	587	888	243	1,131	702	238	940	692	334	1,026
Midland	487	156	643	212	155	367	423	155	578	349	155	504	481	231	712
Missaukee	253	132	385	189	138	327	262	135	397	221	135	356	487	264	751
Monroe	1,221	329	1,550	401	312	713	994	324	1,318	811	320	1,131	606	369	975
Montcalm	588	232	820	215	229	444	490	232	722	401	230	631	765	516	1,281
Montmorency	412	104	516	132	107	239	335	106	441	272	106	378	206	194	400
Muskegon	927	437	1,364	188	436	624	689	436	1,125	557	434	991	560	488	1,048
Newaygo	551	199	750	262	194	456	509	198	707	406	196	602	1,115	547	1,662
Oakland	8,737	1,994	10,731	2,209	2,137	4,346	6,927	2,042	8,969	5,472	2,066	7,538	1,800	747	2,547
Oceana	488	189	677	85	180	265	352	186	538	286	185	471	619	332	951
Ogemaw	392	146	538	214	147	361	330	145	475	304	146	450	424	231	655
Ontonagon	990	185	1,175	108	163	271	701	176	877	549	173	722	379	189	568
Osceola	513	177	690	82	171	253	373	176	549	297	175	472	651	321	972
Oscoda	245	103	348	79	104	183	202	103	305	162	104	266	309	229	538
Otsego	332	148	480	67	144	211	242	147	389	200	147	347	129	240	369
Ottawa	1,403	412	1,815	182	392	574	1,012	407	1,419	793	402	1,195	1,394	682	2,076
Presque Isle	562	170	732	242	185	427	513	174	687	403	176	579	532	22	754
Roscommon	135	94	229	97	93	190	118	93	211	116	93	209	219	107	326
Saginaw	1,454	531	1,985	848	524	1,372	1,268	527	1,795	1,150	526	1,676	1,195	718	1,913
Sanilac	595	197	792	147	188	335	443	193	636	372	192	564	574	644	1,218
Schoolcraft	460	131	591	133	134	267	362	131	493	296	132	428	163	108	271
Shiawassee	537	217	754	544	218	762	553	219	772	540	218	758	710	338	1,048
St. Clair	3,259	482	3,741	957	429	1,386	2,559	465	3,024	2,107	455	2,562	2,136	627	2,763
St. Joseph	694	218	912	326	212	538	624	216	840	510	214	724	679	314	993
Tuscola	436	122	558	249	117	366	369	120	489	343	120	463	318	536	854
Van Buren	445	262	707	406	252	658	445	254	699	426	253	679	700	420	1,120
Washtenaw	1,589	307	1,896	836	310	1,146	1,326	306	1,632	1,213	311	1,524	799	472	1,271
Wayne	13,730	4,946	18,676	11,315	5,754	17,069	12,784	5,148	17,932	12,522	5,361	17,883	4,813	2,136	6,949
Wexford	357	83	440	116	76	192	279	81	360	237	80	317	624	293	917
Sub-Total	87,809	26,162	113,971	35,586	26,659	62,245	72,566	26,280	98,846	61,697	26,411	88,108	61,340	30,843	92,183
Turnbacks	95	1,374	1,469	746	2,863	3,609	237	1,785	2,022	421	2,118	2,539	—	—	—
Total	$87,904	$27,536	$115,440	$36,332	$29,522	$65,854	$72,803	$28,065	$100,868	$62,118	$28,529	$90,647	$61,340	$30,843	$92,183

Table C-2

TOTAL COUNTY ROAD NEEDS

In Thousands

	Construction	Maintenance	Administration	Total
Primary	$1,242,360	$ 510,440	$ 60,140	$1,812,940
Local	1,226,800	560,060	56,800	1,843,660
Total	$2,469,160	$1,070,500	$116,940	$3,656,600

Table C-3

TOTAL COUNTY PRIMARY ROAD NEEDS

BY 5 YEAR TIME PERIODS

In Thousands

Period	Construction	Maintenance	Administration	Total
0-5	$ 569,420	$113,720	$21,280	$ 704,420
6-10	309,620	125,440	14,920	449,980
11-15	213,000	132,840	12,780	358,620
16-20	150,320	138,440	11,160	299,920
Total	$1,242,360	$510,440	$60,140	$1,812,940

Table C-4

TOTAL COUNTY LOCAL ROAD NEEDS

BY 5 YEAR TIME PERIODS

In Thousands

Period	Construction	Maintenance	Administration	Total
0-5	$ 717,750	$132,120	$25,800	$ 875,670
6-10	270,430	139,950	12,850	423,230
11-15	161,560	142,890	10,130	314,580
16-20	77,060	145,100	8,020	230,180
Total	$1,226,800	$560,060	$56,800	$1,843,660

Table C-5

COUNTY PRIMARY ROAD CONSTRUCTION COSTS

BY 5 YEAR TIME PERIODS

In Thousands

Time Period	Roadway	Structure	Total
Rural			
0-5	$435,530	$ 56,420	$ 491,950
6-10	239,710	25,230	264,940
11-15	172,860	14,100	186,960
16-20	119,040	6,800	125,840
Total Rural	$967,140	$102,550	$1,069,690
Urban			
0-5	$ 64,450	$ 13,020	$ 77,470
6-10	38,580	6,100	44,680
11-15	23,620	2,420	26,040
16-20	20,920	3,560	24,480
Total Urban	$147,570	$ 25,100	$ 172,670

Table C-6

COUNTY PRIMARY CONSTRUCTION COSTS BY TYPE OF WORK

In Thousands

Type of Work	Miles	R.O.W.	G & DS	B & S	Structures	Total
Freeways	17	$ 2,275	$ 12,970	$ 19,149	——	$ 34,394
New Construction	1,532	8,032	41,932	69,699	——	119,663
Reconstruction	13,517	35,166	207,589	362,784	——	605,539
Resurfacing and Widening	9,131	23,485	86,794	244,835	——	355,114
Structures	——	——	——	——	$127,650	127,650
Totals	24,197	$68,958	$349,285	$696,467	$127,650	$1,242,360

Table C-7

COUNTY PRIMARY NEEDS – TRUNKLINE TURNBACKS

(Cost in Thousands)

	0-5			5-10			10-15			15-20			Total		
	Miles	Maint.	Repl'nt	Miles	Maint.	Repl'nt	Miles	Maint.	Repl'nt	Miles	Maint.	Repl'nt	Miles	Maint.	Repl'nt
Alcona	22.87	$ 45	$ 1	13.08	$ 115	$ 12	15.80	$ 170	$ 38		$ 200	$ 75	51.75	$ 530	$ 126
Alger	10.98	25	1		50	5		30	15		50	23	10.98	175	44
Allegan	55.59	120	3	2.10	240	27		245	75		245	122	57.69	850	227
Alpena							13.31	25	1		55	6	13.31	80	7
Antrim				1.05			15.55	35	2		65	8	16.60	100	10
Arenac	38.92	63	2	13.77	155	20		175	59		175	101	52.69	570	182
Baraga														0	0
Barry	4.36	10	0	2.00	15	2	7.29	30	7	1.55	45	17	15.20	100	26
Bay	9.19	20	0		40	5	1.43	40	12		45	21	10.62	145	38
Benzie							13.64	25	1		55	6	13.64	80	7
Berrien	41.91	155	3	25.35	385	31	20.19	510	96	0.77	565	178	88.22	1,615	308
Branch				26.24	50	1	20.79	140	14		180	45	47.03	370	60
Calhoun	29.27	65	1	30.74	200	17		270	54	4.76	280	104	64.77	815	176
Cass	1.49	5	0		5	1	60.05	125	5	0.60	245	33	62.14	380	39
Charlevoix							8.18	15	0		35	4	8.18	50	4
Cheboygan	23.87	45	1	4.24	105	12		110	33		110	58	28.11	370	104
Chippewa	84.09	165	4		325	41	2.52	330	113		335	181	86.61	1,155	339
Clare	23.83	40	1		80	12		80	32		80	51	23.83	280	96
Clinton	8.91	15	0	12.44	60	6	8.17	95	18	3.45	130	39	32.97	300	63
Crawford	22.39	45	1		90	11	4.32	100	30		110	50	26.71	345	92
Delta	5.20	10	0		20	3		20	7	28.01	65	12	33.21	115	22
Dickinson	23.24	40	1		80	12	0.78	80	31		80	49	24.02	280	93
Eaton	0.53		0	19.00	40	1	21.95	175	12		200	43	41.48	415	56
Emmet	4.50	10	0	26.21	70	3		125	19		125	45	30.71	330	67
Genesee	30.98	255	1		510	18	15.60	625	47		740	82	46.58	2,130	148
Gladwin	29.28	50	1	12.26	125	16		145	45		145	78	41.54	465	140
Gogebic	28.40	65	1		130	14		130	38	1.43	135	61	29.83	460	114
Grand Traverse				26.01	55	1	20.15	155	14		195	45	46.16	405	60
Gratiot	9.50	15	0		35	5	2.66	40	13	10.35	65	22	22.51	155	40
Hillsdale	47.86	120	2	12.80	275	25	23.25	365	71	19.26	475	132	103.17	1,235	230
Houghton	3.21	10	0	4.83	30	2	0.98	45	7		45	14	9.02	130	23
Huron	4.95	10	0	7.83	35	3		50	10	15.68	80	23	28.46	175	36
Ingham	9.45	35	0	1.25	75	5	6.48	115	14		150	26	17.18	375	45
Ionia	13.40	50	1	9.11	85	6		85	23	12.16	130	42	34.67	350	72
Iosco	26.70	45	1	6.82	105	14		115	39		115	66	33.52	380	120
Iron				8.20	15	0		30	4	0.33	30	11	8.53	75	15
Isabella	32.45	55	2	0.23	110	16		110	43		110	70	32.68	385	131
Jackson	20.53	50	1	11.95	125	11	5.51	165	34		175	61	37.99	515	107
Kalamazoo	17.63	40	1	1.25	80	9		85	24		85	39	18.88	290	73

Kalkaska	9.23	20	0		35	5	19.56	70	13		110	30	28.79	235	48
Kent	60.24	285	3	5.61	585	36	7.42	650	98		695	167	73.27	2,215	304
Keweenaw	2.00	5	0	2.40	10	1		15	4		15	8	4.40	45	13
Lake	15.14	25	1		55	7		55	20		55	33	15.14	190	61
Lapeer	25.37	50	1	13.60	120	14	17.48	180	41	9.27	230	92	65.72	580	138
Leelanau	5.90	10	0	2.53	30	3		35	9		35	17	8.43	110	29
Lenawee	26.15	50	1	1.16	105	13	57.38	225	39	5.59	350	85	90.28	730	138
Livingston	54.69	115	2	10.92	245	31		265	85	3.89	275	142	69.50	900	260
Luce	17.66	30	1		65	9		65	23	0.87	65	38	18.53	225	71
Mackinac	40.84	80	2	62.04	290	23		410	86		410	170	102.88	1,190	281
Macomb	36.62	135	2	5.59	285	18	8.49	335	52		365	91	50.70	1,120	163
Manistee							20.47	40	1		75	10	20.47	115	11
Marquette	35.20	80	2	5.80	175	17	0.29	185	50		185	83	41.29	625	152
Mason							25.63	50	1		100	13	25.63	150	14
Mecosta	20.38	40	1	20.92	115	11		155	37		155	72	41.30	465	121
Menominee	17.89	25	1		55	9		55	24		55	38	17.89	190	72
Midland	45.19	75	2		150	23		150	60		150	97	45.19	525	182
Missaukee	8.99	15			35	5		35	12		35	19	8.99	120	36
Monroe	60.79	150	4		295	32	5.38	305	88		320	144	66.17	1,070	268
Montcalm	5.80	10	0	4.37	30	3		35	10		35	18	10.17	110	31
Montmorency	12.00	25	1	0.38	45	6		45	16	6.77	60	26	19.15	175	49
Muskegon	19.40	50	1	9.48	130	10		155	30	7.39	175	55	36.27	510	96
Newaygo	8.25	15	0	2.00	35	4	27.92	90	14		145	34	38.17	285	52
Oakland	30.27	160	2		325	21	34.87	465	56	1.28	610	107	66.42	1,560	186
Oceana	18.00	30	1	18.05	95	10		130	33		130	62	36.05	385	106
Ogemaw	10.55	20	0		40	6	8.86	55	15	9.69	85	28	27.10	200	49
Ontonagon	12.88	25	1	18.00	85	7	5.72	130	26	0.79	145	55	37.39	385	89
Osceola	21.21	45	1	24.52	150	12		205	40		205	78	45.73	605	131
Oscoda	16.81	35	1		65	8		65	23		65	36	16.81	230	68
Otsego	21.83	50	1	0.56	100	11	19.10	140	30		185	57	41.49	475	99
Ottawa	10.79	30	1	25.77	120	6	16.35	230	28		270	65	52.91	650	100
Presque Isle	6.89	15	0		30	4		30	9		30	15	6.89	105	28
Roscommon	24.60	50	1	3.32	110	12	22.98	165	36		215	69	50.90	540	118
Saginaw	28.16	140	2	11.37	315	20	17.03	415	59		475	107	56.56	1,345	188
Sanilac	18.08	35	1	9.92	85	9	53:81	205	32		310	79	81.81	635	121
Schoolcraft	4.03	10	0		15	2	23.02	60	7	12.06	125	21	39.11	210	30
Shiawassee	17.20	35	1		65	8	20.26	105	24		145	47	37.46	350	80
St. Clair	65.38	155	3	26.65	370	34		435	101		435	175	92.03	1,395	313
St. Joseph				1.17		0	52.95	105	4		205	27	54.12	310	31
Tuscola	22.61	30	1		55	11	17.84	80	31		100	58	40.45	265	101
Van Buren	31.37	65	2		135	15	3.90	140	44		150	67	35.27	490	128
Washtenaw	48.35	90	2		175	24	19.98	215	65		250	114	68.33	730	205
Wayne	1.76	15	0	1.02	65	1	17.40	275	8	1.14	475	27	21.32	830	36
Wexford	15.20	30	1	3.61	65	7	15.96	105	24		135	45	34.77	335	77
Totals	1,639.18	$4,035	$77	570.02	$9,270	$875	828.65	$12,590	$2,608	157.09	$14,990	$4,854	3,192.44	$40,885	$8,414

Table C-8

POPULATION BY COUNTIES

Rural & Urban

OFFICIAL 1960-1950 CENSUS

	1960			1950		
	Total	Rural	Urban	Total	Rural	Urban
Grand Total	7,823,998	2,583,961	5,240,037	6,372,009	1,938,744	4,443,265
Alcona	6,352	5,424	928	5,856	4,962	894
Alger	9,250	5,022	4,228	10,007	5,668	4,339
Allegan	57,729	37,711	20,018	47,493	31,550	15,943
Alpena	28,556	13,874	14,682	22,189	9,054	13,135
Antrim	10,373	6,450	3,923	10,721	7,078	3,643
Arenac	9,860	6,865	2,995	9,644	6,862	2,782
Baraga	7,151	3,763	3,388	8,037	4,719	3,318
Barry	31,738	21,773	9,965	26,183	16,804	9,379
Bay	107,042	46,022	61,020	88,461	30,679	57,782
Benzie	7,834	4,122	3,712	8,306	4,305	4,001
Berrien	149,865	86,041	63,824	115,702	57,586	58,116
Branch	34,903	20,150	14,753	30,202	16,063	14,139
Calhoun	138,858	66,873	71,985	120,813	50,273	70,540
Cass	36,932	25,365	11,567	28,185	18,126	10,059
Charlevoix	13,427	5,700	7,727	13,475	5,737	7,738
Cheboygan	14,550	7,801	6,749	13,731	7,121	6,610
Chippewa	32,655	13,264	19,391	29,206	10,683	18,523
Clare	11,647	7,396	4,251	10,253	6,235	4,018
Clinton	37,969	26,393	11,576	31,195	21,158	10,037
Crawford	4,971	2,956	2,015	4,151	2,085	2,066
Delta	34,298	13,260	21,038	32,913	12,513	20,400
Dickinson	23,917	6,363	17,554	24,844	6,869	17,975
Eaton	49,684	26,576	23,108	40,023	20,431	19,592
Emmet	15,904	7,278	8,626	16,534	7,314	9,220
Genesee	374,313	149,035	225,278	270,963	90,920	180,043
Gladwin	10,769	7,617	3,152	9,451	6,779	2,672
Gogebic	24,370	7,570	16,800	27,053	8,734	18,319
Grand Traverse	33,490	14,254	19,236	28,598	10,852	17,746
Gratiot	37,012	19,612	17,400	33,429	17,547	15,882
Hillsdale	34,742	21,027	13,715	31,916	18,984	12,932
Houghton	35,654	20,675	14,979	39,771	23,742	16,029
Huron	34,006	21,040	12,966	33,149	20,867	12,282
Ingham	211,296	62,534	148,762	172,941	51,248	121,693
Ionia	43,132	22,843	20,289	38,158	19,781	18,377
Iosco	16,505	11,773	4,732	10,906	6,973	3,933
Iron	17,184	6,648	10,536	17,692	6,465	11,227
Isabella	35,348	19,180	16,168	28,964	16,672	12,292
Jackson	131,994	76,307	55,687	108,168	52,955	55,213
Kalamazoo	169,712	79,149	90,563	126,707	61,564	65,143
Kalkaska	4,382	3,061	1,321	4,597	3,347	1,250

