BASES AND PROCEDURES FOR DETERMINING HIGHWAY, ROAD AND STREET DEFICIENCIES IN MICHIGAN

BASES AND PROCEDURES

FOR DETERMINING HIGHWAY, ROAD

AND STREET DEFICIENCIES

IN MICHIGAN

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Washington, D.C.

MARCH 1948

STAFF WORK BY
Planning and Traffic Division
Michigan State Highway Department

PROCEDURES FOR DETERMINING ROADWAY DEFICIENCIES

FOREWORD

The Michigan Good Roads Federation, through its Highway Study Committee, has made a study of Michigan highway, road, and street needs. This study has now been completed and a report of its findings has been prepared and printed for the information of the people, the Governor, and the Legislature of the State.

The present book is a collection of the procedures prepared by the engineering staff and consultants of the committee, and issued to the various highway agencies for their use in determining and reporting the needs of the roadway systems under their jurisdictions. This collection of documents was made at the request of the Public Roads Administration for distribution to agencies or organizations in other states where a similar study might be contemplated.

The Michigan Good Roads Federation which initiated this study is made up of groups and organizations interested in progressive highway development and use. The Highway Study Committee which made the study is composed of representatives of private highway user groups, commercial users, road builders, the County Road Association of Michigan, the Michigan Municipal League and the State Highway Department.

The special staff for the study was made up of personnel from the Planning and Traffic Division of the State Highway Department. The work of the staff was supplemented by technicians from other cooperating agencies and organizations and by specialists and consultants from the Public Roads Administration and the Automotive Safety Foundation.

The standards and methods set forth in these procedural manuals were formulated by three sub-committees conversant, respectively, with conditions in the state, county, and city and village highway jurisdictions. The sub-committee dealing with the bases and procedures for determining state trunkline needs was appointed by the State Highway Commissioner; that with county road needs, by the County Roads Association of Michigan; and that with municipal streets, by the Michigan Municipal League.

The Committee's engineering staff and consultants collected and prepared the basic background material for establishing standards by which the adequacy of the various types of roadways could be measured. They suggested standards for the several kinds of roads and streets. They also suggested procedures for determining needs in relation to these standards.

The sets of proposed standards and procedures for the state trunklines, the county roads, and the municipal streets were each submitted to the appropriate sub-committee for examination, revision, and approval. These sub-committees are responsible for the procedural manuals in their final form as here presented.

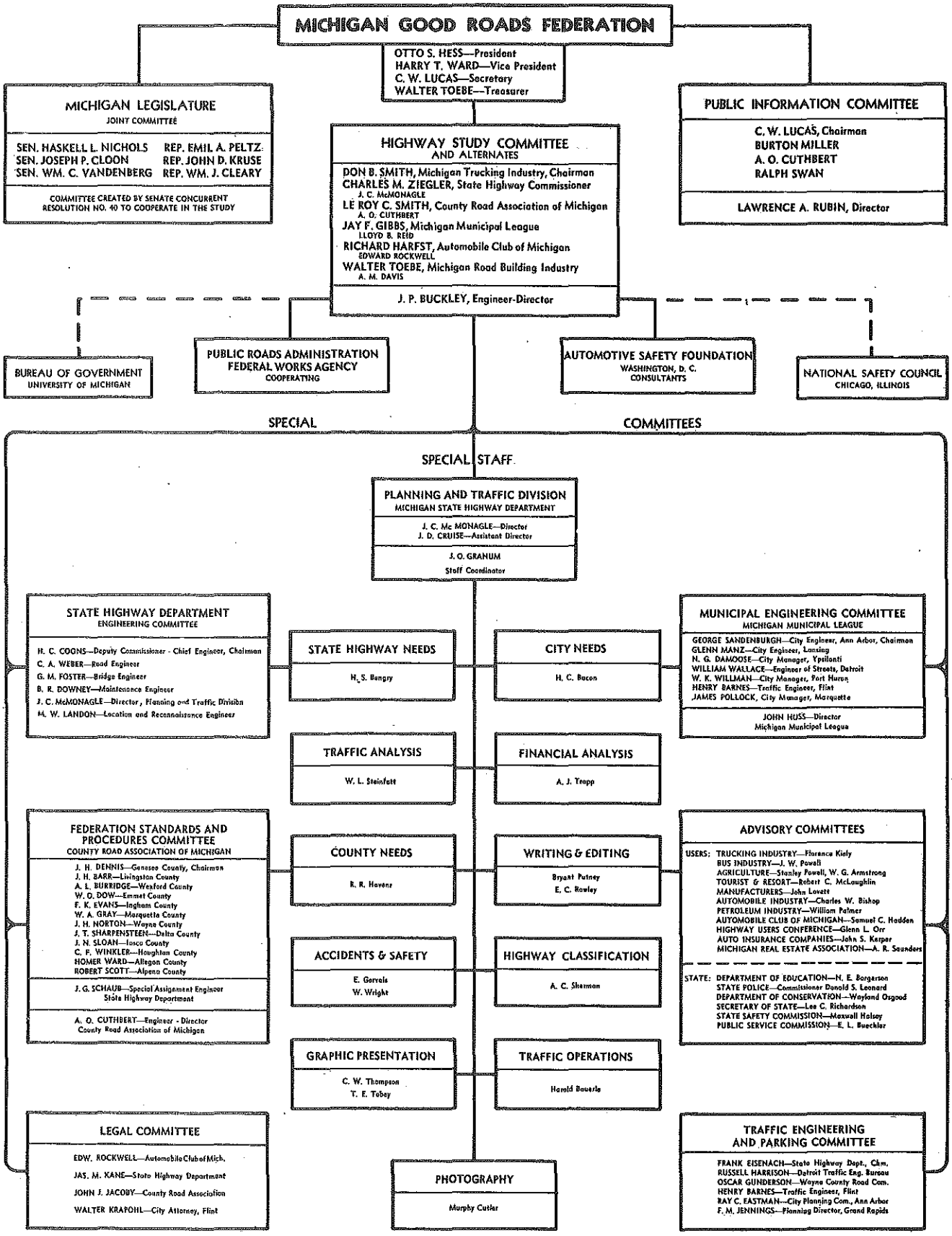
Reference to the accompanying organization chart of the Highway Study Committee, will reveal that the ultimate formulation of the standards and procedures was done by highway and traffic engineers and highway and civil administrators. Their preparation for the task was practical experience with conditions

in their several highway fields. Their object was to establish methods by which other practical highway men could do a job essential to further highway development.

The fact that these manuals produced generally successful results, was due in part to the methods adopted to familiarize county and municipal highway officials with their use. Local committees, acting under the initiative of the County Roads Association, organized regional meetings of county officials at which members of the study committee's staff carefully explained the standards, the procedures, and the methods of operation. A like program was followed in the case of municipal street officials.