Table C-8—Continued

	1960			1950		
	Total	Rural	Urban	Total	Rural	Urban
Kent	363,187	110,076	253,111	288,292	93,847	194,445
Keweenaw	2,417	2,152	265	2,918	2,558	360
Lake	5,338	4,178	1,160	5,257	4,108	1,149
Lapeer	41,926	28,812	13,114	35,794	23,660	12,134
Leelanau	9,321	7,922	1,399	8,647	7,329	1,318
Lenawee	77,789	38,176	39,613	64,629	31,068	33,561
Livingston	38,233	28,684	9,549	26,725	18,350	8,375
Luce	7,827	5,215	2,612	8,147	5,345	2,802
Mackinac	10,853	6,577	4,276	9,287	5,769	3,518
Macomb	405,804	92,854	312,950	184,961	90,511	94,450
Manistee	19,042	8,910	10,132	18,524	8,106	10,418
Marquette	56,154	21,347	34,807	47,654	15,018	32,636
Mason	21,929	10,495	11,434	20,474	9,111	11,363
Mecosta	21,051	10,994	10,057	18,968	10,880	8,088
Menominee	24,717	11,897	12,820	25,299	12,506	12,793
Midland	51,450	22,407	29,043	35,662	20,353	15,309
Missaukee	6,784	5,515	1,269	7,458	6,233	1,225
Monroe	101,120	70,559	30,561	75,666	48,873	26,793
Montcalm	35,795	21,561	14,234	31,013	18,390	12,623
Montmorency	4,424	3,979	445	4,125	3,683	442
Muskegon	149,943	70,492	79,451	121,545	45,913	75,632
Newaygo	24,160	17,284	6,876	21,567	15,173	6,394
Oakland	690,583	205,771	484,812	396,001	152,854	243,147
Oceana	16,547	10,750	5,797	16,105	10,426	5,679
Ogemaw	9,680	6,912	2,768	9,345	6,520	2,825
Ontonagon	10,584	8,226	2,358	10,282	7,975	2,307
Osceola	13,595	7,977	5,618	13,797	8,388	5,409
Oscoda	3,447	3,447	0	3,134	3,134	0
Otsego	7,545	4,468	3,077	6,435	3,754	2,681
Ottawa	98,719	55,515	43,204	73,751	40,986	32,765
Presque Isle	13,117	6,386	6,731	11,996	6,147	5,849
Roscommon	7,200	6,333	867	5,916	5,039	877
Saginaw	190,752	83,806	106,946	153,515	54,514	99,001
Sanilac	32,314	21,929	10,385	30,837	21,427	9,410
Schoolcraft	8,953	4,078	4,875	9,148	4,062	5,086
Shiawassee	53,446	24,965	28,481	45,967	19,630	26,337
St. Clair	107,201	50,649	56,552	91,599	38,806	52,793
St. Joseph	42,332	19,456	22,876	35,071	14,336	20,735
Tuscola	43,305	29,807	13,498	38,258	25,635	12,623
Van Buren	48,395	29,328	19,067	39,184	22,766	16,418
Washtenaw	172,440	72,337	100,103	134,606	57,346	77,260
Wayne	2,666,739	316,334	2,350,405	2,435,235	150,497	2,284,738
Wexford	18,466	6,634	11,832	18,628	6,413	12,215

Table C-9

ESTIMATED CONSTRUCTION COSTS USED FOR COUNTY IMPROVEMENTS

Item of Work	Unit	Unit Cost Range
Grading and Drainage		
Grade Width 32′ to 38′		
Light Soils	Per Mi.	$10,000 to $14,000
Heavy Soils	Per Mi.	14,000 to 17,000
Drainage Structures		
12″ to 48″ Class A Culvert	Lin. Ft.	3.00 to 15.00
12″ to 48″ Class B Culvert	Lin. Ft.	4.00 to 20.00
12″ to 48″ Sewer Pipe	Lin. Ft.	3.50 to 17.50
6″ Drain Tile	Lin. Ft.	1.00 to 1.20
Manholes		$35/ft. of depth
Catch Basins		$30/ft. of depth
Inlets		$30/ft. of depth
Aggregate Base Course (6″ to 8″)	Sq. Yd.	0.45 to 0.65
Sub-base Material (12″ to 20″)	Sq. Yd.	0.85 to 2.25
Bituminous Surface Treatment: (4.06)		
Prime and Double Seal	Per Mi.	5,000
Prime and Triple Seal	Per Mi.	6,300
Bituminous Aggregate Surface: (4.09)		
1 — course, 170#	Per Mi.	7,000
2 — course, 225#	Per Mi.	8,500
Bituminous Aggregate Surface: (4.11)		
Plant Mix — 2 course, 225#	Per Mi.	15,000
Bituminous Concrete Surface: (4.12)	Per Mi.	19,000
8″ Uniform, Reinf. Concrete Pavement (22′)		
(Surface only)	Per Mi.	70,000
Curb and Gutter	Lin. Ft.	2.00 to 3.00
Sidewalk	Sq. Ft.	0.50 to 0.75
Structures 20′ and over:		
New Construction	Sq. Ft.	20.00 to 35.00
Widening	Sq. Ft.	30.00 to 40.00
Box Culverts	Cu. Yd.	45.00 to 65.00
R.R. Flashing Light Signal (Single Track)		5,000
R.R. Flashing Light Signal and Short Arm Gates		11,500

Engineering and Contingencies:

To the estimated construction costs add 5% for preliminary engineering and 10% for construction engineering and contingencies.

Estimates:

It is suggested that the above cost ranges be used for estimating purposes, unless extra work by reason of additional design requirements cause the construction to cost more. If higher costs are used, report extras and changes on back of needs form. Append additional sheets to the form if necessary.

Table C-10

DESIGN STANDARDS FOR RURAL COUNTY PRIMARY ROADS

			2 Lane												Multi-Lane Divided
1980 Average Daily Traffic			Under 100		100-400		400-1000		1000-2000		2000-3000		3000-5000[1]		
Terrain			Flat	Rolling	Flat	Rolling	Flat	Rolling	Flat	Rolling	Flat	Rolling	All		All
Design Speed, M.P.H.			45	35	55	45	60	50	70	60	70	60	70		70
Operating Speed, M.P.H.			30-35	25-30	40-45	35-40	45-50	40-45	45-50	45-50	45-50	45-50	45-50		45-50
Maximum DHV Equivalent Pass. Vehicles	Percent 1500′ Sight Distance Available Per Mile	100%	Not Applicable		Not Applicable		Not Applicable		Not Applicable		900 Total		900 Total		1200 per Lane with Access Control
		80%									860 Total		860 Total		750 per Lane without Access Control
		60%									800 Total		800 Total		
Curvature Maximum Degree			8	14	7	11	6	9	4	6	3	4	3		3
Gradient Maximum Percent			5	7	5	7	5	6	3	4	3	4	3		3
Stopping Sight Distance-Feet			315	240	415	315	475	350	600	475	700	600	700		700
Passing Sight Distance-Feet[2]			1500	1100	1850	1500	2000	1700	2300	2000	2300	2000	2300		Not Applicable
Surface Type			Low (C)		Intermed. (D)		Intermed. (E)		Intermed. (E)		High (F)		High (F)		High (F)
Lane Width-Feet			10		11		11		11		12		12		12
Shoulder Width-Feet			2@4		2@6		2@8		2@8		2@8		2@10		2@10 Rt. 8 Lt.
Right of Way-Minimum Width-Ft.			66		80		100		120		120		150		200-250[3]
Bridges	Design Load		← H-15 →		← H-20 →				← H-20 →				S-16 →		
	Clearance Width, Feet		24		26		28		28		30		Under 100′ long, full pavement Over 100′ long, pavement plus 6′		
	Vertical Clearance		← 14.5 Minimum →												
Grade Separations[4] Basic Design as for Bridges			← None Required →										Special Study for Warrants →		

[1] For volumes in this range, capacity studies may indicate need for 4 lanes.
[2] These sight distances are desirable, but where excessive earthwork costs would be necessary to attain these sight distances; local county procedures will govern.
[3] Desirable median width from edge of pavement to edge of pavement—46′ for 6-lane highway and 70′ for 4-lane highway.
[4] Railroad Crossings—Automatic railroad grade crossing protection devices should be provided when average daily traffic times number of trains per day exceed 3,500.

Table C-11

CONSTRUCTION STANDARDS FOR COUNTY PRIMARY ROADS IN INCORPORATED AREAS

Design Features	All Cities			Cities of over 5,000 population			Cities of under 5,000 population		
	Controlled Access[1]			Free Access			Free Access		
				Downtown area	Intermed. area	Outlying area	Downtown area	Intermed. area	Outlying area
1980 Design Hour Traffic Volume Total for No. of Lanes Shown	7200 to 9000	Up to 6000	County Primary by-passes only under 750[2]	SEE BELOW					
Surface Type[10]	F			F	F-or-E[3]		F	F, E-or-D[3]	
Number of Lanes	6[4]	4[4]	2[4]	Controlled by anticipated 1980 traffic volumes and operating conditions determine required street width by consulting hourly capacity tables[5]					
Surface Width	72′	48′	24′						
Curbs and Sidewalks	Not required: Pedestrians not permitted Pedestrian Crossings to be provided where needed			Yes	Yes	Only as required	Yes	Yes	Only as required
Shoulder Width	12′	12′	10′	——	——	8′	——	——	8′
Median Width	Minimum 4′ if not mountable, otherwise 20′		——	20′ Median where design hour traffic volume exceeds 750 per lane					
Parking	Not Permitted Except on Frontage Roads			For streets having a design hour traffic volume exceeding 750, parking generally to be discouraged, with the parallel parking permitted only during off-peak hours. Parallel parking permitted for lesser traffic volumes.					
Illumination	Continuous		at Intersec.	Continuous	At intersections		Continuous	At intersections	
Intersection Treatment 10% or more of Traffic on Intersecting Street	Full Access Control		(6)	Progressive traffic signal system or fixed time signal where warranted Stop sign control for lower traffic volumes					
Less than 10% of traffic on Intersecting Street			(7)	Traffic or pedestrian actuated signals where warranted or stop sign control.					
Structures Width	Under 100′ long—full roadway width over 100′ long—pavement width[8] plus 6′ plus median			Pavement plus sidewalks					
Vertical Clearance	14.5′			14.5′					
Loading	H-20 - S-16			For heavy commercial traffic H-20-S-16[9] Other H-20					
Railroad Crossing Separation	At all Railroad Crossings			Main Line crossings on streets carrying heavy traffic volume where practical and economically feasible.					
Railroad Grade Crossing Protection	——			Flashing light signals at all crossings without watchman or flagman and where average daily traffic x number of trains=3500 or more.					

[1] Standards for controlled access arterials based on 40 m.p.h. operating speed. Access permitted only at interchanges and intersections with other arterials. Access from abutting property by frontage streets where required.
[2] Applies specifically to new locations of 2-lane County Primary routes by-passing business areas of municipalities.
[3] Character and amount of traffic should determine the type of surface required.
[4] 12 foot traffic lanes.
[5] Street width chosen should be divisible into even numbers of 11′ or 12′ lanes, except where one-way operation is planned.
[6] Grade separations where warranted and feasible otherwise channelized and signalized intersection at grade.
[7] Channelized and signalized intersection at grade.
[8] Includes shoulders of approaches.
[9] Heavy commercial traffic includes large numbers of tractor trailers.
[10] F (High), D & E (Intermediate)

Table C-12

DESIGN STANDARDS FOR COUNTY LOCAL ROADS – 1960

Service Characteristics	Surface Type	Surface Width	Grade Width
ROAD TRAFFIC DETERMINATION			
1980 Average Daily Traffic [1]			
1. Over 2000 (High Density Area)	High (F)	24′	40′
2. 1000-2000	Intermediate (E)	22′	38′
3. 400-1000	Intermediate (D)	22′	38′
4. 100- 400	Surf. Tr. Gravel (D)	20′	32′
5. Under 100	6″ Gravel (C)	20′	28′
RECREATIONAL ROADS			
1. Heavily Developed Area	Surf. Tr. Gravel (D)	22′	38′
2. Sparsely Developed Area	4″ Gravel [1]	...	26′
LOCAL SERVICE ROADS—EXISTING USE			
1. School Bus—Milk Route	Surf. Tr. Gravel (D)	20′	28′
2. Rural Mail Route	4″ Gravel [1]	...	24′
3. Seasonal Trail [4]			
a. Required as public road	[3]	...	...
b. Maintenance could be suspended	[3]	...	...
PLATTED STREETS [4]			
1. Heavily Developed Urbanized Area	Intermediate (E)	34′ [2]	34′ [2]
2. Sparsely Developed Urbanized Area	Intermediate (E)	24′	36′
3. Heavily Developed Resort Area	Surf. Tr. Gravel (D)	20′	32′
4. Sparsely Developed Resort Area	4″ Gravel [1]	...	24′

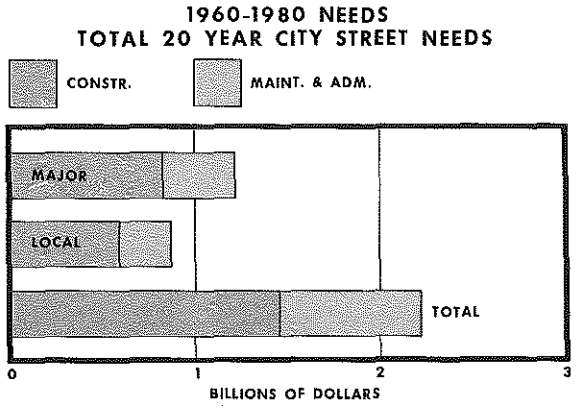
[1] Based on average summer traffic.
[2] Curbed section.
[3] To be considered as maintenance.
[4] Special services system listed under Other Services System on Form 1725.

Municipal Street Needs

In order to determine needs in Michigan cities and villages over 5,000 population, it was necessary for each municipality to establish a master street plan and a long range development program to eliminate the deficiencies on the various street systems. Such systems were predicated upon traffic criteria. In some cities the systems as established in Act 51 were adequate to meet future 20-year developments. In other cities it was necessary for local officials to conduct a comprehensive study of their future transportation requirements in order to determine needs on their street systems.

Future trunkline systems within the various cities and villages were determined. Cost estimates on these systems are reported in the chapter on trunkline needs.

In cities and villages under 5,000 population, a stratified sampling procedure was used to estimate needs. From a total of 407 municipalities under 5,000 population, 188 were selected representing various populations and geographic areas within the state. Staff engineers of the highway department in cooperation with local officials reviewed the street systems in the sample cities and determined the major and local street needs and estimated the cost of correcting the deficiencies. Costs in these sample cities were expanded to obtain major and local street needs in all municipalities under 5,000 population. In order to provide a street system adequate to serve traffic through 1980, $2.13 billion is required. Needed expenditures for construction, maintenance and administration are shown in the following graph.



GENERAL APPRAISAL PROCEDURE

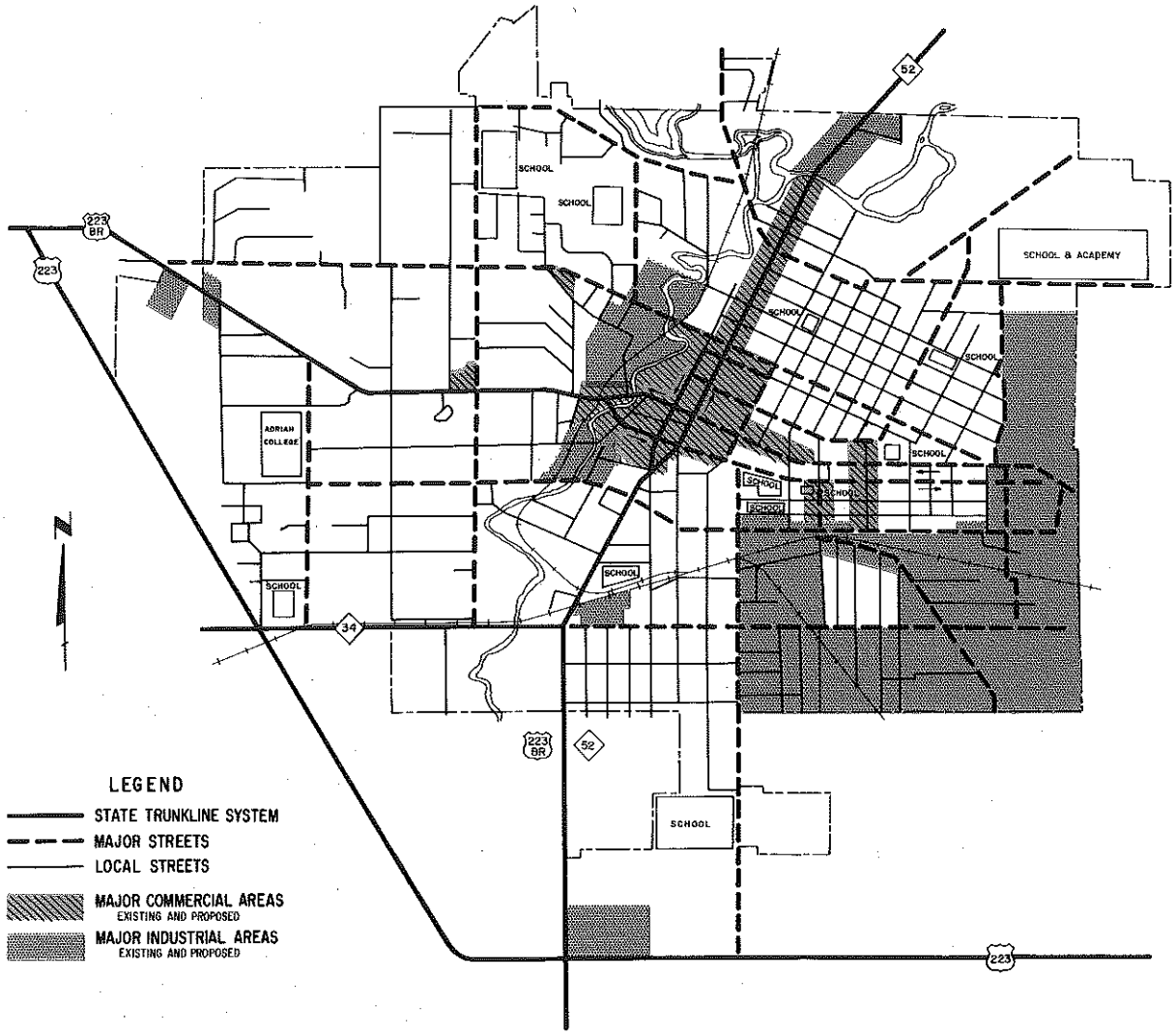
There were three objectives involved in the municipal street needs appraisal.