During the period when the field work based on these manuals was in progress, the study staff maintained steady and cooperative contact with the local agencies. District and assistant district engineers of the State Highway Department also gave much assistance, particularly to the smaller cities and villages.

It is hoped that this presentation of some of the basic working documents used in the Michigan highway study, may prove of value and interest to those responsible for highway administration and development in other states.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BASES AND PROCEDURE
FOR DETERMINING
STATE TRUNKLINE NEEDS

Prepared By

The State Highway Department Engineering Committee

and the

Staff of the Highway Study Committee

1947

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BASES AND PROCEDURE FOR DETERMINING STATE TRUNKLINE NEEDS

July 1947

INTRODUCTION

The Michigan Good Roads Federation has appointed the Highway Study Committee to gather, analyze, and present facts about highways, roads, and streets to assist in solving the highway transportation problem in Michigan.

A major part of this study is directed toward answering the question "What are the road needs?"

Commissioner Charles M. Ziegler has appointed the State Highway Department Engineering Committee to cooperate with the Highway Study Committee and to determine what improvements are needed on the state trunklines to enable them to serve traffic safely and efficiently. The Engineering Committee has developed the bases and procedure set forth in this manual. The procedure is necessary to provide a sound, uniform, acceptable, and practical estimate of present trunkline needs.

The district engineers are to exercise their judgment in the use of this manual and are to supplement the accompanying data with facts based on their own knowledge and experience.

Similar committees have been established to study and determine the needs of county roads and city streets on the basis of similar procedures. All needs will be reviewed by the Highway Study Committee which has stated to the Governor and the Legislature:-

> "When these needs, measured by recognized engineering standards, are determined and related to each other, it will be possible for the people of Michigan and their public officials to decide intelligently to what extent they wish to meet the needs, and how quickly.
>
> Some preliminary material on road needs is available. But the gathering of data on a uniform and complete basis, so they can be analyzed and interpreted as a whole, is a major part of the present study."

OUTLINE OF PROCEDURE
(explained on pages 3 to 6)

1. Standards were established for geometric design of rural trunklines requiring new construction.

2. Tolerable conditions permitted to exist on present rural trunklines were determined.

3. Trunklines were segregated by sections according to significant traffic volumes and character.

4. Deficiencies of existing highways and structures, as related to the tolerable conditions, were tentatively determined, shown on maps and listed ty routes and sections.

5. On the basis of the kind and number of existing deficiencies, a preliminary list of required improvements to eliminate the deficiencies was prepared and locations shown on a separate map.

6. The district engineers are to examine the data and, on the basis of judgment and knowledge, prepare a critical review including:

   a. additions or deletions of deficiencies, both in kind and location, stating reasons.
   b. additions or deletions to the schedule of proposed improvements, both in kind and location, stating reasons.

7. The review is to be completed and returned to the Chief Engineer by August 19, 1947, after which the final needs of all existing state trunklines will be determined.

8. Additional needs for new construction not otherwise included will be determined by the Committee after considering recommendations of district engineers. These will include:-

   a. bypasses
   b. major relocations or additional highways
   c. connecting links to complete a section

9. Urban state trunkline needs will be determined by joint action of

   a. The State Highway Department Engineering Committee
   b. The Municipal Engineering Committee

10. Cost estimates of the physical needs are to be prepared for

    a. highways - - by the Road Division
    b. structures - - by the Bridge Division
    c. right of way - - by the Right of Way Division

EXPLANATION OF PROCEDURE

1. Standards

The "GEOMETRIC DESIGN STANDARDS FOR NEW CONSTRUCTION OF RURAL STATE TRUNKLINES" ar stated in Table I, page 7, and explained on pages 8 and 9.

The STANDARDS are the bases for cost estimates of required new construction. They show the kinds of highways required to serve the various traffic volumes which can be expected during their life.

The STANDARDS are not used directly in this study to gauge deficiencies. However, the data on which the standards are based are used to judge the "Tolerable Conditions" as described in the next paragraph.

2. Tolerable Conditions

The "TOLERABLE CONDITIONS PERMITTED TO EXIST ON RURAL STATE TRUNKLINES" are stated in Table II, page 10 and explained on pages 11 and 12.

Table II states the minimum facilities and conditions which can be permitted to remain on the rural state trunklines within the various traffic flow ranges.

The values stated in Table II are the criteria by which the various trunklines have been judged to determine the deficiencies shown on the accompanying map. The district engineers are to use these criteria in the items which have definite values, and elsewhere exercise their judgment.

3. Trunkline Segregation

The average 24 hour total traffic flow estimated for 1948 was determined for each section of all trunklines, as the first basis for measurement of deficiencies.

The average 24 hour heavy truck and trailer flow was determined to segregate the heavy and medium commercial traffic as required by Tables I and II.

Certain trunklines have characteristics of traffic distribution which result in frequent congestion at lower average 24 hour traffic volumes than other trunklines. These were determined by examining values of traffic flow in the 30th high hour of the year as referred to the Explanations of Tables I and II.

4. Deficiency Determination

A. Highways

Present deficiencies of rural trunklines are based on the present (1948) traffic flow related to the present physical conditions. When the latter are deficient when measured by one or more of the criteria shown in Table II and its explanation, the trunkline is considered deficient in that location.

The locations of deficient sections of highways and the kinds of deficiencies are displayed on the map entitled "Rural State Trunkline Needs - Existing Deficiencies" and are listed in the accompanying tabulation entitled "State Trunklines - Rural, Deficiencies and Needs". This tabulation (see sample following page 12) shows the existing traffic and physical conditions, and the nature of the deficiency based on available records.

B. Structures

Deficiencies of existing structures are to be determined in a manner similar to that for highways. Since the tolerable conditions for structures are the same for all trunklines, as stated in Table II, the Bridge Division will furnish a preliminary list of all deficient structures to district bridge engineers for review.

5. Determination of Needs

A. Highways

The tabulation referred to in paragraph 4-A includes, for each location, a statement of "Needed Improvements". The type of improvement suggested is based on

1. the nature and extent of the deficiencies
2. the "Geometric Design Standards" shown in Table I

both as related to traffic volume and traffic characteristics. The map entitled "Rural State Trunkline Needs - Proposed Improvements" displays the proposed improvements graphically.

B. Structures

The tabulation of deficient structures will include the needed improvement at each location. The improvement is based on the "Geometric Design Standards" shown in Table I.

6. District Engineers' Review

Since records are not completely up to date, examination by district engineers is necessary to add, delete or confirm specific locations and nature of deficiencies. The district engineers are to record their comments as follows:-

A. Highways

1. When the district engineer agrees with the listing of existing conditions and the nature of the deficiencies, "OK" is to be written in red pencil in the column labeled "Length", at each mileage figure so approved.