1. To provide a plan for an integrated street system, including state trunklines, county primary roads, major streets, and local streets.
2. To determine how best to fit present streets into desirable future plans at least cost, what new facilities are needed to complete the plan, and what the total cost would be.

3. To divide the 20-year plan into stages of work according to degree of urgency and practicability.

To accomplish these goals local officials completed a map showing the major and local street systems and their location. City officials also developed a land use map illustrating residential, commercial, public, and industrial areas within their respective cities. In order to complete the third objective each street was appraised section by section and construction needs were based upon a comparison of geometrics and physical features with the approved design standards in the manual of Procedures and Instructions. A copy of these standards appears at the end of the tables in this chapter.

LAND USE AND STREET CLASSIFICATION
CITY OF ADRIAN
(NEEDS STUDY)
1960 - 1980



Some of the guiding principals used in the study of municipal streets are as follows:

1. Proposed design of streets should anticipate the probable direction and extent of population, industry, business and traffic growth.
2. Reasonable freedom from delay should be provided with special attention given to major intersections.
3. Sound engineering judgment should be followed in determining future designs.
4. Consideration should be given to development of alternative routes to serve directional traffic movement.
5. Street widening should be done only when feasible and where the widening at least adds a full effective traffic lane or at least meets 1980 traffic capacity requirement.
6. Proposed improvement should be consistent with terrain and existing urban development.
7. Resurfacing or reconstruction should be in accordance with the estimated life expectancy of the existing surface.
8. Removal of parking should be considered particularly at peak periods to gain additional traffic capacity and better traffic operation. No construction project should be considered where diagonal parking is to be maintained. No construction project should be considered where provision for parallel parking will require additional right-of-way involving excessive costs.

City officials were requested to consider all relief measures through reasonable operational change before major construction was proposed. These include removal of parking at peak hours, removal of parking at all times, conversion to one-way operations, regulation of turning movements, striping of traffic lanes, better signal operations, and intersection channelization.

Construction in this appraisal is the improving of an existing street by correcting grade, drainage structures, width, alignment or surface, and the building of streets and pavements. Also included is the building of bridges or other street structures and the repair of such structures by strengthening, widening and placement of piers and abutments. The signing of newly constructed streets, major resigning projects and the installation, replacement or improvement of traffic signals was also considered in construction. The method of determining construction needs is explained under "Major Street Appraisal".

Maintenance is the routine labor and materials required to keep the street, roadbed, surface and drainage in good repair; prevent damage by water; repair and paint bridge and guard rails; provide for safe and convenient travel by keeping signs, signals and pavement marking in good condition and by snow and ice removal and street cleaning. Some of the items listed as maintenance were bituminous surface treatment on bituminous surface, adding gravel or stone surface to replace wear, reconditioning by scarifying and remixing, patching concrete and bituminous surfaces, curb construction and replacement of less than one block length, cleaning or repairing drainage structures, dust layers, sprinkling and flushing, and tree trimming.

Maintenance costs used in this appraisal were based upon past experience for the various surface types existing within municipalities. These costs were then expressed as cost per mile according to surface type and number of lanes. After these costs were reviewed by the Municipal Engineering Advisory Committee, they were adopted for use in this appraisal.

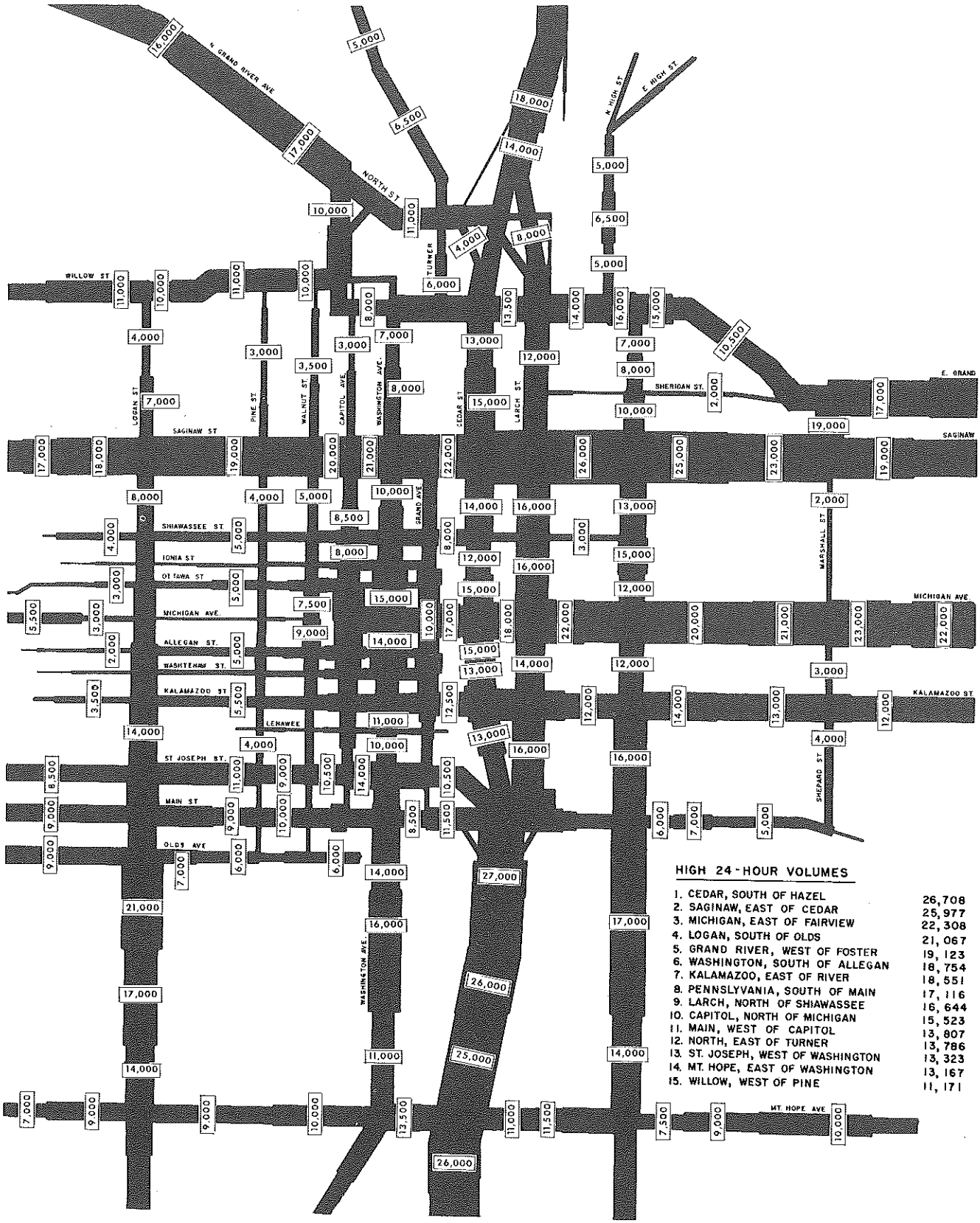
MAJOR STREET APPRAISAL

Four basic steps were involved in the determination of improvement needs:

1. Identification of each street section including the bridges and railroad crossings on a work map.
2. Inventory of the special characteristics and existing condition of each street section, bridge and railroad crossing.
3. Determination of character and degree of the existing and future deficiencies and estimating the time period in which the improvement should be made.
4. Determination of the type of improvement and estimated cost to correct the deficiencies and bring the street or bridge to standards commensurate with anticipated future traffic.

CITY OF LANSING

1960 24 HOUR VOLUME FLOW MAP



HIGH 24-HOUR VOLUMES

1.	CEDAR, SOUTH OF HAZEL	26,708
2.	SAGINAW, EAST OF CEDAR	25,977
3.	MICHIGAN, EAST OF FAIRVIEW	22,308
4.	LOGAN, SOUTH OF OLDS	21,067
5.	GRAND RIVER, WEST OF FOSTER	19,123
6.	WASHINGTON, SOUTH OF ALLEGAN	18,754
7.	KALAMAZOO, EAST OF RIVER	18,551
8.	PENNSLYVANIA, SOUTH OF MAIN	17,116
9.	LARCH, NORTH OF SHIAWASSEE	16,644
10.	CAPITOL, NORTH OF MICHIGAN	15,523
11.	MAIN, WEST OF CAPITOL	13,807
12.	NORTH, EAST OF TURNER	13,786
13.	ST. JOSEPH, WEST OF WASHINGTON	13,323
14.	MT. HOPE, EAST OF WASHINGTON	13,167
15.	WILLOW, WEST OF PINE	11,171

Step 1 Identification. Each street was appraised section by section. A section is continuous, of generally uniform characteristics and traffic, and requires the same standard of improvement in the same time period. Each street section was identified on a map by a number, and arrows were drawn to indicate limits of the project. This aided in the review of the data submitted and insured complete coverage. Bridges and railroad crossings were numbered with either a B or an X prefix.

Step 2 Inventory. This information included such data as surface type and width, remaining surface life, right of way widths, and soil type. Information on traffic was requested including peak hour volume, practical capacity, percent of commercial traffic, and the year that capacity would be exceeded.

The engineer could calculate the remaining surface life of each pavement from the year that the surface was built. Average surface lives of various types of surfaces from a national road life study were included in the survey manual to assist the engineer. The knowledge of the local conditions and the experience of the engineer was very important in determining remaining surface life.

Another basic factor in the inventory was traffic capacity. Average hourly tables were included in the instruction manual. Capacities in these tables reflect such conditions as area of the city; i.e., downtown, intermediate, or outlying, type of street operation; i.e., one-way or two-way, extent of parking, amount of green signal time available in the hour, and width of the street. After the engineer determined the 1960 design hour volume by means of actual traffic count, he estimated the 1980 D.H.V. for each street based upon the general economy of the area, future traffic growth and demand, and the type of service the street was intended to provide in the long-range plan for his city.

If the 1960 D.H.V. exceeded the capacity of the street as determined from the appropriate hourly capacity table in the manual, the year of deficiency was entered as 1960. If the 1980 D.H.V. did not exceed the capacity, the street was considered adequate from a traffic standpoint. If the capacity was between the 1960 D.H.V. and the 1980 D.H.V., this capacity was compared to values obtained from a straight line projection of the 1960 D.H.V. to the 1980 D.H.V. in order to determine the year in which the capacity of the street would be exceeded.

Step 3 Character of Deficiencies and the period in which they will become critical. The geometric, capacity, and the physical condition of each mile of street, design load or clearance width of each bridge and the type of protection at each railroad crossing was appraised to determine the degree of adequacy for a 20-year period.

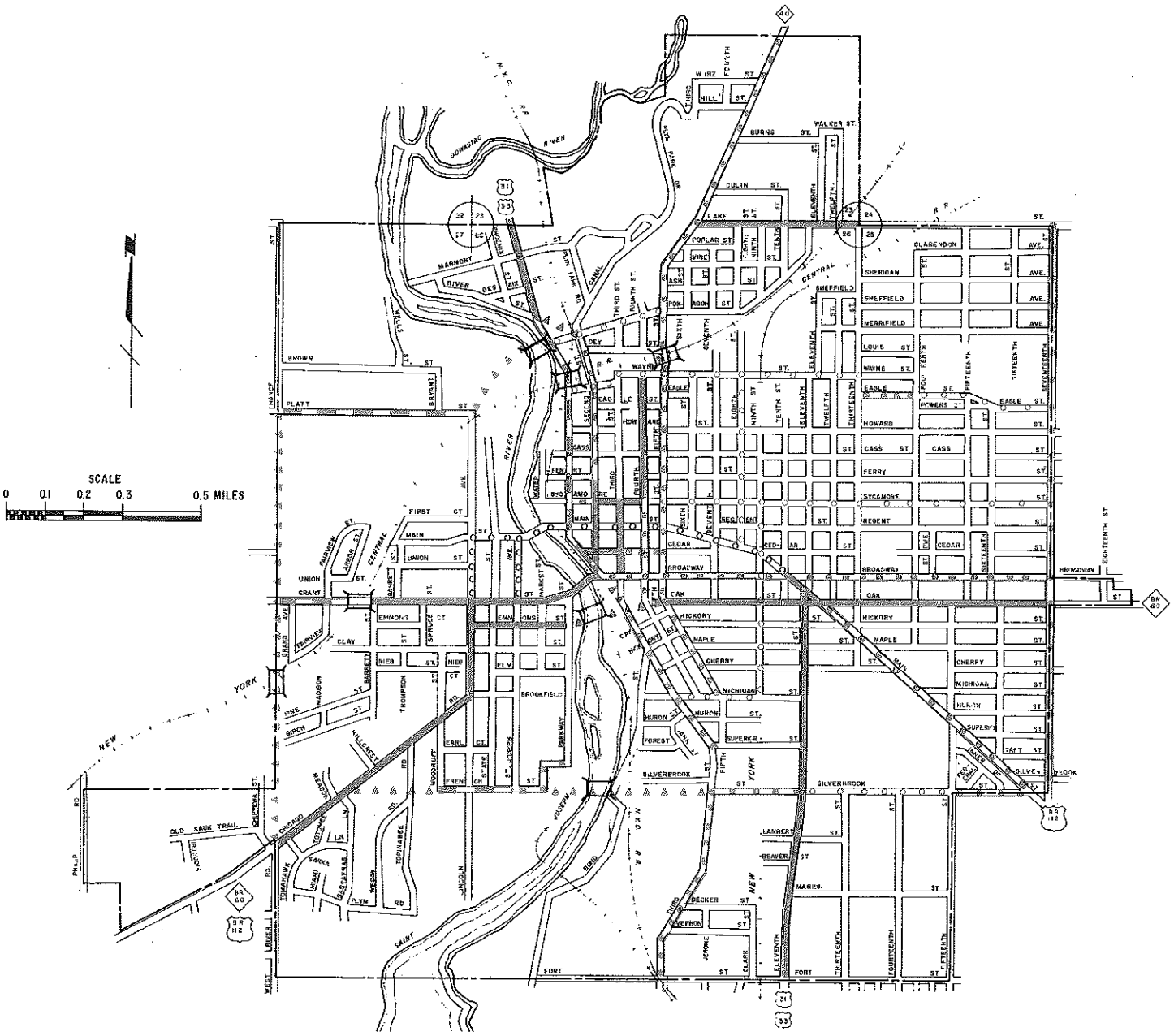
One of the conditions rated was street width. The basic factor in this analysis was traffic capacity. If traffic capacity was exceeded on a street section within 5 years, the street was rated as critical. If capacity was exceeded in 20 years, the street section was rated as adequate. Another condition rated was surface and/or base condition. The engineer's experience and the calculated remaining surface life determined the rating for base and surface condition. Such conditions as inadequate right-of-way, inadequate curb and gutter, and poor drainage conditions were considered of lesser importance. However, the existence of two or more deficiencies of these types might require critical attention. If replacement or improvement of curb was less than block length, this item was considered as maintenance. If the cost of correcting minor deficiencies was less than $1000 on a street section and could be reasonably corrected through better maintenance, the street section was not considered as a construction project for the purposes of this study.

In programming the schedule of improvements, economic trends, and engineering judgment were taken into consideration. Even though the financial plan was outside the scope of the Engineering phase of the Needs Study, each city was requested to indicate the degree of urgency of the proposed improvement in one of four time periods. The criteria for this determination was the remaining physical life of the surface and the year that capacity would be exceeded.