2. When existing conditions are other than stated in the tabulation, or deficiencies should be deleted or added, the district engineer is to prepare a separate comment for each location. The route, item number, location and mileage is to be included for identification of each comment. Reasons for changes to be given.

If the work is under construction or to be awarded in 1947 for some of the listed locations, this fact should be included in the comments, together with a statement as to whether the listed deficiencies will be eliminated thereby.

3. When the district engineer agrees to the type of proposed improvement, he is to write "OK" in red pencil immediately above the type of proposed improvement for each route and location.

4. When he does not agree, comments are to be prepared in a manner similar to that described in paragraph 6. A. 2.

B. Structures

1. The district bridge engineers are to add, delete or approve according to instructions included with the list of deficient bridges and proposed improvements.

2. If work is under construction or to be awarded in 1947 for some of the listed locations, this fact should be noted so that the list may be corrected.

7. Return Review

The district engineers' review for both highways and structures is to be completed and returned to Chief Engineer, H. C. Coons, by August 19, 1947. Return:

A. the "Existing Deficiency" map
B. the "Proposed Improvement" map
C. the tabulation sheets for highways and the list for structures
D. your comments, with reasons for changes

The Committee will review your comments before making final determination of needs.

The Bridge Division will review the proposed highway improvements to include bridges which would be inadequate if the highway were improved to the "Geometric Design Standards".

8. Additional Needs

The maps and tabulations previously referred to will show only the needs on present state trunkline locations. Additional facilities to serve present traffic may be necessary. Such needs include bypasses, major relocations and new highways. Complete studies have not been made for all such necessary facilities. However, sufficient data is available to make reasonable estimates for many locations.

It should be understood that the determination of state trunkline needs is not a commitment nor a program. It should be considered that the funds required to correct a deficiency would provide that correction regardless of the final method selected. For example, the cost of improvement of two parallel highways may not be materially different than the combined cost of a higher standard on one and a lower on the other. The choice of the actual improvement could be determined later without greatly affecting the overall estimates.

On this basis, then, the Committee will include highway and structure needs for bypasses and major relocations or additional highways if the equivalent needs have not been otherwise included.

Regardless of traffic requirements, connecting links between previously completed sections may be justified on the basis of safety and convenience. If not otherwise included, the Committee will determine such needs.

District engineers are requested to suggest additional needs as described in this section (8). Reasons for each such need are to be stated. The Chief Engineer must receive these suggestions by August 19, 1947, if they are to be considered.

9. Urban Trunkline Needs

The Municipal Engineering Committee requested all municipalities to include in their estimates of street needs, the needs of state trunklines inside the city or village limits.

Standards were established for municipal streets and, when streets (including trunklines) are found below tolerable limits, estimates for improvements are based on the standards.

In the smaller places, the rural state trunkline may dictate higher standards on the urban trunkline than those contemplated by the municipality. In larger places, local needs may dictate higher standards for the urban trunklines.

Therefore, whichever is the more justified estimate available will be used to represent urban trunkline needs in specific places.

Agreement will be reached between the State Highway Department and the Municipal Engineering Committees on the general estimates. Work under construction or to be awarded in 1947 is not to be included. District engineers may be requested to review specific problems.

10. Cost Estimates

Cost estimates are to be prepared using current prices. Estimates will be made for the cost of

a. highways - - by the Road Division
b. structures - - by the Bridge Division
c. right of way - - by the Right of Way Division

The estimates will be per mile costs for the various standards of new construction shown in Table I.

In some locations, adjustments will be necessary to properly reflect unusual conditions.

The estimates are to be applied to the total accumulation of needs to determine the complete estimated cost of improving the state trunklines to the standards required.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

TABLE I

GEOMETRIC DESIGN STANDARDS FOR NEW CONSTRUCTION OF RURAL STATE TRUNKLINES

(Adopted by the State Highway Department Engineering Committee, July, 1947)

HIGHWAYS

Av. 24 hr. Traffic Flow Capacity Range	above 12,000	1/ 3,000-12,000	600-3,000		up to 600
Commercial Traffic 2/ (volume and weight)	Heavy	Heavy	Heavy	Medium	Medium
All Separated Grades Required	Yes	No	No	No	No
Control of Access Required	Complete	Partial or Complete	When located in developing areas		No
Number of Lanes	4-6 (divided)	4 (divided)	2	2	2
Design Speed (mi./hr.)	70	70	70	60-70	60
Pavement Type	High	High	High	High	Intermediate
Lane Width (ft.)	12	12	12	11	11
Maximum Grade (percent)	3	3	3	4	4-6
Shoulder Width (ft.)	10	10	10	8	8
Right of Way Width (ft.)	230	200	120	120	120

1/ Trunklines carrying between 3000 and 4000 vehicles in the average 24 hour period shal be given special study

2/ "Heavy" commercial traffic exists where its volume exceeds 200 trucks or 20 trailer combination in the average 24 hour period.

STRUCTURES
(On All Trunklines)

Design Load	H-20 S-16
Height over Pavement	14.0 feet
Clear Width - curb to curb	
Less than 80 ft. length	Same as pavement width plus shoulders
More than 80 ft. length	Same as pavement width plus 3.0 feet on each side

EXPLANATION OF

TABLE I

GEOMETRIC DESIGN STANDARDS FOR NEW CONSTRUCTION OF RURAL STATE TRUNKLINES

The geometric design standards stated in Table I have been determined on the basis of traffic flow values and characteristics which distinguish some of the physical elements of the highways.

These standards are the bases of estimates for required new construction. (The methods of determining required new construction are explained on page 11, in the explanation of Table II.)

Reasons for selection of values shown in Table I are stated below:

All Separated Grades

Studies of the PRA and others have determined that the practical working capacity of a four lane divided highway with traffic lights or intersections at grade is 12,000 vehicles per day. Separation of grades and control of access will more than double the capacity of a four lane divided highway without these facilities.

Control of Access

The PRA and the AASHO recommend control of access to preserve the ability of the newly constructed highway to serve the traffic for which it was designed and built. Control of access reduces the number of major and minor intersections, resulting in fewer turning movements. This will increase the capacity and safety of the highway.

Number of Lanes

The number of lanes required is based on studies of the desirable traffic capacity of each lane related to the average 24 hour traffic flow. The flow in the 30th high hour of the year is also considered because it is a measure of the frequency and degree of traffic congestion. More than two lanes are warranted when the value of the 30th high hour is over 600, and more than four lanes are warranted at values over 2100.

The warrant for divided highways is based on traffic demands and on studies of accident occurrence which clearly indicate the low accident frequency of divided compared with undivided highways.

Design Speed

The design speed is based on the recommendations of the AASHO and the PRA. Design speed will control other items of geometric design including horizontal curvature, the minimum stopping distance and the minimum passing sight distance which, in turn, controls vertical curvature.

Pavement Type

Examination of the records of the Michigan State Highway Department indicates that high type pavements are constructed when the average 24 hour traffic flow approaches 600 vehicles.

This 25 year practice appears to be a reliable guide to the type of pavement desired by the public and needed to economically serve traffic.

The value is confirmed by a majority of state highway departments which consider that 750 vehicles in the average 24 hour period is the maximum traffic for intermediate type pavements. The value of 600 is justified in Michigan due to the varied soil conditions and frost problems.

Lane Widths

The lane width is based on studies of the PRA and recommendations of the AASHO, which indicate that wider lanes are necessary for these reasons:-

a. The traffic stream contains an increasing volume of large dimension trucks and trailers. Their use is being extended to a greater mileage of highways.

b. Wider lanes are safer because they increase clearance between the large trucks and between passenger cars travelling at higher speeds.

c. The practical traffic capacity of a two lane rural road is 30 per cent greater for 12 foot lanes than for 10 foot lanes.

d. Shoulder maintenance costs are reduced.

Maximum Grade

The maximum grade percentages are based on PRA studies of economy in truck operation and the influence of slow trucks on traffic. The percentages selected are influenced by the relatively flat topography of Michigan which permits moderate grades.

Shoulder widths

The widths of shoulders are based on recommendations of the AASHO to provide safe standing of vehicles off the travelled way.

Right of Way Width

The right of way widths are based on State Highway Department experience and physical requirements necessary to provide the facilities otherwise indicated.

STRUCTURES

The values stated for structures apply to all state trunklines to permit freedom of movement for commercial traffic and military vehicles. The values are based on AASHO recommendations modified by current practice and the increasing volume of large dimension heavy trucks and trailer combinations.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

TABLE II

TOLERABLE CONDITIONS PERMITTED ON EXISTING
RURAL STATE TRUNKLINES

(Adopted by the State Highway Department
Engineering Committee, July, 1947)

HIGHWAYS

1948 Av. 24 hr. Traffic Flow Range	over 12000	7000-12000	4000-7000	3000-4000 [1]	1000 - 3000		up to 1000
Commercial Traffic [2]	Heavy	Heavy	Heavy	Medium to Heavy	Heavy	Medium	Medium
Number of Lanes not less than	6	4	3	2	2	2	2
Width of Lanes not less than (ft.)	10	10	10	10	10	10	10
Pavement Type not less than	High	High	High	High	High	Inter-mediate	Surface-treated Gravel
Surface Condition	Good						
Maintenance Cost (Surface and shoulders)	Not excessive to maintain in good condition						
Single Horizontal Curves not over	6 degrees						
No. of "No Passing Zones" not over	2 per mile						

[1] Trunklines carrying between 3000 and 4000 vehicles in the average 24 hour period shall be given special study.

[2] "Heavy" commercial traffic exists where its volume exceeds 200 trucks or 20 trailer combinations in the average 24 hour period.

STRUCTURES
(All Trunklines)

Load Capacity - - not less than legal limits.
Condition - - structurally sound.
Alignment - - safe for traffic, with no major waterway restriction.
Clear Width
(curb to curb) - not less than two feet wider than tolerable pavement widths.

EXPLANATION OF

TABLE II

TOLERABLE CONDITIONS PERMITTED ON EXISTING
RURAL STATE TRUNKLINES

Table II sets forth the general criteria by which deficiencies on existing state trunklines are to be measured for the purposes of this study. The deficiency map has been prepared from available data by application of these criteria. This is to be supplemented by the knowledge and judgment of the district engineers.

Use of Criteria

A practical analysis of the present needs of state trunklines for improvement requires practical limits of acceptability of present conditions. If deficiencies were measured by the Geometric Design Standards stated in Table I, nearly the entire rural trunkline system would be found below standard. Therefore, Table II states the minimum existing conditions considered acceptable for present traffic, although such conditions are not desirable standards of construction. The criteria of Table II should be applied with the knowledge that roads built with the design standards specified in Table I would be much more convenient to use and would have a practical traffic capacity up to 50 per cent greater than most of the roads proving acceptable when measured by the values in Table II.

A need for improvement will be determined by the Committee on the basis of

a. a single important deficiency, such as an inadequate number of lanes for the traffic flow
b. a combination of other deficiencies in such items as surface condition and number of "no passing zones"

both as measured by the limits stated in Table II and supplemented by the field work of the district engineers. Further explanation of the methods of determining needs is stated in the Explanation of Procedure, pages 3-6.

When the need is determined, estimates for construction to eliminate the deficiencies are to be based on the standards stated in Table I.

Traffic Values

The traffic groups have been selected to distinguish the various physical conditions which singly or in combination, may represent an intolerable condition. The estimated 1948 traffic values are applied to trunklines for the purpose of determining deficiencies, since the accumulated needs up to January 1, 1948 are to be determined on the basis of the traffic values at that time.

Number of Lanes

The number of lanes is indicated for the different traffic values. The number represents the lanes necessary to carry the maximum average 24 hour flow of each range.

This is based on PRA studies of the traffic capacity of each lane, and values selected by the AASHO.

Since it is not economical to design highways for the peak traffic alone, the flow in the 30th high hour of the year is also used. It is a measure of the frequency and degree of traffic congestion. The maximum values of the 30th high hour for 1948 traffic are:-

600 or 800 in certain cases - - - for 2 lanes
1050 - - - - - - - - - - - - - - - - - - for 3 lanes
2100 - - - - - - - - - - - - - - - - - - for 4 lanes

Any 30th high hour value in excess of these, results in intolerable congestion and therefore a need for greater capacity is indicated.

Other Conditions

The width of lanes and pavement type which can be tolerated are based on consideration of available data and the judgment of the Committee.

Deficient surface condition has been indicated on the deficiency maps by assuming that high type pavements over 15 years old are in poor condition except where available field reports indicate the contrary. The limit of 15 years was selected because records indicate that high type pavements have been rebuilt or resurfaced at that average age. District engineers are best qualified to indicate the present status. Judgment of surface condition is to include consideration of:-

a. tolerable riding qualities (smoothness)
b. extent of broken slabs, patched areas, edge ravel, etc.

Maintenance costs which can be tolerated for 1948 traffic on specific highways must be judged by district engineers. The Committee only recommends that any highway which requires excessive maintenance to keep it in good condition is to be judged deficient in that respect.

The limits of 6 degrees for single horizontal curves and two "no passing zones" (yellow lines on 2 and 3 lane highways) per mile are based on studies of accident occurrence and AASHO recommendations, together with Committee judgment as to the tolerance which can be permitted. Other hazardous conditions or additional locations not shown on the map should be noted by the district engineers.