Step 4 Determining Type of Improvement and Estimated Cost

Design standards based upon 1980 design hour volume and location of the route in downtown,

TRUNKLINE AND MAJOR STREET NEEDS
IN THE CITY OF NILES
1960 - 1980



STATE TRUNKLINES

- RESURFACING & WIDENING
- BASE & SURFACE
- RECONSTRUCTION
- NEW CONSTRUCTION
- TURNBACK

MAJOR STREETS

- RESURFACING & WIDENING
- BASE & SURFACE
- RECONSTRUCTION
- NEW CONSTRUCTION
- TURNBACK

intermediate or outlying areas were given in the instruction manual. The engineer selected the appropriate design for each street section based on traffic volume using the design standard tables.

Cost estimates were based upon 1958 contract prices. Preliminary engineering and direct project engineering were included in the construction cost. Unit cost range for the various items of work such as earth excavation, drainage base and sub-base material, surfaces, and curb and gutter were included in the instruction manual.

The development of a new shopping center, large housing project, public buildings, parking area, or recreational area could generate traffic out of proportion to the normal trends within the city. In this case, a higher type of design was used.

In some cases, relief measures such as removal of parking during peak hours, conversion of two-way traffic to one-way, development of signal timing, restricting turning movement, or construction of channelizing islands could increase traffic to meet 1980 requirements so that widening was not necessary. If all of these measures did not increase capacity to meet 1980 volumes, then the existing facility had to be widened.

If the percentage of commercial trucks using a street was extremely high, then a higher type design had to be selected.

Where local conditions were exceptional, the local engineer was requested to qualify any substantial changes in design type in the remarks.

All of the steps in the appraisal were outlined in the instruction manual. The experience and judgment of engineers in each city and village contributed to make this a realistic and practical appraisal of needed improvements on municipal streets.

LOCAL STREET APPRAISAL

Local streets were appraised in a manner similar to the procedure used on the major streets. Subdivision streets within the same subdivision, having the same existing characteristics and requiring similar improvements during the same time period were grouped.

Standards used in the local streets appraisal appear at the end of this chapter. The proposed minimum specifications for construction of a local street consist of a six-inch base of gravel, stone or slag on a properly drained subbase with a ¾ inch bituminous surface course. On relatively low traffic volume streets this could be modified to a surface consisting of prime and double seal. In sparsely populated areas in which there was no anticipated development, the minimum construction standards was a six-inch stabilized aggregate base course.

MUNICIPAL STREETS

In 1960 there were 16,112 miles of streets, including urban trunklines and county road extensions, within the 509 municipalities in Michigan. Although this total represents only 14 percent of the total state highways, roads and streets, 49 percent of the total vehicle miles of state travel occurs on these streets. The most critical deficiency requiring attention on municipal streets is lack of capacity.

Needed construction requirements on these streets totals 13,997 miles of improvement at a cost of $3.24 billion. Following is a breakdown of this cost.

TOTAL MUNICIPAL CONSTRUCTION NEEDS
1960-1980

System	Miles	Cost ($1,000)
State Trunklines	964	$1,641,840
Major Streets	3,503	884,360
County Primary Roads	703	172,670
Local Streets	8,827	543,220
TOTAL	13,997	$3,242,090

The miles of different type of work required in these improvements are:

TOTAL MUNICIPAL STREET IMPROVEMENT MILES BY TYPE OF WORK
1960-1980

Type of Work	State Trunklines	Major Streets	County Primary Roads	Local Streets	Total (Miles)
Freeways	218	16	1	—	235
New Construction	45	285	53	1,160	1,543
Reconstruction	53	1,294	138	2,329	3,814
Resurfacing and Widening	648	1,908	511	5,338	8,405
TOTAL	964	3,503	703	8,827	13,997

Urban Trunkline Improvement Cost

A large portion of the total municipal needs is included in the urban trunklines. While the State Highway Department is responsible for construction and maintenance of trunklines within municipalities, the legislature has provided that cities and villages shall share in the state's construction costs. The municipal participation according to present law is on a sliding scale ranging from 25 percent for cities over 50,000 population to 22.5 percent for cities 40,000 to 49,999, and 17.5 percent in cities 30,000 to 39,999. Cities with population less than 30,000 bear no cost of trunkline improvements.

A breakdown of urban trunkline costs by population groups is illustrated in the following table.

URBAN TRUNKLINE CONST. COSTS: 1960-1980
(In Thousands)

Pop. Group	% Mun. Part of State Total	Urban - Interstate				Urban - Other T.L. Systems				Total			Grand Total
		Fed.	State	Mun.	Total	Fed.	State	Mun.	Total	Fed.	State	Mun.	
50,000 & over	25.0	$540,322	$45,027	$15,009	$600,358	$278,643	$208,982	$69,661	$557,286	$ 818,965	$254,009	$84,670	$1,157,644
40,000 - 49,999	22.5	55,597	4,787	1,390	61,774	12,294	9,528	2,766	24,588	67,891	14,315	4,156	86,362
30,000 - 39,999	17.5	5,648	518	110	6,276	4,186	3,453	733	8,372	9,834	3,971	843	14,648
10,000 - 29,999	0.0	105,517	11,724	0	117,241	48,210	48,209	0	96,419	153,727	59,933	0	213,660
5,000 - 9,999	0.0	20,740	2,304	0	23,044	14,773	14,772	0	29,545	35,513	17,076	0	52,589
1,000 - 4,999	0.0	13,027	1,448	0	14,475	36,439	36,438	0	72,877	49,466	37,886	0	87,352
1 - 999	0.0	47	5	0	52	14,767	14,766	0	29,533	14,814	14,771	0	29,585
Total		$740,898	$65,813	$16,509	$823,220	$409,312	$336,148	$73,160	$818,620	$1,150,210	$401,961	$89,669	$1,641,840

This table shows the percentage of matching funds for federal, state and local agencies on urban trunkline projects. In special cases such as Wayne County and the City of Detroit, the amounts needed to match federal and state funds are shared by Wayne County and the City of Detroit.

The State participation on the Interstate System is 10 percent and on the primary and secondary systems 50 percent. An indication of the possible municipal participation in urban trunkline construction, under existing legislation, can be determined from this table. City participation, in accordance with Act 51 of 1951 as amended, supplemented by Acts 153 and 252 of 1957, is calculated as a percentage of the State's share of the cost.

Municipal County Primary Cost

Improvements on county primary road extensions within municipalities totals approximately $173 million. The total 20-year costs of improvements on these roads by type of work are as follows:

COUNTY PRIMARY ROADS WITHIN MUNICIPALITIES

Type of Work	Miles	Cost ($1,000)
Freeways	1	$ 298
New Construction	53	16,104
Reconstruction	138	40,140
Resurfacing & Widening	511	91,040
Structures	—	25,088
Total	703	$172,670

Municipalities participate in varying degrees in construction improvements according to agreements with their respective county government on urban extensions of county primary roads.

Major Street Improvement Costs

By 1980 there will be approximately 4,386 miles of major city streets. Of this total 80 percent or 3,503 miles need improvement within the next twenty years, 54 percent or 1,908 miles of streets need resurfacing or widening and 37 percent or 1,294 miles need to be reconstructed. The total roadway cost excluding structures is $647,143,000. Of this total 30 percent is for right-of-way, 18 percent for grading and drainage, 43 percent for base and surface, and 9 percent for curb and gutter. Structures, and railroad protection total $237,217,000.

MAJOR STREET IMPROVEMENT COSTS

Type of Work	Miles	Cost ($1,000)
Freeways	16	$ 93,992
New Construction	285	72,808
Reconstruction	1,294	317,857
Resurfacing & Widening	1,908	162,486
Structures & RR Protection	—	237,217
Total	3,503	$884,360

The totals in this table represent the costs needed to overcome all backlog of deficiencies and to meet future design requirements needed in the next twenty years.

The urgency of major street improvements is illustrated when costs are broken down by time periods. A total of $319,380,000 or 36 percent is needed in 5 years, $537,560,000 or 61 percent is needed in 10 years, and $670,100,000 or 76 percent is needed in 15 years.

Municipalities Over 5,000 Population Improvement is required on 2,500 miles of major streets at a cost of $580 million within the 20-year period. The miles and cost of improving major streets according to the recommended 1980 design type of surfaces is shown below:

Surface Type	*Miles*	Cost ($1,000's)
Bituminous Surface Treatment	18	$ 2,060
Bituminous Aggregate	343	41,839
Bituminous Concrete (2-lane)	746	55,678
Bituminous Concrete (multilane)	939	282,609
Cement Concrete (2-lane)	244	39,373
Cement Concrete (multilane)	210	158,511
Total	2,500	$580,070

The projected 1980 mileage in municipalities over 5,000 population is 2,793. The following table gives the mileage and percent of mileage paved in 1960. It also shows the percent of total major street mileage that would be paved in 1980.

A Comparison of Dust Free Miles of Surface

	Miles	% of Total Mileage
1960	2,572	92.5
1980	2,793	100.0

The 1980 Surface Types would be:

	Miles
Bituminous Surface Treatment	32
Bituminous Aggregate	315
Bituminous Concrete (2-lane)	1,215
Bituminous Concrete (4-lane)	1,231

Local Street Improvements

Traffic congestion is seldom a problem on residential and other local streets. The prime need on local streets is improved surfaces with adequate drainage. Today there are 10,394 miles of local streets and 245 structures. At the beginning of this study 44 percent of the local street miles were inadequate due to base and surface condition. Inadequate stuructures totaled 30 percent. In order to overcome this backlog and build adequate local streets according to design standards in the engineering manual to meet future service demands, 8,827 miles of streets need improvement at a construction cost of $543,220,000, including structures. Cost to improve the roadway is $530,766,000. Of this total 1 percent is for right-of-way, 21 percent for grading and drainage, 65 percent for base and surface, and 13 percent for curb and gutter. The improvement costs by type of work are depicted in the following table:

LOCAL STREET IMPROVEMENT COSTS

Type of Work	Miles	Cost ($1,000)
New Construction	1,160	$126,991
Reconstruction	2,329	208,301
Resurfacing & Widening	5,338	207,928
Total	8,827	$543,220

In cities over 5,000 population 6,852 miles of local streets need improvement, or 81 percent at a total cost of $460,237,000. If the construction program is completed as programmed in this study, 99 percent of the local streets in cities over 5,000 population will have dust-free surfaces.

DETROIT METROPOLITAN AREA

A vital element of any local community plan is its layout of thoroughfares—the system of arteries that carry traffic generated by local neighborhoods, business districts and industrial plants as well as much traffic moving into or through the community. Throughout Michigan, the state system of highways is a vital factor in local street systems.

In many instances, state highways make up a major part of the total circulation system, and in these cases the modernization program becomes in effect a program to achieve substantial improvement in local movement.

As the streets in the business district are relieved of their burden of extraneous traffic, a unique opportunity is offered to reshape and redesign the downtown area to make it a more desirable place to shop, work and do business. This redevelopment is taking place in Detroit as well as Grand Rapids, Flint, Jackson, Lansing, Kalamazoo, and other Michigan cities. This development of the freeway system also has created need for local access streets and roads in order to obtain the greatest benefit possible of this high-type design system.

Total 20-Year Needs

A series of well developed long-range arterial street plans have been proposed for Detroit. To complete this program 2,864 miles of streets need improvement for a total construction cost of approximately $1.43 billion. The miles of improvement and expenditures required on the various street systems are shown on the following page.

All other structure costs are listed separately. This construction cost includes $117 million for improvement of structures, excluding structures on the freeway system.

To meet service requirements of future vehicle traffic on the Detroit local street system 2,025

miles of streets need improvement at a cost of $97,173,000. The major construction work on the local systems is resurfacing and widening of existing facilities.

An additional $266,111,000 is needed for maintenance and administration on the total street network. The grand total of expenditures needed in Detroit is $1,696,138,000.

Freeway Plan

Detroit, with the greatest concentration of people and vehicles in the state, provides the perfect illustration of the coordinated development of a freeway system with the major, collector, and local street systems for the most efficient flow of traffic in and through the city.

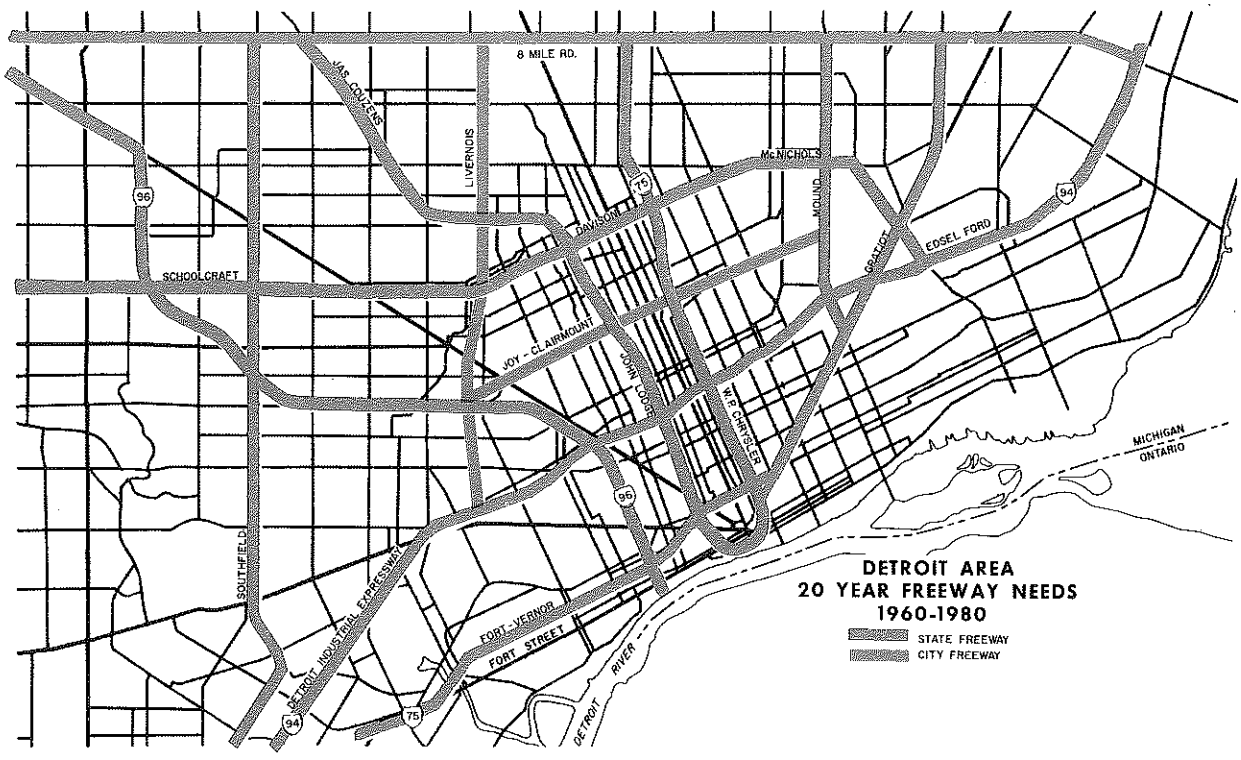
The Needs Study includes certain Interstate, State Trunkline, and Major street routes as part of this freeway system of controlled access highways in Detroit. Briefly, each group includes the routes on the following page.

CONSTRUCTION NEEDS FOR DETROIT

System	Miles	Cost ($1,000)
Interstate	48	$ 448,790
State Trunklines	65	444,105
Major Streets	629	421,727
Local Streets	2,025	97,173
County Primary Roads Within Detroit	97	18,232
Total	2,864	$1,430,027

Type of Work	Miles	Cost ($1,000)
*Freeways	125	$ 986,217
Widening & Resurfacing	572	62,060
Reconstruction	126	156,903
New Surface Arterials	16	16,121
Local Streets	2,025	92,213
Structures	—	116,513
Total	2,864	$1,430,027

*Freeway Costs include freeway structure costs.



Interstate—48 miles

Walter P. Chrysler Freeway
Fort-Vernor Freeway
Grand River Freeway
Edsel Ford Freeway

State Trunkline—65 miles

James Couzens
Southfield Expressway
John C. Lodge Expressway
Eight Mile Road
Schoolcraft—Davison—McNichols
Conner—McNichols
Gratiot—Schoenherr
Mound

City Expressways (Existing Major Streets)—12 miles

Jay—Clairmount
Livernois

The freeway system, therefore, represents 125 miles of controlled access highways which will cost some $986 million to complete. Utilizing the many important collector and distributor roads serving both the freeway system and the other major and local street system, the total Detroit area is well integrated by an overall pattern of highways thus circulating traffic in a most expeditious manner.