Structures

Tolerable conditions which can be permitted in connection with existing structures are based on Committee judgment. Each structure will be subject to special study and the judgment of bridge engineers is to be exercised.

STATE TRUNK LINES - RURAL
DEFICIENCIES AND NEEDS

DISTRICT NO. 7
(KALAMAZOO)

ROUTE	ITEM NO.	LOCATION	LENGTH (Miles)	EXISTING CONDITIONS										BASIS FOR CONCLUSIONS REASONS:	NEEDED IMPROVEMENTS					
				Physical Deficiencies	Hazardous Conditions	Year Built	Surface Type	Width Ft.	Width No. Lanes	Traffic (1948) Aver. 24 Hr.	Aver. 24 Hr. Commercial	30th Hi Hr.	Aver. 24 Hr Truck Comb	No. of Structures		Type of Improvement	No. of Structures	Estimated Costs Road	Structures	R.O.W.	Total
M-43	1	Ingham Co. Line to Jct. M-100	7.0	Age Capacity	Width	1925	Concrete	18	2	5700	760	1080	180			Divided - 4 lane					
	2	Mulliken to Woodland	13.6	Surf. Type	Width-Poor Condition	1921 & 1926	Gravel	16	2	930	150	170	10			High Type - 2 lane					
	3	Woodland to N.E. Hasting	9.0	Surf. Type	Width-Poor Condition	1940	Surf. Treat. Gravel	20	2	870	120	160	8			High Type - 2 lane					
	4	N.E. of Hasting W. of Schultz	8.8	Age	Alinement	1929	Concrete	20	2	1040	140	190	10			High Type - 2 lane					
	5	W. of Schultz to Delton	6.9	Surf. Type	Poor Condition	1940	Surf. Treat. Gravel	20	2	810	90	150	3			High Type - 2 lane					
	6	Delton to Richland	9.0	Surf. Type	Poor Condition	1940	Surf. Treat. Gravel	20	2	1400	160	250	4			High Type - 2 lane					
	7	Richland to Kalamazoo	7.3	Age Capacity	Width	1925	Bit. Conc. on Gravel	18	2	2800	340	700	12			Divided - 4 lane Special Study					
	8	Kalamazoo to W. Taylor Pk.	2.0	Age	Width	1932	Bit. Conc. on Gravel	18	2	2850	340	520	34			High Type - 2 lane					
	9	M-40 to Bangor	12.5	Surf. Type	Alinement Poor Condition	1930	Gravel	20	2	1080	190	200	9			High Type - 2 lane					
M-50	1	Charlotte to Potterville Rd.	3.5	Surf. Type	Poor Condition	1934	Gravel	20	2	750	130	140	16			High Type - 2 lane					
	2	Potterville Rd. to Jct. M-43	13.0		Poor Condition	1940	Gravel & S.T	20	2	470	80	90	13			Intermediate Type 2 lane					
M-60	1	Jackson Co. Line to Homer 1/	4.7	Capacity		1933	Concrete	20	2	3800	450	700	120			High Type - 2 lane					
	2	Calhoun Co. Line to Three Rivers	27.6	Age		1929	Concrete	20	2	2320	400	420	80			High Type - 2 lane					
	3	Three Rivers to Cass Co. Line	8.7	Age	Width-Alinement	1924	Concrete	18	2	3000	500	640	160			High Type - 2 lane					
	4	St. Joseph Co. Line to W. of Jones	4.2	Surf. Type	Width		Surf. Treat. Gravel	18	2	2600	330	470	100			High Type - 2 lane					
	5	Cassopolis to Niles	13.4	Age Capacity		1924 & 1927	Concrete	20	2	4400	430	800	44			High Type - 2 lane					
M-62	1	US-31 to Eau Claire	5.0													High Type - 2 lane					
	2	Eau Claire E. Jct. M-140	3.0	Age	Width-Poor Condition	County Built)	Bit. Macadam	18	2	1160	200	210	10								
	3	E. Jct. M-140 to Cassopolis	13.7	Surf. Type	Alinement Poor Condition		Surf. Treat. Gravel	20	2	1100	175	200	9			High Type - 2 lane					
	4	Cassopolis to Ind. State Line	9.8	Age	Width-Poor Condition	1924 & 1929	Concrete	20	2	1850	240	340	19			High Type - 2 lane					

1/ Diversion of traffic to US-12 (Expressway) should reduce traffic on M-60 to where 2-lanes will be adequate.

PROCEDURES AND INSTRUCTIONS
FOR DETERMINING
COUNTY ROAD NEEDS

Prepared By

The Federation Standards and Procedures Committee

of the

County Road Association of Michigan

and the

Staff of the Highway Study Committee

1947

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PROCEDURES AND INSTRUCTIONS FOR DETERMINING COUNTY ROAD NEEDS 1947

OUTLINE OF REQUIRED OPERATIONS

The Federation Standards and Procedures Committee of the County Road Association has established the method by which the present deficiencies and needs of county roads are to be determined. The procedure is necessary to provide a sound, uniform, acceptable and yet practical estimate of the actual existing needs.

The procedure is:

1. Review and correct the suggested locations of roads designated herein as Class B county roads, shown on the map provided herewith entitled "Tentative Selection, Minimum Transportation System," in accordance with the statement "Classifying the County Roads" pages 5-10.

2. Review the traffic data indicated on the map. If later information or your best judgment indicates some error, the data should be corrected to show the proper figures and sections to which they apply.

3. Return one signed copy of the corrected map, showing corrected traffic data thereon, to the County Road Association at Lansing as soon as approved. You are to retain a copy of the corrected map for use in determining deficiencies and needs.

4. Deficiencies of roads and structures compared to the established tolerable conditions (see Table 2) are to be indicated on a work map (copies provided herewith).

5. If the deficiencies of each road section or structure are such as to indicate a need for improvement, an estimate sheet, form CN-1, 2, or 3, based on Table 1, "Construction Standards," is to be prepared for each section or structure, according to instructions (pages 12-17).

6. Upon completion of forms CN-1, 2, or 3, one copy of the forms and the work map are to be sent to the County Road Association at Lansing.

EXPLANATION OF PROCEDURE

1. Item 1 above is self-explanatory after review of the statement "Classifying the County Roads" (pages 5-10).

2. Traffic data is shown on the map (provided herewith) for the suggested Class B system only. The figures indicate the annual average 24-hour traffic estimated to occur in 1948 over the mileage bracketed by each figure. The figure was derived by increasing 1936 data by 60 percent. It may be considerably in error, either in total or for certain miles within the bracketed section. The data should be reviewed and corrected in accordance with later surveys or other knowledge of traffic conditions.

   It should be observed, however, that the estimated traffic is that which would use the road if it were properly improved. A present local road may be changed to the Class B system and improved accordingly, thus attracting traffic from adjacent roads. Such possibilities should be considered in advance so that proper construction standards may be applied.

A 1936 traffic flow map is provided herewith for your information. All traffic indicated thereon should be increased by 60 percent. It will be useful in determining the proper standards and tolerable conditions permitted on the Class C roads. If roads are added to the Class B system, the traffic thereon can be estimated from the traffic flow map and local knowledge.

3. Self-explanatory.

4. Deficiency Determination

The tolerable conditions which can be permitted to exist with normal maintenance and with correction by construction operations are shown in Table 2 "Tolerable Conditions Permitted on County Roads and Bridges" (page 11).

This table will be used by the committee and by the staff of the Highway Study Committee to judge the uniformity with which needs are determined and to judge whether projects are justified. However, the table is no substitute for the knowledge, experience and judgment of the County Engineer or Superintendent and the County Road Commission. The table will be used mainly as a broad guage for determination of needs.

Class B Roads

A deficiency exists when the road section under consideration does not meet the "tolerable conditions" established in Table 2. In order to clearly indicate the location and kind of deficiencies:

a. Trace the finally selected Class B system on one of the blank work maps furnished herewith.

b. Examine each road on this system and judge it for deficiencies according to Table 2 and the corrected traffic data, and your special knowledge.

c. Indicate on the map, by symbols of your own choosing, the kinds of deficiencies found to exist on each section of road. (See form CN-1, page 12, which lists deficiencies that should be recorded.) If no deficiency is found, leave that road section unmarked. A road section may include several miles of the same road, if those miles have similar characteristics.

Class C Roads

a. For special cases of Class C roads with a traffic volume over 150 per day and for which the tolerable conditions indicated in Table 2 are not adequate, follow the same procedure as listed under Class B roads.

b. The majority of the remaining Class C roads can be divided approximately into groups according to use, which may be approximated by examination of the traffic flow map (1936 figures plus 60%) or other better information. Your general knowledge of the deficiencies of these groups of roads compared to the tolerable conditions permitted (Table 2) will be adequate for the purpose of this survey.

Structures

a. Deficiencies of all structures on both the Class B and C systems are to be determined. "Structures" are defined as bridges and separations of 20 feet or more in span length.

b. The kinds of deficiencies which are to be recorded are listed on form CN-2 (page 12).

c. The deficiencies may be recorded on the map at the proper location, using appropriate symbols; or separately listed with proper identification for your own use.

d. In general, the structure should be judged according to the appropriate tolerable conditions permitted. (Table 2.)

5. Needs. A review of the deficiencies shown on the work map will indicate the extent of need for improvement. Your determination of those needs will be subject to review by the Standards and Procedures Committee and by the staff of the Highway Study Committee which will include a field check of the stated needs. If you can justify an improvement, include it; if not, omit it.

Projects are not to be established, or estimated as a need, for work which would normally be accomplished by maintenance operations as defined in the Uniform Accounting Procedure which has been adopted by every county.

When it is found that deficiencies are such as to require construction improvement, the standards to which the roads should be constructed are indicated on page 10 in Table 1, "Construction Standards for County Roads and Bridges." If it is found that these standards are not adequate for the special conditions existing on any road, the cost estimate may be increased with proper explanation in justification of this change. The average cost per mile indicated in Table 1 has been estimated by the committee on the basis of current prices. If the costs you report are the same or less than these averages no further explanation is required.

After determining that a need for improvement exists, job numbers are to be assigned and placed on the work map for each project on the Class B system, special cases on the Class C system and for all structure projects. The assignment of these numbers should be approximately in accordance with the priority of the projects, regardless of system or kind of job (road or bridge). This priority will not consitute a commitment or a program. It is desired for review of the uniformity with which the work is done and to indicate the kind of work most urgently needed.

Prepare, in accordance with the applicable instructions (see pages 12-17):-

a. Form CN-1, (two copies) for each required road project on the Class B system and for special cases on the Class C system.

b. Form CN-2, (two copies) for each required structure (bridge or separation) project on both the Class B and Class C systems.

c. Form CN-3, (two copies) for groups of roads on the Class C system.

d. A copy of the work map described on page 2. Be sure the work map contains the job numbers and legend explaining the symbols used to indicate deficiencies. Please be sure the job numbers on forms CN-1 and CN-2 correspond with the job numbers placed on the map.

Send to the County Road Association at Lansing not later than the indicated date (earlier if you possibly can):-

1. The corrected classification map by_____1947

2. One copy of the forms CN-1, 2 and 3 and a copy of the work map by_____1947

CLASSIFYING THE COUNTY ROADS

Summary of Procedure

1. For the purposes of this study, there is need for a selection of county roads which are predominately of county-wide interest. The majority of the present county primary roads are of this nature. However, by sound, logical and tested principles, now available, their qualifications can be reviewed and the advisability of selecting better locations for some roads can be examined.

   The selected system will be designated "Class B" and the remaining roads will be designated "Class C". The existing state trunklines are designated "Class A," pending their re-classification.

2. Selection of the Class B system does not commit counties or the state to its legal adoption. In no way would the acceptance of Class B and C road systems alter or otherwise affect the legal status of the "county" and "township" -- or McNitt -- roads. The revised classification would serve solely as the basis for tabulations and analysis of needs of county roads for the review of the Highway Study Committee and ultimate inclusion in the report of that committee. However, it is believed that the ultimate FAS system will be comprised of roads included in the Class B system. Changed future conditions may make some changes in the revised road classification desirable.

3. The staff of the Highway Study Committee has prepared a map of each county showing a minimum practical transportation system of county-wide interest. It has been selected with reference to adjoining counties so that a state-wide integrated system of principal county roads is established. Definitions, purposes and principles of system selection are explained on pages 5-8.

4. It is recognized that the system shown on the map provided herewith, entitled "Tentative Selection, Minimum Transportation System," may not be adequate to serve the transportation needs of the county. Analysis alone is not a substitute for the knowledge, experience and judgment of those most closely associated with the problems of service to the areas and people to whom they are responsible. Therefore, a local review is essential. Changes which may be required should, however, be guided by the principles of classification outlined on pages 5-8.

5. When changes in the proposed system are made by county officials, adjoining counties should be contacted to make sure that such changes will tie in with the proposed systems in those counties.

6. To the extent desired by each county, assistance in reviewing special problems will be given by the staff of the Highway Study Committee and the County Road Association.