Financing Urban Trunkline Costs

Projects on the Interstate System in Detroit, such as the Walter P. Chrysler Freeway, are financed in accordance with Federal law in that 90 percent of the total construction cost is defrayed by Federal Aid with the state matching the remaining 10 percent. Other trunkline projects under the Federal Aid Primary System, such as the Southfield Expressway, receive 50 percent Federal Aid with the state contributing the remaining 50 percent of the construction cost. Of the states' share of the cost under both systems, Detroit participates in 25 percent of the states' share of the cost excluding Federal Aid, due to the fact that Detroit is in the population group of over 50,000. On this basis the construction cost breakdown for each system becomes:

	Interstate Freeways	Other Trunkline Freeways on Urban Systems
Federal Aid	90.0%	50.0%
State Funds	7.5%	37.5%
*Detroit Share	2.5%	12.5%
Total	100.0%	100.0%

*By law and by special agreement between the Wayne County Road Commission and the City of Detroit the county has agreed to participate in the cost of certain freeways on the trunkline system, exclusive of Federal and State funds. In essence the county has agreed to participate in one-half of Detroit's share of the cost of the Chrysler, Fort Vernor, Southfield, James Couzens, and part of the Grand River Expressways within Detroit. On this basis, and for these projects only, the cost breakdown becomes:

	Interstate Freeways	Other Trunkline Freeways on Urban Systems
	(Chrysler, Fort-Vernor, Grand River in part)	(Southfield, James Couzens)
Federal Aid	90.0%	50.0%
State Funds	7.5%	37.5%
County Funds	1.25%	6.25%
Detroit Funds	1.25%	6.25%
Total	100.0%	100.0%

DETROIT NEEDS BY SYSTEMS
ACCUMULATED BY 5-YEAR PERIODS

(In Thousands)

System	Cost Item	0–5	0–10	0–15	0–20
Interstate	Construction	$291,922	$447,514	$ 447,963	$ 448,790
	Maintenance	5,065	13,060	21,985	30,510
	Administration (6%)	17,819	27,634	28,197	28,758
	Total Program Cost	$314,806	$488,208	$ 498,145	$ 508,058
Trunkline	Construction	$ 56,951	$ 83,679	$ 392,991	$ 444,105
	Maintenance	2,535	5,305	10,620	19,130
	Administration (6%)	3,299	5,339	24,220	27,798
	Total Program Cost	$ 62,785	$ 94,323	$ 427,831	$ 491,033
Co. Primary	Construction	$ 6,424	$ 9,131	$ 13,875	$ 18,232
	Maintenance	4,195	8,495	12,910	17,405
	Administration (3%)	320	530	805	1,070
	Total Program Cost	$ 10,939	$ 18,156	$ 27,590	$ 36,707
City Major	Construction	$ 98,201	$197,528	$ 266,700	$ 421,727
	Maintenance	13,910	28,070	42,420	57,540
	Administration (3%)	3,365	6,770	9,270	14,380
	Total Program Cost	$115,476	$232,368	$ 318,390	$ 493,647
City Local	Construction	$ 34,144	$ 55,757	$ 77,457	$ 97,173
	Maintenance	16,565	33,130	49,695	66,260
	Administration (2%)	1,015	1,780	2,550	3,260
	Total Program Cost	$ 51,724	$ 90,667	$ 129,702	$ 166,693
Subtotal	Construction	$487,642	$793,609	$1,198,986	$1,430,027
	Maintenance	42,270	88,060	137,630	190,845
	Administration	25,818	42,053	65,042	75,266
	Grand Total	$555,730	$923,722	$1,401,628	$1,696,138

MUNICIPAL MAJOR AND LOCAL AVERAGE ANNUAL PROGRAM COSTS

Alternative programs have been developed for proposed city major and local street systems based upon overcoming the backlog of existing needs in 10 years, 15 years, and in 20 years. All three programs provide also for meeting future needs as they occur including maintenance and administration.

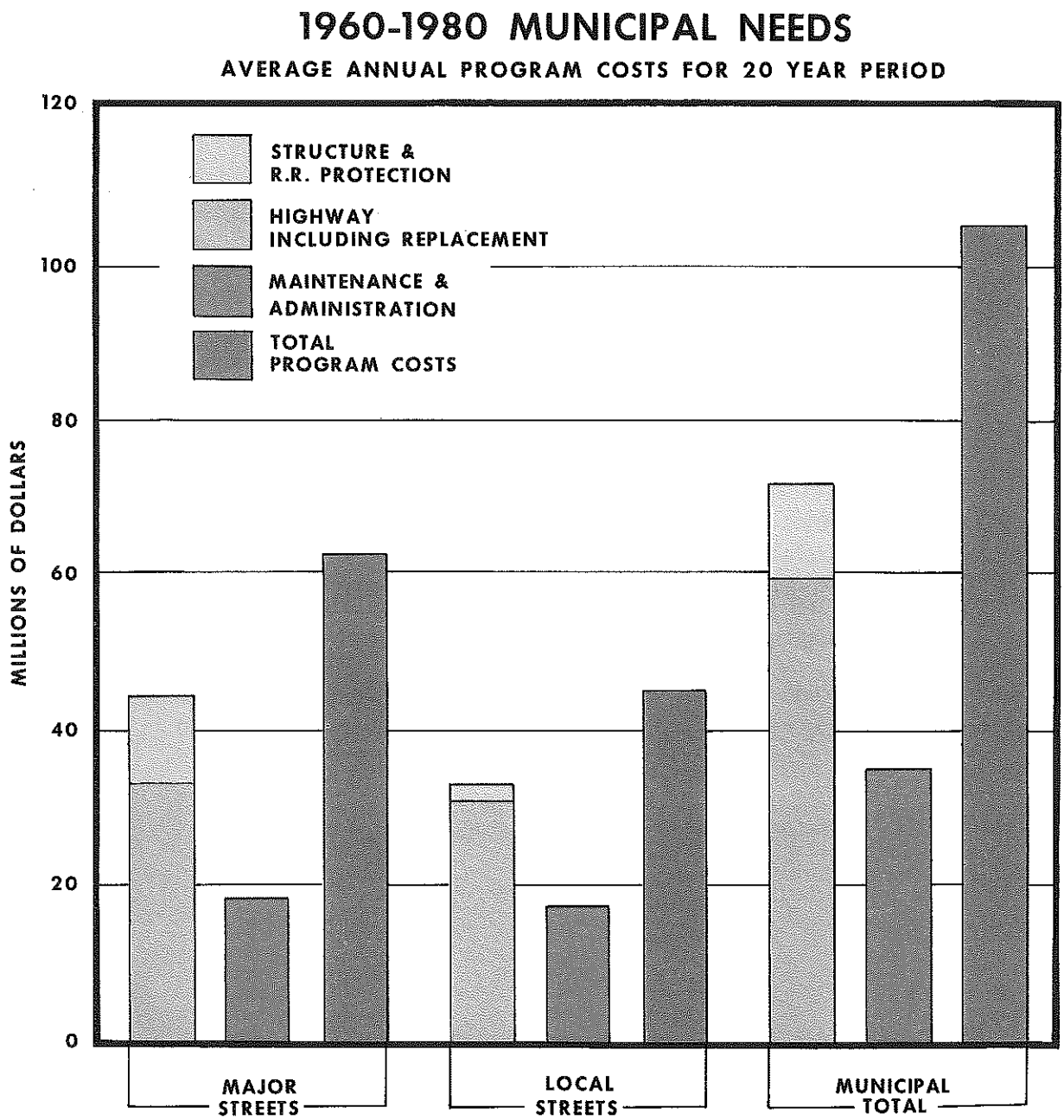
Elements of these programs are:

To eliminate the backlog of improvements needed now on all city major and local streets.

To meet future needs for improvement on these streets as they develop.

To maintain these streets at levels essential to preservation of capital investment in them and,

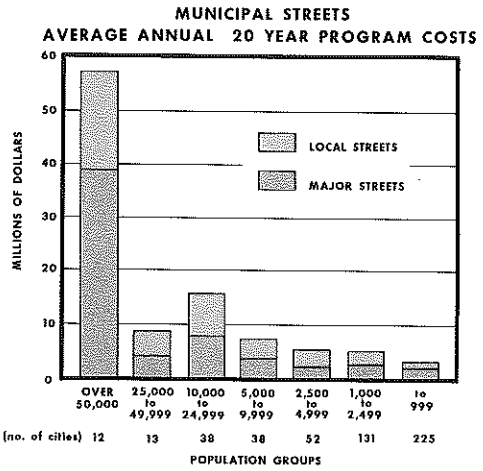
To provide for the engineering and business management costs required.



The annual expenditure required to overcome the backlog of needs and take care of future needs including maintenance and administration will be $106 million within a 20-year period; $112 million, if accomplished in a 15-year period; $128 million, if done in 10-year period.

The first 10-year annual program cost of $128 million provides for catching up on all existing deficiencies and meeting new needs as they occur in the first 10 years. The second 10-year annual program cost of $85 million is much less since only the needs that occur in this second 10-year periods have to be met.

A chart has been included to show the 20-year annual program costs for construction, maintenance, and administration on both the major and local streets. Of the total 20-year annual program cost, $106 million, 12 percent is for structure and railroad protection, 55 percent is for roadway including replacement, and 33 percent for maintenance and administration. In the chart on 20-year program costs by population groups,



the needs for 12 cities over 50,000 population totals $58 million which is 54 percent of the total cost. Costs for cities under 5,000 population represents only 13 percent of the total costs.

Regardless of which financial program is selected, the total 20-year cost for municipal street needs as a result of this appraisal is $2.13 billion.

AVERAGE ANNUAL PROGRAM COSTS
(Including Maintenance & Administration)
(In Thousands)

	10-Year Program (Based on catching up in 10 yrs. and meeting needs as they occur in last 10 yrs.)		15-Year Program (Based on catching up in 15 yrs. and meeting needs as they occur in last 5 yrs.)		20-Year Program (Based on catching up the needs within 20 yrs.)
			MAJOR STREETS		
	1st 10-Year Period	2nd 10-Year Period	1st 15-Year Period	Last 5-Year Period	20-Year Period
Construction	$ 53,756	$ 34,680	$ 44,673	$ 42,853	$ 44,218
Maint. & Admin.	18,028	18,314	18,095	18,399	18,171
Annual Program Cost	$ 71,784	$ 52,994	$ 62,768	$ 61,252	$ 62,389
			LOCAL STREETS		
Construction	$ 38,742	$ 15,580	$ 31,872	$ 13,028	$ 27,161
Maint. & Admin.	17,132	16,438	16,914	16,398	16,785
Annual Program Cost	$ 55,874	$ 32,018	$ 48,786	$ 29,426	$ 43,946
			TOTAL MAJOR AND LOCAL STREETS		
Construction	$ 92,498	$ 50,260	$ 76,545	$ 55,881	$ 71,379
Maint. & Admin.	35,160	34,752	35,009	34,797	34,956
Annual Program Cost	$127,658	$ 85,012	$111,554	$ 90,678	$106,335

Municipal Tables

Table M-1

TOTAL MUNICIPAL STREET NEEDS

In Thousands

	Construction	Maintenance	Administration	Total
Major	$ 884,360	$314,460	$48,960	$1,247,780
Local	543,220	303,760	31,940	878,920
Total	$1,427,580	$618,220	$80,900	$2,126,700

Table M-2

MAJOR MUNICIPAL STREET NEEDS

BY MUNICIPALITY AND POPULATION GROUP

In Thousands

0-20

Population Group	Construction: Road	Construction: Struc. & R.R.	Maint.	Admin. & Engr.	Total
250,000 & Over					
Detroit	$297,271	$124,456	$57,540	$14,380	$493,647
Total	297,271	124,456	57,540	14,380	493,647
100,000-249,999					
Grand Rapids	11,993	6,240	10,360	1,280	29,873
Flint	46,275	14,803	14,940	3,420	79,438
Total	58,268	21,043	25,300	4,700	109,311
50,000-99,999					
Lansing	21,941	16,832	6,360	2,040	47,173
Dearborn	1,859	420	6,220	380	8,879
Saginaw	9,610	12,417	6,180	1,260	29,467
Pontiac	17,354	10,517	5,320	1,500	34,691
Kalamazoo	9,619	950	5,980	740	17,289
Warren	7,931	0	4,780	580	13,291
Bay City	2,547	6,042	4,400	600	13,589
Jackson	5,213	5,278	4,240	680	15,411
Ann Arbor	3,887	853	3,640	380	8,760
Total	79,961	53,309	47,120	8,160	188,550
45,000-49,999					
Battle Creek	7,144	460	3,690	555	11,849
Muskegon	5,762	0	3,150	442	9,354
Royal Oak	1,698	156	3,340	258	5,452
Highland Park	857	0	1,320	108	2,285
Roseville	2,129	5	1,840	197	4,171
Total	17,590	621	13,340	1,560	33,111

Table M-2–Continued

Population Group	Construction: Road	Construction: Struc. & R.R.	Maint.	Admin. & Engr.	Total
40,000-44,999					
Hamtramck	729	0	1,180	94	2,003
Wyoming	4,692	330	3,780	426	9,228
Total	5,421	330	4,960	520	11,231
35,000-39,999					
Wyandotte	2,843	1,053	2,260	310	6,466
Port Huron	5,444	965	2,660	450	9,519
Total	8,287	2,018	4,920	760	15,985
30,000-34,999					
Allen Park	412	35	1,140	80	1,667
Total	412	35	1,140	80	1,667
25,000-29,999					
Ferndale	2,186	3,200	1,680	350	7,416
Lincoln Park	1,162	248	2,450	190	4,050
Southgate	1,824	0	1,030	140	2,994
Total	5,172	3,448	5,160	680	14,460
20,000-24,999					
Southfield	7,826	0	6,200	698	14,724
East Lansing	1,152	0	1,190	125	2,467
Monroe	1,892	1,901	1,710	271	5,774
East Detroit	637	0	1,440	104	2,181
Madison Heights	2,694	0	1,840	225	4,759
River Rouge	377	23	740	57	1,197
Total	14,578	1,924	13,120	1,480	31,102
15,000-19,999					
St. Clair Shores	6,984	0	1,850	442	9,276
Midland	4,294	777	4,870	497	10,438
Muskegon Heights	1,469	0	1,040	130	2,639
Benton Harbor	2,573	1,626	1,610	294	6,103
Adrian	1,441	288	1,500	161	3,390
Ypsilanti	1,322	2,489	1,580	269	5,660
Ecorse	225	0	720	47	992
Berkley	2,365	0	1,000	168	3,533
Sault Ste. Marie	1,397	2,100	2,010	279	5,786
Hazel Park	478	0	920	70	1,468
Livonia	4,996	75	2,800	389	8,260

Table M-2–Continued

Population Group	Construction				
	Road	Struc. & R.R.	Maint.	Admin. & Engr.	Total
Marquette	696	15	1,460	111	2,282
Mt. Clemens	1,583	432	1,330	167	3,512
Traverse City	2,089	55	1,610	185	3,939
Inkster	529	8	1,020	78	1,635
Owosso	1,766	856	1,400	199	4,221
Holland	2,821	319	1,960	257	5,357
Birmingham	3,234	126	1,900	263	5,523
Escanaba	598	0	1,280	94	1,972
Total	40,860	9,166	31,860	4,100	85,986
10,000-14,999					
Troy	3,747	78	1,730	284	5,839
Niles	1,162	1,603	1,360	210	4,335
Alpena	1,248	5	1,500	138	2,891
Grosse Pointe Park	901	0	980	94	1,975
Trenton	551	225	800	79	1,655
Ironwood	1,535	1,738	1,220	224	4,717
Mount Pleasant	1,270	548	1,300	156	3,274
Wayne	1,027	0	940	98	2,065
Menominee	1,224	0	1,160	119	2,503
St. Joseph	3,086	1,630	1,250	298	6,264
Cadillac	926	20	990	96	2,032
Albion	2,621	1,468	1,100	258	5,447
Grosse Pointe Woods	353	0	1,030	66	1,449
Total	19,651	7,315	15,360	2,120	44,446
5,000-9,999					
Iron Mountain	1,470	58	890	120	2,538
Grand Haven	2,002	5	1,540	174	3,721
Ludington	298	285	830	69	1,482
Melvindale	603	0	400	50	1,053
Grosse Pointe Farms	552	0	890	72	1,514
Harper Woods	408	0	660	54	1,122
Garden City	3,131	0	2,150	260	5,541
Ishpeming	67	0	750	44	861
Manistee	577	0	680	66	1,323
Coldwater	1,341	7	890	109	2,347
Beverly Hills	2,074	246	990	163	3,473
Alma	2,263	352	1,220	189	4,024
Sturgis	983	60	940	98	2,081
Centerline	769	0	520	67	1,356
Hillsdale	215	0	450	37	702

Table M-2–Continued

Population Group	Construction				
	Road	Struc. & R.R.	Maint.	Admin. & Engr.	Total
Three Rivers	1,681	857	730	161	3,429
Big Rapids	783	13	630	70	1,496
Greenville	431	355	850	84	1,720
Plymouth	756	1,900	630	162	3,448
Charlotte	291	31	430	40	792
Dowagiac	178	15	610	43	846
Negaunee	178	10	630	45	863
Petoskey	302	564	530	68	1,464
Ionia	314	20	510	47	891
East Grand Rapids	1,007	10	1,080	107	2,204
Grosse Pointe	280	0	660	46	986
Lapeer	859	326	680	91	1,956
Hastings	817	0	810	84	1,711
Marshall	868	284	450	82	1,684
South Haven	513	0	680	61	1,254
Cheboygan	888	175	670	90	1,823
Oak Park	1,528	0	1,460	150	3,138
Buchanan	420	0	640	54	1,114
Hancock	196	30	330	29	585
Clawson	503	0	620	57	1,180
Novi	2,624	5	2,140	237	5,006
Manistique	309	0	310	33	652
Kingsford	120	0	840	47	1,007
Total	32,599	5,608	30,720	3,460	72,387
2,500-4,999					
52 Cities	26,980	2,960	19,620	2,480	52,040
Total	26,980	2,960	19,620	2,480	52,040
1,000-2,499					
131 Cities	22,633	2,120	23,880	2,480	51,113
Total	22,633	2,120	23,880	2,480	51,113
1-999					
225 Cities	17,460	2,864	20,420	2,000	42,744
Total	17,460	2,864	20,420	2,000	42,744
GRAND TOTAL	$647,143	$237,217	$314,460	$48,960	$1,247,780