7. The map with revisions and corrected traffic data should then be returned to the County Road Association with written approval thereon, accepting the system for the purposes of the Federation Study, but subject to future needed changes. The Standards and Procedures Committee will review, check integration with adjoining systems, adjust differences of opinions with the respective counties, approve and transmit the system map to the staff of the Highway Study Committee.

CLASSIFYING THE COUNTY ROADS

Explanation

HIGHWAY CLASSIFICATION

Highway classification is accomplished by a method in which roads are segregated into groups of similar importance according to their predominant purpose. The functional characteristics of the transportation system dictate a subdivision of the road plant into three general classes:

A. Roads connecting places of state-wide interest. This group generally comprises the state trunkline system.
B. Roads connecting places of county-wide interest. These roads provide facilities for movement between lesser populated places not served by state trunklines and are collector roads for traffic destined for trunklines or market centers.
C. Roads of local interest which provide adequate connections with collector roads and furnish access to farms, homes and immediate market centers.

Determining the class of a road does not necessarily determine the required standard of construction. The standard will be dictated, not only by its classification, but also by the volume and character of the traffic on the road.

PURPOSE

The purpose of highway classification is to establish the relative importance of each segment of the entire state transportation system. Such classification will be guided by criteria that will provide the bases for--

--the selection of an integrated system of transportation highways.
--the establishment of their proper governmental jurisdiction.
--an estimate of the general degree of each travel interest.
--potential uses in determining their proper and adequate financing.
--estimating the volume and character of traffic which will use a properly improved road, thus establishing a basis for the standards to which it should be built.
--directly comparing the relative needs for improvement of roads.
--determining the quality of maintenance and the proper allocation of maintenance funds.
--more easily ascertaining the need for signs, signals and traffic control devices.

The Federal-Aid Secondary system when expanded will, in general, be comprised of those roads selected in the Class "B" system subject to review and revision as conditions dictate.

NEED FOR REVISION

The present system of county highways has been developed over a period of years. In 1931 the Legislature created two separate road systems for the counties to administer; first, the county primary system designated prior to that date and, secondly, the former township roads taken over by the counties under provisions of this legislative act. No provision was made for a reconsideration of the qualifications of the previous county system roads.

Addition of the township roads, and later platted streets, to the county system has created many complex problems. The maintenance of these roads without adequate financial provisions has been so difficult that there has been no opportunity for the counties to revise their original road systems.

There has been a constantly increasing demand by highway users for better road service. The change in the traffic pattern on county roads is evidenced by the many changes in land usage. Development of rural recreational sites, the rapid growth of extensive residential areas beyond the confines of the city, etc., are some of the many elements contributing to the change in road usage that makes a review of the existing problems necessary.

An examination of these traffic movements will establish the habitual uses of each segment of the transportation system. Establishment of the pattern of travel will result in criteria that will determine the fundamental characteristics of each separate highway system.

PRINCIPLES OF HIGHWAY CLASSIFICATION:

The classification of populated places into similar groups according to their relative importance provides the fundamental bases for highway classification. Places of the same relative importance have like traffic attraction characteristics and are dependent upon highways for the same predominant purpose. The functional characteristics of each place are reflected directly in the character and volume of traffic using the highways which connect these places.

It is generally recognized that the predominant purpose of a route connecting two regional centers is of state-wide traffic interest, while a route connecting two minor market centers is predominantly of county-wide movement. The establishment of a classified register of all populated places is the step necessary to the ultimate product, classification of highways according to predominant purpose.

The social, economic and industrial activities of the state are carried on, in and from the populated places. Each of these populated places furnishes its part in carrying on these functions, a part that varies in intensity and amount, depending on such factors as the extent of its trade area, its overall area of influence, its ability to attract traffic, and the part it furnishes in the economy of the state or region in which it is located.

Classification of populated places into groups of similar importance has been accomplished through the medium of two separate, yet related, studies. The results of the study based on the degree of interest, or extent of traffic attracted to each market center from other populated places or areas in the state was the basis used in classifying the market centers. This study was further supplemented by a classification of places based on certain social and economic statistics that were selected as being representative of the organized activities which promote travel to the various centers of population or traffic interest areas.

The county map showing the minimum transportation system, indicates the place classification resulting from this study. Where changes in the relative importance of the places should be made, the correction should be indicated on the map to be returned.

A comprehensive plan for the development of an integrated highway system must be based on a thorough study of the functional usage of each segment of the entire transportation system. Integrated systems can be designed by connecting all points of traffic interest of similar relative importance. A system will be established by connecting the group of the most important places in the state. A second state-wide system will be designed to connect the next most important group of places. This process will be continued until all places of state interest are connected. It will be further continued until all points of significant traffic interest are included in the connected system. Highways connecting all places of traffic attraction in the state form the skeleton network of primary roads for all systems of highways.

Within each major trade area it is necessary to provide a system of interconnecting highways that will provide adequate facilities for the inter-change of traffic between all points of traffic interest. The skeleton network of roadways must be supplemented by such additional roads as are necessary to provide for this movement.

Studies of traffic movement within the trade areas revealed the following conditions for consideration in designing the Class B road system.

1. Three or four mile spacing is the most desirable depending upon the density of the population to be served.
2. The best arrangement in agricultural areas is a three mile by four mile rectangular spacing bordered by principal highways.
3. Development of extensive residential areas adjacent to the larger cities are urban in character. In these instances a spacing of one mile appears reasonable.
4. There are natural barriers that prevent the selection of the ideal connected network of roads. The spacing of roads in these instances should be decided by an inspection of each specific case.
5. There are over 6,000 lakes and many streams in Michigan. The existence of the lakes and streams will increase the mileage of principal secondary roads that are necessary to serve the points of interest which are located near these waterways. In general, large lakes will require a principal road around its shore and wide rivers will require a principal road on each side.
6. Diagonal roads must be given consideration in designating routes in any system of highways. Where they serve a considerable volume of traffic they will have to be a part of the system. These roads are an addition to the rectangular grid that is advocated and will increase the mileage of principal roads.
7. Spurs to principal secondary routes are necessary to reach consolidated schools, institutions, parks, etc. However, in many instances the spurs will be component parts of a connected principal secondary route when the use of the land suggests an expansion of the system of roads serving these areas.

PLACE CLASSIFICATION AND THE MINIMUM TRANSPORTATION SYSTEM

The principles of highway classification as outlined were used as a guide in selecting the minimum transportation system:-

A. The system was located to connect, with the minimum mileage, places of county-wide interest, determined on the basis of their traffic attraction and their social and economic characteristics.

B. In addition, the system was located with consideration of the seven conditions just stated.

A minimum transportation system is one that provides access facilities to all points of traffic interest within the trade area. It is a system of roadways with the least mileage that will still adequately ensure inter-community mobility. It is based on the principles delineated in the classification of highways and produces the best economy, securing the highest ratio of utility to cost.