Table M-3

LOCAL MUNICIPAL STREET NEEDS

BY MUNICIPALITY AND POPULATION GROUP

In Thousands

0-20

City by Pop. Group	Construction: Road	Construction: Struc. & R.R.	Maint.	Admin. & Engr.	Total
250,000 & Over					
Detroit	$ 92,213	$ 4,960	$ 66,260	$ 3,260	$ 166,693
Total	92,213	4,960	66,260	3,260	166,693
100,000-249,999					
Grand Rapids	11,661	381	9,600	640	22,282
Flint	20,940	884	11,580	1,000	34,404
Total	32,601	1,265	22,180	1,640	56,686
50,000-99,999					
Lansing	11,974	–	6,380	640	18,994
Dearborn	4,336	–	6,200	360	10,896
Saginaw	11,278	10	6,500	620	18,408
Pontiac	19,958	764	4,700	880	26,302
Kalamazoo	14,422	–	4,700	660	19,782
Warren	14,060	–	6,600	720	21,380
Bay City	2,755	–	3,920	240	6,915
Jackson	4,404	59	3,300	280	8,043
Ann Arbor	6,714	30	3,520	360	10,624
Total	89,901	863	45,820	4,760	141,344
45,000-49,999					
Battle Creek	7,440	280	3,530	450	11,700
Muskegon	13,282	–	3,830	686	17,798
Royal Oak	5,389	101	5,980	460	11,930
Highland Park	969	–	880	74	1,923
Roseville	5,410	–	2,840	330	8,580
Total	32,490	381	17,060	2,000	51,931
40,000-44,999					
Hamtramck	905	–	700	66	1,671
Wyoming	9,392	80	3,220	514	13,206
Total	10,297	80	3,920	580	14,877
35,000-39,999					
Wyandotte	2,408	–	2,110	179	4,697
Port Huron	9,859	462	2,910	521	13,752
Total	12,267	462	5,020	700	18,449
30,000-34,999					
Allen Park	2,824	273	2,180	220	5,497
Total	2,824	273	2,180	220	5,497

Table M-3–Continued

City by Pop. Group	Construction		Maint.	Admin. & Engr.	Total
	Road	Struc. & R.R.			
25,000-29,999					
Ferndale	1,579	–	1,580	126	3,285
Lincoln Park	2,064	102	2,480	187	4,833
Southgate	3,777	–	1,860	227	5,864
Total	7,420	102	5,920	540	13,982
20,000-24,999					
Southfield	6,245	–	3,640	443	10,328
East Lansing	667	–	960	73	1,700
Monroe	3,424	12	1,480	221	5,137
East Detroit	2,041	–	2,340	197	4,578
Madison Heights	4,509	–	2,000	293	6,802
River Rouge	680	–	500	53	1,233
Total	17,566	12	10,920	1,280	29,778
15,000-19,999					
St. Clair Shores	9,768	68	5,000	664	15,500
Midland	3,797	–	2,510	284	6,591
Muskegon Heights	3,403	–	1,660	228	5,291
Benton Harbor	2,512	150	1,310	179	4,151
Adrian	2,274	125	1,330	168	3,897
Ypsilanti	1,020	–	1,080	95	2,195
Ecorse	385	–	880	57	1,322
Berkley	1,760	–	1,380	141	3,281
Sault Ste. Marie	519	–	1,720	101	2,340
Hazel Park	2,869	–	1,640	203	4,712
Livonia	16,501	–	2,050	830	19,381
Marquette	1,254	–	1,440	121	2,815
Mt. Clemens	3,181	5	1,400	206	4,792
Traverse City	2,592	–	1,600	189	4,381
Inkster	2,643	–	1,080	168	3,891
Owosso	2,259	–	1,480	168	3,907
Holland	4,516	–	1,900	289	6,705
Birmingham	4,084	175	1,910	278	6,447
Escanaba	1,082	–	1,390	111	2,583
Total	66,419	523	32,760	4,480	104,182
10,000-14,999					
Troy	2,423	–	2,280	210	4,913
Niles	2,249	–	1,200	155	3,604
Alpena	2,557	–	1,060	163	3,780
Grosse Pte. Park	1,652	–	760	109	2,521

Table M-3–Continued

City by Pop. Group	Construction: Road	Construction: Struc. & R.R.	Maint.	Admin. & Engr.	Total
Trenton	1,542	–	1,120	120	2,782
Ironwood	2,645	–	1,180	172	3,997
Mt. Pleasant	2,682	–	940	163	3,785
Wayne	2,447	–	980	154	3,581
Menominee	2,212	–	1,100	149	3,461
St. Joseph	1,936	–	840	125	2,901
Cadillac	1,487	–	1,080	116	2,683
Albion	5,607	329	1,280	324	7,540
Grosse Pte. Woods	343	–	980	60	1,383
Total	29,782	329	14,800	2,020	46,931
5,000-9,999					
Iron Mountain	4,290	98	1,060	246	5,694
Grand Haven	3,647	10	1,120	216	4,993
Ludington	444	–	920	61	1,425
Melvindale	1,791	–	700	112	2,603
Grosse Pte. Farms	191	–	800	45	1,036
Harper Woods	1,854	–	1,040	130	3,024
Garden City	6,096	–	2,170	373	8,639
Ishpeming	359	–	710	48	1,117
Manistee	1,294	–	640	87	2,021
Coldwater	2,789	145	940	174	4,048
Beverly Hills	1,169	–	920	94	2,183
Alma	3,079	–	1,120	189	4,388
Sturgis	1,440	15	840	103	2,398
Centerline	703	–	540	56	1,299
Hillsdale	210	–	540	34	784
Three Rivers	3,060	245	1,060	196	4,561
Big Rapids	1,229	8	640	84	1,961
Greenville	383	–	800	53	1,236
Plymouth	2,325	–	640	133	3,098
Charlotte	1,612	67	560	101	2,340
Dowagiac	126	25	700	38	889
Negaunee	511	10	820	60	1,401
Petoskey	206	–	580	35	821
Ionia	980	–	440	64	1,484
East Grand Rapids	2,250	–	1,000	146	3,396
Grosse Pointe	273	–	300	26	599
Lapeer	1,478	35	540	92	2,145
Hastings	1,623	–	800	109	2,532
Marshall	1,826	62	720	117	2,725
South Haven	1,025	–	680	77	1,782
Cheboygan	1,352	–	840	99	2,291
Oak Park	1,108	–	1,900	135	3,143
Buchanan	933	–	460	63	1,456

Table M-3–Continued

City by Pop. Group	Construction		Maint.	Admin. & Engr.	Total
	Road	Struc. & R.R.			
Hancock	938	10	460	63	1,471
Clawson	1,696	–	860	115	2,671
Novi	937	–	800	78	1,815
Manistique	953	–	480	64	1,497
Kingsford	297	–	680	44	1,021
Total	56,477	730	30,820	3,960	91,987
2,500-4,999					
52 Cities	32,709	1,002	15,920	2,480	52,111
Total	32,709	1,002	15,920	2,480	52,111
1,000-2,499					
131 Cities	30,040	1,100	19,240	2,520	52,900
Total	30,040	1,100	19,240	2,520	52,900
1-999					
225 Cities	17,760	372	11,940	1,500	31,572
Total	17,760	372	11,940	1,500	31,572
GRAND TOTAL	$530,766	$ 12,454	$303,760	$31,940	$878,920

Table M-4

TOTAL MUNICIPAL STREET NEEDS

BY 5 YEAR TIME PEDIODS

In Thousands

Period	Construction	Maintenance	Administration & Engineering	Total
0-5	$ 563,790	$148,150	$29,180	$ 741,120
6-10	361,190	154,140	20,130	535,460
11-15	323,200	158,190	15,340	396,730
16-20	379,400	157,740	16,250	453,390
Total	$1,427,580	$618,220	$80,900	$2,126,700

Table M-5

MAJOR MUNICIPAL STREET NEEDS

BY 5 YEAR TIME PEDIODS

In Thousands

Period	Construction	Maintenance	Administration & Engineering	Total
0-5	$319,380	$ 73,400	$16,820	$ 409,600
6-10	218,180	78,330	11,730	308,240
11-15	132,540	81,930	9,210	223,680
16-20	214,260	80,800	11,200	306,260
Total	$884,360	$314,460	$48,960	$1,247,780

Table M-6

LOCAL MUNICIPAL STREET NEEDS

BY 5 YEAR TIME PEDIODS

In Thousands

Period	Construction	Maintenance	Administration & Engineering	Total
0-5	$244,410	$ 74,750	$12,360	$ 331,520
6-10	143,010	75,810	8,400	227,220
11-15	90,660	76,260	6,130	173,050
16-20	65,140	76,940	5,050	147,130
Total	$543,220	$303,760	$31,940	$ 878,920

Table M-7

AVERAGE ANNUAL MUNICIPAL STREET PROGRAM COSTS

(NOT INCLUDING URBAN TRUNKLINE AND COUNTY PRIMARY EXTENSIONS)

In Thousands

	MAJOR STREETS					LOCAL STREETS
	10-Year Program (Based on catching up in 10 yrs. and meeting needs as they occur in last 10 yrs.)		15-Year Program (Based on catching up in 15 yrs. and meeting needs as they occur in last 5 yrs.)		20-Year Program (Based on catching up the needs within 20 yrs.)	20-Year Program (Based on catching catching up the needs within 20 yrs.)
	10 Year Period	2nd 10 Yr. Period	15 Year Period	Last 5 Yr. Period	20 Year Period	20 Year Period
Detroit	$23,237	$26,128	$21,224	$35,056	$24,682	$ 8,335
Grand Rapids	1,873	1,115	1,722	810	1,494	1,114
Flint	6,688	1,256	4,930	1,098	3,972	1,720
Lansing	2,046	2,670	2,155	2,971	2,359	950
Dearborn	479	409	482	330	444	545
Saginaw	2,030	917	1,770	582	1,473	920
Pontiac	2,458	1,010	2,070	730	1,735	11,315
Kalamazoo	1,101	628	974	534	864	989
Warren	921	408	805	245	665	1,069
Bay City	727	632	590	946	679	346
Jackson	1,183	358	914	342	771	402
Ann Arbor	566	310	470	342	438	531
45-50,000 (5)	2,140	1,170	1,742	1,398	1,656	2,597
40-45,000 (2)	758	365	642	322	562	744
35-40,000 (2)	1,146	452	894	514	799	922
30-35,000 (1)	66	101	70	122	83	275
25-30,000 (3)	591	855	567	1,191	723	699
20-25,000 (6)	1,925	1,185	1,761	937	1,555	1,489
15-20,000 (19)	5,723	2,876	4,730	3,006	4,299	5,209
10-15,000 (13)	2,820	1,625	2,322	1,922	2,222	2,347
5-10,000 (38)	4,383	2,856	3,957	2,605	3,619	4,599
2,500-5,000 (52)	3,386	1,819	2,982	1,462	2,602	2,605
1,000-2,500 (131)	3,093	2,019	2,795	1,839	2,556	2,645
Under 1,000 (225)	2,444	1,830	2,200	1,948	2,137	1,579
TOTALS	$71,784	$52,994	$62,768	$61,252	$62,389	$43,946

Table M-8

PROJECTED 1980 INVENTORY OF MUNICIPAL STREET MILEAGE

(CITIES OVER 5,000 POPULATION)

MAJOR STREETS

	SURFACE TYPE					
	Bit. Surface Treatment	Bit. Aggregate	Bituminous - Concrete F-2	F-4	F-5+	Total
Adrian	1.72	2.39	8.02	7.19	.47	19.79
Albion			8.72	4.04	.41	13.17
Allen Park			7.22	3.76	1.41	12.39
Alma		10.82	2.66	.84	.64	14.96
Alpena	9.78		8.67	1.07	.08	19.60
Ann Arbor		29.39		8.62	.20	38.21
Battle Creek		12.00	6.47	21.71		40.18
Bay City			38.58	5.59	1.40	45.57
Benton Harbor			6.71	12.04		18.75
Berkley	.60		10.07	2.06		12.73
Beverly Hills			1.20	10.80		12.00
Big Rapids	.70	8.14				8.84
Birmingham			11.51	11.02	1.20	23.73
Buchanan		3.92	3.32	.70	.16	8.10
Cadillac		1.61	9.11	1.05		11.77
Centerline	.57		6.06	1.32		7.95
Charlotte		2.05	3.19	.29		5.53
Cheboygan	1.19	5.33	1.82			8.34
Clawson			7.33	.81		8.14
Coldwater		.10	9.91	.92		10.93
Dearborn			31.82	13.60	2.02	47.44
Detroit			181.84	217.67	205.91	616.92*
Dowagiac	1.31	4.62	2.40			8.33
East Detroit			18.01			18.01
East Grand Rapids			6.58	6.83	.26	13.67
East Lansing	2.45	.66	5.12	5.98		14.21
Ecorse		2.75	4.08	2.34		9.17
Escanaba	.25		7.15	6.09	2.44	15.93
Ferndale	.39		10.16	7.53	2.06	20.14
Flint			37.68	50.77	62.38	150.83
Garden City			21.64	5.55		27.19
Grand Haven			16.42	2.66	.32	19.40
Grand Rapids			15.41	80.10	5.15	100.66
Greenville		1.00	9.52	.66		11.18
Grosse Pte.			7.61	.45	.27	8.33
Grosse Pte. Farms			8.35	2.80		11.21
Grosse Pte. Park			9.48	2.60		12.08
Grosse Pte. Woods			11.85			11.85

*Detroit total includes 11.50 miles of expressway.

Table M-8—Continued

	SURFACE TYPE					
	Bit. Surface Treatment	Bit. Aggregate	Bituminous - Concrete F-2	F-4	F-5+	Total
Hamtramck			9.48	4.01	.04	13.53
Hancock		4.32				4.32
Harper Woods			7.48	1.33		8.81
Hazel Park			6.21	4.91		11.12
Hastings	.27	4.67	3.30	2.16		10.40
Highland Park			11.03	1.91	2.48	15.42
Hillsdale	1.45		3.70			5.15
Holland			20.38	2.90		23.28
Inkster	.23		10.45	2.68		13.36
Ionia	1.08	.25	4.58	.98		6.89
Iron Mountain		11.72				11.72
Ironwood			9.89	3.60		13.49
Ishpeming			8.47	.41		8.88
Jackson		1.38	27.11	13.65		42.14
Kalamazoo			15.73	32.17	10.85	58.75
Kingsford		7.56	2.36	1.16		11.08
Lansing		23.02	1.21	32.13	8.41	64.77
Lapeer		4.54	3.29	.50	.47	8.80
Lincoln Park			26.17	.38		26.55
Livonia			31.94			31.94
Ludington		3.56	.88	5.81	.51	10.76
Madison Heights			21.01	2.38		23.39
Manistee		.81	6.88	1.15		8.84
Manistique	.88		2.91	.48		4.27
Marquette			14.86	3.41		18.27
Marshall		5.37	.29	.92	.25	6.83
Melvindale			4.56	.72		5.28
Menominee		5.96	6.45	1.17	1.49	15.07
Midland		52.27			5.52	57.79
Monroe		.30	13.28	5.26	.23	19.07
Mt. Clemens			2.78	12.89	.04	15.71
Mt. Pleasant		.32	13.61	2.40	.25	16.58
Muskegon			8.69	14.09	9.34	32.12
Muskegon Heights		4.97	.88	5.19		11.04
Negaunee		7.68		.60		8.28
Niles	.31	2.42	11.25	1.03		15.01
Novi			28.66			28.66
Oak Park			9.46	2.18	6.27	17.91
Owosso	5.40	8.74	2.81	.40	1.06	18.41

Table M-8—Continued

	SURFACE TYPE					
	Bit. Surface Treatment	Bit. Aggregate	Bituminous - Concrete F-2	F-4	F-5+	Total
Petoskey		2.38	2.42	.88	.07	5.75
Plymouth			2.42	4.18	.62	7.22
Pontiac	.23	6.30	4.94	29.15	13.68	54.30
Port Huron		19.31	1.22	5.09		25.62
River Rouge		.71	5.64	2.72		9.07
Roseville			20.26	2.96		23.22
Royal Oak			8.85	18.39	11.03	38.27
Saginaw	.17		40.77	15.57	3.75	60.26
Sault Ste. Marie		2.62	19.20	3.55		25.37
Southfield			67.62	1.04	6.01	74.67
Southgate			10.56	2.81		13.37
South Haven			6.20	1.59	.97	8.76
St. Clair Shores			2.27	6.01	10.40	18.68
St. Joseph			5.49	7.24		12.73
Sturgis	.80		9.38	1.71		11.89
Three Rivers			7.53	2.20	.08	9.81
Traverse City		5.03	8.51	5.60		19.14
Trenton			6.80	2.03	1.60	10.43
Troy		6.36	14.85	2.13		23.34
Warren	.25		21.99	32.56		54.80
Wayne			9.67	1.86		11.53
Wyandotte			13.50	9.04	3.75	26.29
Wyoming	1.83	37.82		3.24	3.00	45.89
Ypsilanti			14.05	4.77		18.82
TOTAL	31.86	315.17	1,214.79	830.80	388.95	2,793.07

Table M-9

MILES OF TRUNKLINE TURNBACK TO MAJOR STREETS

City	0-5			6-10			11-15			16-20			Total Miles
	F-1	F-2	F-3	F-1	F-2	F-3	F-1	F-2	F-3	F-1	F-2	F-3	
250,000 and Over													
Detroit	—	—	—	—	—	8.00	—	—	0.25	—	—	—	8.25
Total	—	—	—	—	—	8.00	—	—	0.25	—	—	—	8.25
100,000 - 249,999													
Grand Rapids	—	—	—	5.95	—	—	—	2.23	—	—	—	—	8.18
Flint	—	6.75	—	1.08	2.00	—	—	—	—	—	—	—	9.83
Total	—	6.75	—	7.03	2.00	—	—	2.23	—	—	—	—	18.01
50,000 - 99,999													
Lansing	—	—	—	—	—	—	—	4.68	—	—	—	0.17	4.85
Dearborn	—	4.37	—	—	—	—	—	—	—	—	—	—	4.37
Saginaw	1.06	1.35	0.84	1.95	—	—	—	1.99	—	0.55	1.02	—	8.76
Pontiac	0.39	—	—	0.60	1.09	—	1.39	0.24	—	0.39	—	—	4.10
Kalamazoo	3.92	1.19	—	—	—	—	—	—	—	—	—	—	5.11
Warren	—	2.51	—	—	2.06	—	—	—	—	—	—	—	4.57
Bay City	—	—	—	0.51	1.50	—	0.57	1.22	—	—	0.23	—	4.03
Jackson	—	—	—	0.36	—	—	3.15	1.42	—	—	—	—	4.93
Ann Arbor	0.80	—	—	0.41	—	—	3.27	—	—	4.48	—	—	8.96
Total	6.17	9.42	0.84	3.83	4.65	—	8.38	9.55	—	5.42	1.25	0.17	49.68
45,000 - 49,999													
Battle Creek	2.68	0.62	—	—	0.46	—	0.32	1.30	—	—	—	—	5.38
Muskegon	1.95	—	—	—	—	—	—	—	—	1.77	0.54	—	4.26
Royal Oak	—	—	—	—	—	—	—	—	—	—	—	—	—
Highland Park	—	—	—	—	—	—	—	—	—	—	—	—	—
Roseville	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4.63	0.62	—	—	0.46	—	0.32	1.30	—	1.77	0.54	—	9.64
40,000 - 44,999													
Hamtramck	—	—	—	—	—	—	—	—	—	—	—	—	—
Wyoming	—	—	—	—	—	—	—	2.43	—	—	—	—	2.43
Total	—	—	—	—	—	—	—	2.43	—	—	—	—	2.43

35,000 - 39,999													
Wyandotte	—	—	—	—	—	—	—	—	—	—	—	—	—
Port Huron	3.77	0.17	—	1.34	—	—	2.65	—	—	—	—	0.35	8.28
Total	3.77	0.17	—	1.34	—	—	2.65	—	—	—	—	0.35	8.28
30,000 - 34,999													
Allen Park	—	—	—	—	0.67	—	0.66	—	—	—	—	—	1.33
Total	—	—	—	—	0.67	—	0.66	—	—	—	—	—	1.33
25,000 - 29,999													
Ferndale	—	—	—	—	—	—	—	—	—	—	—	—	—
Lincoln Park	—	—	—	—	3.56	—	—	—	—	—	—	—	3.56
Southgate	2.64	—	—	—	0.21	—	—	0.34	—	—	—	—	3.19
Total	2.64	—	—	—	3.77	—	—	0.34	—	—	—	—	6.75
20,000 - 24,999													
Southfield	—	—	—	—	—	—	—	—	—	—	—	—	—
East Lansing	—	—	—	—	—	—	—	1.74	0.74	—	—	—	2.48
Monroe	—	—	—	0.98	—	—	1.04	1.14	—	—	—	—	3.16
East Detroit	—	—	—	—	—	—	—	—	—	—	—	—	—
Madison Heights	—	—	—	—	—	—	—	—	—	—	—	—	—
River Rouge	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	0.98	—	—	1.04	2.88	0.74	—	—	—	5.64
15,000 - 19,999													
St. Clair Shores	—	—	—	—	6.09	—	—	—	—	—	—	—	6.09
Midland	6.37	—	—	—	—	—	2.62	1.38	—	—	—	—	10.37
Muskegon Heights	—	—	—	0.83	1.09	—	0.96	—	—	—	—	—	2.88
Benton Harbor	0.82	0.14	—	0.51	—	—	—	—	—	—	—	—	1.47
Adrian	—	—	—	—	—	—	—	—	—	—	—	—	—
Ypsilanti	0.07	—	0.32	—	—	—	—	—	—	—	—	—	0.39
Ecorse	—	—	—	—	—	—	—	—	—	—	—	—	—
Berkley	—	—	—	—	—	—	—	—	—	—	—	—	—
Sault Ste. Marie	0.30	—	—	—	—	—	—	—	—	—	—	—	0.30
Hazel Park	—	—	—	—	—	—	—	—	—	—	—	—	—
Livonia	1.25	—	—	—	4.92	—	—	—	—	—	—	—	6.17
Marquette	—	—	—	—	—	—	—	0.12	—	—	—	—	0.12
Mt. Clemens	—	0.55	—	—	—	—	—	—	—	—	—	—	0.55

NOTE: F-1=36′ or less, High Type; F-2=37′-48′, High Type; F-3= 49′ & over, High Type.

Table M-9—Continued

City	0-5			6-10			11-15			16-20			Total Miles
	F-1	F-2	F-3	F-1	F-2	F-3	F-1	F-2	F-3	F-1	F-2	F-3	
15,000 - 19,999 Cont'd													
Traverse City	0.55	0.11	—	—	—	—	—	1.92	—	—	—	—	2.58
Inkster	—	—	—	—	—	—	—	—	—	—	—	—	—
Owosso	—	0.48	—	—	—	—	—	1.41	—	—	—	—	1.89
Holland	1.00	0.21	—	—	—	—	—	—	—	—	—	—	1.21
Birmingham	—	—	—	—	—	—	—	—	—	—	—	—	—
Escanaba	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	10.36	1.49	0.32	1.34	12.10	—	3.58	4.83	—	—	—	—	34.02
10,000 - 14,999													
Troy	—	—	—	—	—	—	—	—	—	1.54	—	0.23	1.77
Niles	—	—	—	—	1.03	—	1.22	—	—	—	—	—	2.25
Alpena	—	—	—	—	—	—	—	—	—	—	—	—	—
Grosse Pte. Park ...	—	—	—	—	—	—	—	—	—	—	—	—	—
Trenton	—	—	—	—	—	—	—	—	—	—	—	—	—
Ironwood	—	—	—	—	0.33	—	—	—	—	—	—	—	0.33
Mt. Pleasant	—	—	—	—	—	—	—	—	—	—	—	—	—
Wayne	—	—	—	—	—	—	—	—	—	—	—	—	—
Menominee	—	—	—	—	—	—	—	—	—	—	—	—	—
St. Joseph	—	3.49	—	—	—	—	—	—	—	—	—	—	3.49
Cadillac	0.07	1.20	—	—	—	—	—	—	—	—	—	—	1.27
Albion	1.09	—	—	—	—	—	—	—	—	—	—	—	1.09
Grosse Pte. Woods..	—	0.32	—	1.29	—	—	—	—	—	—	—	—	1.61
Total	1.16	5.01	—	1.29	1.36	—	1.22	—	—	1.54	—	0.23	11.81
5,000 - 9,999													
Total	6.19	2.94	—	7.16	2.97	—	6.28	1.89	—	1.22	—	—	28.65
1,000 - 4,999													
Total	50.79	7.71	—	17.74	0.89	—	20.95	1.58	—	5.55	—	—	105.21
1 - 999													
Total	31.29	7.23	—	17.16	0.75	—	12.87	—	—	4.16	—	—	73.46
GRAND TOTAL ..	117.00	41.34	1.16	57.87	29.62	8.00	57.95	27.03	0.99	19.66	1.79	0.75	363.16

NOTE: F-1=36′ or less, High Type; F-2=37′-48′, High Type; F-3= 49′ & over, High Type.

Table M-10

POPULATION OF MUNICIPALITIES

(1960-1950 CENSUS)

City	1960 Population	1950 Population	District
	50,000 and over (17)	(10)	
Detroit	1,670,144	1,849,568	10
Flint	196,940	163,143	6
Grand Rapids	177,313	176,515	5
Dearborn	112,007	94,994	10
Lansing	107,807	92,129	8
Saginaw	98,265	92,918	6
Warren	89,246	727	9
Pontiac	82,233	73,681	9
Kalamazoo	82,089	57,704	7
Royal Oak	80,612	46,898	9
St. Clair Shores	76,657	19,823	9
Ann Arbor	67,340	48,251	8
Livonia	66,702	17,534	10
Lincoln Park	53,933	29,310	10
Bay City	53,604	52,523	6
Jackson	50,720	51,088	8
Roseville	50,195	15,816	9
	40,000-49,999 (5)	(6)	
Muskegon	46,485	48,429	5
Wyoming	45,829	0	5
East Detroit	45,756	21,461	9
Battle Creek	44,169	48,666	7
Wyandotte	43,519	36,846	10
	30,000-39,999 (11)	(2)	
Inkster	39,097	16,728	10
Highland Park	38,063	46,393	10
Garden City	38,017	9,012	10
Allen Park	37,494	12,329	10
Oak Park	36,632	5,267	9
Port Huron	36,084	35,725	9
Hamtramck	34,137	43,355	10
Madison Heights	33,343	0	9
Southfield	31,501	0	9
Ferndale	31,347	29,675	9
East Lansing	30,198	20,325	8
	20,000-29,999 (10)	(6)	
Southgate	29,404	0	10
Midland	27,779	14,285	6
Hazel Park	25,631	17,770	9
Birmingham	25,525	15,467	9
Holland	24,777	15,858	5

Table M-10—Continued

City	1960 Population	1950 Population	District
Berkley	23,275	17,931	9
Monroe	22,968	21,467	10
Mt. Clemens	21,016	17,027	9
Ypsilanti	20,957	18,302	8
Adrian	20,347	18,393	8
	10,000-19,999 (29)	(31)	
Harper Woods	19,995	9,148	10
Marquette	19,824	17,202	1
Muskegon Heights	19,552	18,828	5
Troy	19,382	0	9
Benton Harbor	19,136	18,769	7
Sault Ste. Marie	18,722	17,912	2
Grosse Pte. Woods	18,580	10,381	10
Trenton	18,439	6,222	10
Traverse City	18,432	16,974	3
River Rouge	18,147	20,549	10
Ecorse	17,328	17,948	10
Owosso	17,006	15,948	6
Wayne	16,034	9,409	10
Grosse Pte. Park	15,457	13,075	10
Escanaba	15,391	15,170	2
Mt. Pleasant	14,875	11,393	5
Clawson	14,795	5,196	9
Alpena	14,682	13,135	4
Niles	13,842	13,145	7
Melvindale	13,089	9,483	10
Albion	12,749	10,406	7
Grosse Pte. Farms	12,172	9,410	10
St. Joseph	11,755	10,223	7
Menominee	11,289	11,151	1
Grand Haven	11,066	9,536	5
East Grand Rapids	10,924	6,403	5
Ironwood	10,265	11,466	1
Centerline	10,164	7,659	9
Cadillac	10,112	10,425	3
	5,000-9,999 (39)	(38)	
Ludington	9,421	9,506	3
Iron Mountain	9,299	9,679	1
Alma	8,978	8,341	5
Sturgis	8,915	7,786	7
Coldwater	8,880	8,594	7

Table M-10—Continued

City	1960 Population	1950 Population	District
Ishpeming	8,857	8,962	1
Plymouth	8,766	6,637	10
Huntington Woods	8,746	4,949	9
Big Rapids	8,686	6,736	5
Beverly Hills	8,633	0	9
Houghton-Hancock	8,415	9,052	1
Manistee	8,324	8,642	3
Grandville	7,975	2,022	5
Charlotte	7,657	6,606	8
Hillsdale	7,629	7,297	8
Greenville	7,440	6,668	5
Riverview	7,237	1,432	10
Dowagiac	7,208	6,542	7
Three Rivers	7,092	6,785	7
Tecumseh	7,045	4,020	8
Fraser	7,027	1,379	9
Farmington	6,881	2,325	9
Ionia	6,754	6,412	5
Marshall	6,736	5,777	7
Grosse Pointe	6,631	6,283	10
Novi	6,390	0	9
Hastings	6,375	6,096	7
Lapeer	6,160	6,143	6
South Haven	6,149	5,629	7
Fenton	6,142	4,226	6
Petoskey	6,138	6,468	4
Negaunee	6,126	6,472	1
Cheboygan	5,859	5,687	4
St. Johns	5,629	4,954	5
Rochester	5,431	4,279	9
Buchanan	5,341	5,224	7
Gladstone	5,267	4,831	2
Grand Ledge	5,165	4,506	8
Kingsford	5,084	5,038	1
	2,500-4,999 (64)	(47)	
	1,000-2-499 (133)	(129)	
	1-999 (201)	(219)	
Total Number of Incorp. cities or villages	509	488	
Total Urban Population	5,240,037	4,433,265	
Total Rural Population	2,583,961	1,938,744	
Grand Total	7,823,998	6,372,009	

Table M-11

ESTIMATED CONSTRUCTION COSTS USED FOR MUNICIPAL IMPROVEMENTS

Item of Work	Unit	Unit Cost Range
Light Grading (2′ to 4′)	Sq. Yd.	$ 1.25 to $ 1.75
Earth Excavation	Cu. Yd.	0.75 to 1.50
Drainage —		
12″ to 48″ Class A Culvert	Lin Ft.	3.00 to 15.00
12″ to 48″ Class B Culvert	Lin Ft.	4.00 to 20.00
12″ to 48″ Sewer	Lin Ft.	3.50 to 17.50
6″ Sewer	Lin Ft.	1.00 to 1.20
Manholes	Each	$35/ft. of depth
Catch Basins	Each	$30/ft. of depth
Inlets	Each	$30/ft. of depth
Aggregate Base Course (6″ to 8″)	Sq. Yd.	0.45 to 0.65
Sub-base Material (12″ to 28″)	Sq. Yd.	0.85 to 2.25
Bituminous Aggregate Surface (1″ to 2½″)	Sq. Yd.	0.50 to 1.70
Bituminous Concrete Surface (1″ to 2½″)	Sq. Yd.	1.35 to 1.80
Bituminous Concrete Surface (2½″ to 4″)	Sq. Yd.	1.80 to 3.50
Concrete Pavement —		
7″ Uniform (no reinforcement)	Sq. Yd.	3.50 to 4.25
8″ Uniform (including reinforcement)	Sq. Yd.	5.00 to 5.50
9″ Uniform (including reinforcement)	Sq. Yd.	5.25 to 5.75
10″ Uniform (including reinforcement)	Sq. Yd.	5.50 to 6.00
Reinforcement	Sq. Yd.	0.65 to 0.75
Curb and Gutter	Lin Ft.	2.50 to 3.50
Sidewalk (4″ to 7″)	Sq. Ft.	0.50 to 0.75
Structures —		
New Construction	Sq. Ft.	20.00 to 35.00
Widening	Sq. Ft.	30.00 to 40.00
R.R. Flashing Light Signal (single track)		9,000.00
R.R. Flashing Light Signal and short arm gates		22,000.00

Right-of-Way —

If costs are not available when right-of-way acquisition is necessary, estimate right-of-way as 20% to 25% of construction costs.

Engineering and Contingencies —

To the estimated construction costs add 5% for preliminary engineering and 10% for construction engineering and contingencies.

Estimates —

It is suggested that the above cost ranges be used for estimating unless other costs are justifiable. If higher costs are used, a report to that effect should be submitted showing costs and reasons for change.

Table M-12

CONSTRUCTION STANDARDS FOR ARTERIAL STREETS

Design Features	All Cities			Cities of over 5,000 population			Cities of under 5,000 population		
	Controlled Access[1]			Arterials			Arterials		
				Downtown area	Intermed. area	Outlying area	Downtown area	Intermed. area	Outlying area
1980 Design Hour Traffic Volume Total for No. of Lanes Shown	7200 to 9000	Up to 6000	State trunkline by-passes only under 750[2]	SEE BELOW					
Surface Type[10]	F			F	F or E[3]		F	F, E or D[3]	
Number of Lanes	6[4]	4[4]	2[4]	Controlled by anticipated 1980 traffic volumes and operating conditions determine required street width by consulting hourly capacity tables[5]					
Surface Width	72′	48′	24′						
Curbs and Sidewalks	Not required: Pedestrians not permitted Pedestrian Crossings to be provided where needed			Yes	Yes	Only as required	Yes	Yes	Only as required
Shoulder Width	12′	12′	10′	—	—	8′	—	—	8′
Median Width	Minimum 4′ if not mountable, otherwise 20′		—	4′ Median where design hour traffic volume exceeds 750 if feasible					
Parking	Not Permitted Except on Frontage Roads			For streets having a design hour traffic volume exceeding 750, parking generally to be discouraged, with the parallel parking permitted only during off-peak hours. Parallel parking permitted for lesser traffic volumes.					
Illumination	Continuous		at Intersec.	Continuous	At intersections		Continuous	At intersections	
Intersection Treatment 10% or more of Traffic on Intersecting Street	Full Access Control		(6)	Progressive traffic signal system or fixed time signal where warranted Stop sign control for lower traffic volumes					
Less than 10% of traffic on Intersecting Street			(7)	Traffic or pedestrian actuated signals where warranted or stop sign control.					
Structures Width	Under 100′ long—full roadway width over 100′ long—pavement width[8] plus 6′ plus median			Pavement plus sidewalks					
Vertical Clearance	14.5′			14.5′					
Loading	H-20 - S-16			For heavy commercial traffic H-20-S-16[9] Other H-20					
Railroad Crossing Separation	At all Railroad Crossings			Main Line crossings on streets carrying heavy traffic volume where practical and economically feasible.					
Railroad Grade Crossing Protection	—			Flashing light signals at all crossings without watchman or flagman and where average daily traffic x number of trains=3500 or more.					

[1] Standards for controlled access arterials based on 40 m.p.h. operating speed. Access permitted only at interchanges and intersections with other arterials. Access from abutting property by frontage streets where required.
[2] Applies specifically to new locations of 2-lane state trunkline routes by-passing business areas of municipalities.
[3] Character and amount of traffic should determine the type of surface required.
[4] 12 foot traffic lanes.
[5] Street width chosen should be divisible into even numbers of 11′ or 12′ lanes, except where one-way operation is planned.
[6] Grade separations where warranted and feasible otherwise channelized and signalized intersection at grade.
[7] Channelized and signalized intersection at grade.
[8] Includes shoulders of approaches.
[9] Heavy commercial traffic includes large numbers of tractor trailers.
[10] F (High), D & E (Intermediate)

Table M-13

CONSTRUCTION STANDARDS FOR MUNICIPAL LOCAL STREETS

Design Features	Cities of over 5,000 Population		
	Residential Areas		Business and Industrial
	High Density	Medium-Low Density	
Surface Type[4]	F	E	F
Surface Width[1] (curb to curb)	44′	34′	46′
Curb and Gutter	Yes	Yes	Yes
Sidewalk	Yes	Only as required	Only as required
Shoulder Width	——	——	——
Parking	Parallel parking permitted until capacity reached. When capacity is exceeded, parking permitted only during off-peak hours.		
Illumination	No	No	Yes
Traffic Control Devices	No	No	Yes[2]
Structures	Same as New Construction Standards for Major Streets.		

Design Features	Cities under 5,000 Population		
	Residential Areas		Business and Industrial
	High Density	Medium-Low Density	
Surface Type	F	D & E	F
Surface Width[1] (curb to curb)	44′	24′	46′
Curb and Gutter	Yes	Only as required	Yes
Sidewalk	Yes	Only as required	Only as required
Shoulder Width	——	2 @ 8′	——
Parking[3]	Parallel parking permitted until capacity reached. When capacity is exceeded, parking permitted only during off-peak hours.		
Illumination	No	No	Yes
Traffic Control Devices	No	No	Yes[2]
Structures	Same as New Construction Standards for Major Streets.		

[1] Surface widths based on straight curb; for rolled curb, add width of gutter pan.
[2] Traffic or pedestrian actuated signals where warranted or stop sign control.
[3] No parking on pavement and no curb and gutter, provided drainage will be reasonably satisfactory. If not, use 34′ curbed section.
[4] F (High), D & E (Intermediate)

Construction Needs on Federal Aid Systems

This portion of the Engineering Report describes the provisions of the Federal Highway Act of 1956, as amended, the application of this Act in Michigan, and future construction needs on highways and roads covered in this Act.

FEDERAL AID PROGRAM

Federal-aid authorized under the terms of the Federal-Aid Highway Act of 1956, as amended, was enacted by congress mainly to accelerate the progress of the Interstate and National Defense Highway program. The Act established in the Treasury of the United States a Trust Fund as a depository of the designated taxes and fees collected by the Federal Government from highway users. The amounts therein deposited are annually appropriated for aid in the construction of the Interstate System and for construction on primary and secondary systems. The definition of these systems, the method of apportioning the funds on these systems, and the restrictions thereof are as follows:

The Interstate System shall be designated within the continental United States and it shall not exceed 41,000 miles in total length. It shall be so located as to connect by routes, as direct as practicable, the principal metropolitan areas, cities, and industrial centers, to serve national defense, and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico.

Funds are apportioned for the Interstate System in the following manner:

1. Reduction of a sum not to exceed 3¾ per centum, as the Secretary of Commerce may deem necessary for administering the provisions of this law.
2. The remainder is apportioned among the several states in the ratio which the estimated cost of completing the Interstate System in each state bears to the sum of the estimated cost of completing the Interstate System in all of the states. Federal-aid Interstate Funds may be used to defray 90% of construction costs on projects approved by the Secretary of Commerce.

The Federal-aid primary system consists of an adequate system of connected main highways in rural or urban places, selected or designated by each State through its State Highway Department, subject to the approval of the Secretary of Commerce.

The Federal-aid secondary system is selected by the State Highway Department and the appropriate local road officials in cooperation with each other, subject to the approval of the Secretary of Commerce. In making such selections farm-to-market roads, rural mail routes, public school bus routes, local rural roads, county roads, township roads, and roads of the county road class may be included, so long as they are not on the Federal-aid primary system or the Inter-

state system. This system shall be confined to rural areas, except (1) that in any State having a population density of more than two hundred per square mile as shown by latest available Federal census, the system may include mileage in urban areas as well as rural, and (2) that the system may be extended into urban areas subject to the conditions that any such extension passes through the urban area or connects with another Federal-aid system within the urban area, and that Federal participation in projects on such extensions is limited to urban funds.

The annual apportionment for these systems, after deduction of an amount, not to exceed 3¾ percent of the total appropriated, deemed necessary for the administration of the law, is apportioned in the following ratio:

The Federal-aid Primary Funds, 45%
The Federal-aid Secondary Funds, 30%
The Federal-aid Urban Funds, 25%

These are apportioned between the several states in the following manner:

For the Federal-aid Primary Fund:

- One third in the ratio which the area of each state bears to the total area of all the states, except that only one-third of the area of Alaska shall be included.
- One third in the ratio which the population of each state bears to the total population of all of the state as shown by the latest available federal census.
- One third in the ratio which the mileage of rural delivery routes and star routes in each state bears to the total rural delivery and star routes in all the states at the close of the next preceding year, as shown by a certificate of the Postmaster General.

No State shall receive less than ½ of 1% of each year's apportionment.

For the Federal-aid Secondary Fund:

- One third in the ratio which the area of each state bears to the total area of all the states, except that only one-third of the area of Alaska shall be included.
- One third in the ratio which the *rural* population of each state bears to the total *rural* population of all the states as shown by the latest available federal census.
- One third in the ratio which the mileage of *rural* delivery and star routes in each state bear to the total of all *rural* delivery and star routes in all the states, as certified by the Postmaster General.

No state shall receive less than ½ of 1% of each year's apportionment.

For the Federal-aid Urban Funds:

In the ratio which the population in municipalities and other urban places, of 5,000 or more, in each state bears to the total population in municipalities and other urban places of 5,000 or more in all the states as shown by the latest available federal census.

Federal funds for aid on the primary and secondary systems and their extension in urban areas may be used to defray 50% of the construction costs on all projects approved by the Secretary of Commerce.

FEDERAL-AID APPLICATION IN MICHIGAN

Interstate Fund

Federal-aid apportioned to Michigan for the Interstate System is based upon the ratio in which the cost of completing the Interstate System in this state bears to the sum of the estimated cost of completing the Interstate System in all of the states. Allotments to the various states including Michigan are based upon the 104(b)5 Study conducted in 1960. The Federal-aid Interstate Funds are used to defray 90 percent of the construction costs on approved projects while Michigan must pay the remaining 10 percent to complete the cost of the projects. On all rural Interstate projects the state's share of 10 percent is matched from Highway Department funds. On urban Interstate projects cities having a population of over 30,000 contribute to the state's share in the following proportion.

Population Group	State Partic. %	Local Share %
50,000 & over	7.50	2.50
40,000-49,999	7.75	2.25
30,000-39,999	8.25	1.75
0-29,999	10.00	0.00

Federal-aid Primary Fund

This fund can only be used for construction projects on state primary roads in rural areas or in municipalities under 5,000 population. Funds available for the state primary system is on a 50-50 Federal and State matching basis.

Federal-aid Secondary Fund

This fund must be used for construction projects on state secondary roads and county secondary roads in rural areas or in municipalities under 5,000 population. Available funds for the secondary systems is on a 50-50 Federal and States matching basis. By agreement between the State Highway Department and the various County Road Commissions, approximately $3 million of the Federal-aid received is used to defray 50% of the construction costs on secondary routes under State jurisdiction. The remaining Federal-aid is used to defray 50% of the construction costs on secondary routes under the various county jurisdictions. Amounts apportioned to each county is based upon the ratio each county bears to the sum of all counties according to the following criteria:

- One third in the ratio which the population of each county bears to the total population of all counties as shown by the latest available census.
- One third in the ratio which the total county road mileage in each county bears to the total county road mileage under jurisdiction of the several County Road Commissions in Michigan.
- One third in the ratio which the area of each county bears to the total area of all counties.

Federal-aid Urban Fund

This fund must be used for construction projects on extensions of state primary and secondary routes in urban areas over 5,000 population. Funds available for these routes, excluding Interstate routes, is on a 50-50 Federal and State matching basis. Cities with population over 30,000 contribute to the state's share according to the following proportion:

Population Group	State Partic. %	Local Share %
50,000 & over	37.50	12.50
40,000-49,999	38.75	11.25
30,000-39,999	41.25	8.75
5,000-29,999	50.00	0.00

NEEDS ON FEDERAL-AID SYSTEMS IN MICHIGAN

Municipal Interstate Needs

Municipal Interstate Needs consist of 122 miles of freeway construction at a total cost of $823 million during the study period. New locations of Interstate routes for the most part would bypass municipalities. The bypasses would be located as closely to the built-up area of the city as possible to provide a high order of traffic service on one hand, and on the other to avoid undue disruption to homes, business communication, and surface transportation. Only in the Detroit area, Grand Rapids, Saginaw, Lansing, Flint and Battle Creek would Interstate routes be carried through or into the cities. Some of the other cities where access would be provided to Interstate routes are Benton Harbor, St. Joseph, Kalamazoo, Jackson, Ann Arbor, Pontiac and Bay City. Locations of Interstate routes are shown on page 29.

Urban portions of the Interstate System average $6.7 million per mile of which 33 percent is for right-of-way alone. The total construction cost to complete the urban portions of the Interstate System is $823 million.

All Interstate improvement and costs were submitted as a part of the 104(b)5 study.

Rural Interstate Needs

The total construction cost of completing rural portions of the Interstate System is $661 million. All improvements are based upon design stand-

ards for Interstate routes which call for multi-lane divided highways with complete control of access, providing maximum safety at average operating speeds of 50-55 miles per hour in near-peak hour traffic.

Some sections are more urgently needed than others, but all are required within 15 years. Priority depends upon many factors but existing conditions and traffic demands point to the earliest possible development on most routes.

Interstate Cost Summary

Total improvement cost during the 20-year period for construction on the Interstate System and its urban connection in Michigan are shown below:

COST OF INTERSTATE IMPROVEMENTS
(In Thousands)

	First 10 Years	Second 10 Years of 20-Year Period	Total 20-years
Rural	$ 575,986	$ 84,894	$ 660,880
Urban	700,928	122,292	823,220
Total	$1,276,914	$207,186	$1,484,100

Of the total 20-year construction costs, 86 percent or $1.28 billion is needed in the first 10-year period.

Needs On Rural Primary Systems

Over a 20-year period, this study shows that $1.58 billion is needed for construction to improve to adequate standards 4,636 miles of primary routes in rural areas and in municipalities under 5,000 population. Standards on these routes vary from two-lane bituminous concrete roads to multi-lane divided highways with access control.

Due to the present and anticipated traffic on the state trunkline system the "Arterial System" specified by the Michigan Legislature which totals 948 miles and 1,080 miles of other routes on the primary system must be constructed to freeway standards during the next 20 years. These systems are illustrated on page 29.

The following table summarizes the cost of needed construction improvements on rural state primary routes eligible for aid from the Federal-aid Primary Fund:

RURAL PRIMARY CONSTRUCTION NEEDS
(In Thousands)

	First 10-years	Second 10-years	20 Year Total
Primary — Rural	$871,080	$655,590	$1,526,670
Primary — Cities under 5,000	38,200	16,790	54,990
Total — Rural Primary System	$909,280	$672,380	$1,581,660

Needs on Rural Secondary Systems

Within a 20-year period, this study reports that construction costs total $1.37 billion to improve to adequate standards 26,528 miles of state and county secondary routes in rural areas and in municipalities under 5,000 population. The predominant type of design called for on

these routes is two-lane bituminous construction with adequate base and shoulders. The following table summarizes the cost of needed construction improvements on state and county secondary routes eligible for aid from the Federal-aid Secondary Fund:

RURAL SECONDARY CONSTRUCTION NEEDS
(In Thousands)

	First 10-years	Second 10-years	20-year Total
State Secondary — Rural	$191,720	$ 59,190	$ 250,910
State Secondary — Cities under 5,000	19,460	14,620	34,080
County Secondary — Rural	756,900	312,790	1,069,690
County Secondary — Cities under 5,000	14,150	2,260	16,410
Total — Rural Secondary Systems	$982,230	$388,860	$1,371,090

NEEDS ON STATE PRIMARY AND SECONDARY EXTENSIONS IN URBAN AREAS

Improvements on 480 miles of state primary and secondary extensions in municipalities over 5,000 population is $683 million. The predominant type of improvement required on these routes is resurfacing and widening to increase traffic capacity. Wherever possible matched pairs of one-way streets were called for to relieve traffic in congested areas. The following table shows the cost of needed construction improvements on state primary and secondary extensions in municipal areas eligible for aid from the Federal-aid Urban Fund:

CONSTRUCTION NEEDS ON PRIMARY AND SECONDARY URBAN EXTENSIONS
(In Thousands)

	First 10-years	Second 10-years	20-year Total
Primary — Cities over 5,000	$239,530	$428,570	$668,100
Secondary — Cities over 5,000	12,110	3,150	15,260
Total — Urban Extensions	$251,640	$431,720	$683,360

SUMMARY

Construction costs on all systems eligible for Federal-aid is shown in the following table:

CONSTRUCTION NEEDS ON ALL FEDERAL-AID SYSTEMS
(In Thousands)

	First 10-years	Second 10-years	20-Year Total	% of Total
Interstate	$1,276,914	$ 207,186	$1,484,100	29
Rural Primary	909,280	672,380	1,581,660	31
Rural Secondary	982,230	388,860	1,371,090	27
Urban Primary & Secondary	251,640	431,720	683,360	13
Total — All Systems	$3,420,064	$1,700,146	$5,120,210	100

The total cost of improving 32,516 miles of highways and roads on these systems is $5.12 billion.

Federal-aid available for apportionment to the various states is based upon taxes and fees collected from highway users. Any change in existing Federal legislation can have considerable effect on the amount of Federal-aid available to Michigan to defray a part of the needed construction costs as outlined in this report. It is not anticipated that Federal-aid will be available to defray 90 percent of the construction cost required on the Interstate System nor will Federal-aid be available to defray 50 percent of the construction costs on primary and secondary routes as these costs are reported in this study. If construction needs as outlined in this engineering report are met within 20 years, funds required in excess of Federal-aid will have to be financed from State taxes. This problem, however, is outside the scope of this report and will have to be solved by the Fiscal Study and the State Legislature.

There are some road and street systems which do not receive Federal-aid. These systems and the needed expenditures for construction are as follows:

CONSTRUCTION NEEDS ON SYSTEMS NOT ELIGIBLE FOR FEDERAL-AID

(In Thousands)

System	20-Year Total
State Trunklines	$ 190,370
County Primary (Municipalities over 5,000)	156,260
County Local	1,226,800
Major Streets	884,360
Local Streets	543,220
Total	$3,001,010

Construction needs on all systems is $8.12 billion. Maintenance and administration $2.92 million bring this total to $11.04 billion.

Cost in this study are based upon an engineering analysis of all roads and streets by county, municipal, and state engineers. Procedures used in this analysis by the three agencies are reported in each chapter of this report. The programming of future improvements and the cost involved within 5, 10, 15, or 20 years are based upon existing conditions and 1980 traffic requirement on all road and street sections in the state. This study was possible through the joint efforts of all agencies involved. The advice and counsel of the Michigan Municipal League, County Road Association, State Advisory Committee, and the Bureau of Public Roads contributed immeasurably at various stages during this study.