The most efficient network of roads is one that connects all populated places and other points of traffic interest by extending roads outward, north, south, east, and west from the central business districts of the market centers. These roads can

be planned to lead directly into all places of traffic interest in one of the four cardinal directions.

The principles and procedures by which these systems were selected are fundamentally sound and subject to relatively exact analysis. However, such analysis alone is not a substitute for the intimate knowledge, experience and judgment of those most closely associated with the problem of the areas and the people to whom they are responsible.

This presentation is the minimum system and since it was designed without the benefit of the knowledge and judgment of local officials it is probably inadequate. A review of this system by the county road commission is necessary to ensure the most practical approach.

The best classification will be accomplished with the cooperative efforts of the state and county officials.

The staff of the Highway Study Committee has prepared maps on which are shown the relative importance of all classified places within the county connected by a minimum transportation system. Each county system will be adjusted to that of the adjoining counties in order that an integrated system of secondary roads will be established throughout the state.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

TABLE I

CONSTRUCTION STANDARDS FOR COUNTY ROADS AND BRIDGES

Adopted by the Federation Standards and Procedures Committee
of the County Road Association of Michigan

April 18, 1947

Road System Class	Annual Average 24 Hour Traffic	ROADS Code No.	Surface Type	Surface Width (feet)	Grade Width (feet)	Alignment & Gradient	Av. Cost Per Mile (dollars)	BRIDGES AND SEPARATIONS 4/ Code No.	Design Load	Clear Roadway Width (feet)
B	Over 2000	1	Concrete or Similar	Same as State Highway Dept. Standards				1	H-20	State Hwy. Dept. Stds.
B	100 - 2000	2	Black Top (heavy mat)	20	30	Safe	15000 1/	2	H-15	24
B	Under 100 2/	4	Standard Gravel	20	30	Safe	6000	2	H-15	24
C	Over 150 3/	3	Black Top (light mat or Surf. Treated Gravel)	20	30	Safe	9000	2	H-15	24
C	50 - 150	4	Standard Gravel	20	30	Safe	6000	3	H-15	22
C	Under 50	5	Minimum Gravel	9	24	Safe	3000	4	H-15	20
Platted Streets (Old Plats) Suburban Areas		6	Gravel	18'	30'	----	8000			
Resort Areas		7	Gravel	12'	24'	----	3000			

Seasonal Resort Trail Roads - No construction standards. These will be kept in proper condition by maintenance.

1/ Grading, drainage structures and gravel base at $10,000 per mile. Surface at $5,000 per mile.

2/ Moderate truck traffic, no high peak traffic.

3/ For special cases of this group, the standards for appropriate traffic volumes of the Class B group may be used with proper explanation.

4/ Recommendations for estimating costs of structures are stated on page 18.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

TABLE 2

TOLERABLE CONDITIONS PERMITTED ON COUNTY ROADS AND BRIDGES 1/

Adopted by the Federation Standards and Procedures Committee
of the County Road Association of Michigan

April 18, 1947

Road System Class	Annual Average 24 Hour Traffic	ROADS					BRIDGES	
		Surface Type	Surface Width (feet)	Grade Width (feet)	Alignment & Gradient	Surface Maintenance Cost Per Mile less than- (dollars)	Width (feet)	Safe Load
B	Over 2000	County Determination. Explanation required if construction is needed					22	H-20
B	100 - 2000	Surface Treated Gravel	18	30	Safe	600	19	H-15
B	Under 100 2/	Gravel	16	24	Safe	600	19	No Posted Loads
C	Over 150 3/	Surface Treated Gravel	18	24	Safe	600	19	No Posted Loads
C	50 - 150	Gravel	16	24	Safe	600	Reasonably safe for existing traffic.	
C	Under 50	Earth	--	24	----	---	Reasonably safe for existing traffic.	

1/ Roads and bridges meeting these conditions on January 1, 1948 require no improvement. However, unusual conditions such as heavy truck traffic, unsafe alignment and grades and bad accident records may require road construction even though otherwise meeting these tolerable conditions. When such conditions exist, they should be explained on form CN-1.

2/ Moderate truck traffic, no high peak traffic.

3/ For special cases of this group, the conditions for appropriate traffic volumes of the Class B group may be used with proper explanation.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

CN-1

COUNTY ROAD NEEDS

on January 1, 1948

County Washington Road System B x C ____ Job No. 17

Township Name Red Oak (for rural projects only)

Is this project inside a municipality: x No ____ Yes: Name

DEFICIENCIES

1. Grade	
a. Width	x
b. Gradient	
2. Alignment	x
3. Drainage & Base	x
4. Surface	
a. Type	
b. Width	x
c. Condition	x
5. New Location	

DATA ON EXISTING ROAD

Type $1\frac{1}{2}$" road mix on 4" gravel base

Year Built (if known) 1938

Length 4.5 Miles

Width: Surface 16' Grade 24'

Traffic Volume 550

Construction Standard No. 2

PROPOSED REMEDY

Surface

			Width	Grade Width
New Construction:	____	Type ____	Width ____ ft.	____ ft.
Reconstruction:	x	Type 2" Bit. Agg. on 6" gravel base	Width 20 ft.	30 ft.
Widening:	____	Type ____	Width ____ ft.	____ ft.
Resurfacing:	____	Type ____	Width ____ ft.	____ ft.

Grade Widening only: ____ ft.

ESTIMATED COST

1. R.O.W.	$	1,200
2. G. & D. S.	$	36,000
3. Surface	$	22,500
Total	$	59,700

Special Reasons for Required Work:

Soil Conditions x Drainage x
Unusual Traffic Conditions ____
Snow Removal ____ Mail Route x
School Bus Route x Milk Route ____
Bad Accident Record x
High Surface Maintenance x

Remarks: (Explain special reasons and higher than average costs.) 5 accidents in 1946, including 1 fatality, caused by three sharp curves and narrow surface width. Surface maintenance cost has averaged $700 per mile per year for last 3 years. Project will correct drainage, and remove frost heave soil areas. Some new grade on new r.o.w. to reduce curves.

Date June 4, 1947 Prepared by J. Jones, Engr.

INSTRUCTIONS FOR USE OF FORM CN-1

General: This form is to be used for individual road projects which have been determined to be needed according to instructions in Section I. Use check mark or "x" wherever applicable. See example on opposite page.

Items not mentioned in these instructions are self-explanatory. Do not include as a present need, any project which is contracted for or is to be constructed during 1947.

Identification:

1. Check on which road system the project is located, according to the accepted system designation. One project should not cover parts of both systems, nor include both rural and municipal sections. A project may include several miles of road which has similar kinds of deficiencies and similar traffic.
2. Job numbers are to correspond with the work map numbers, assigned in approximate order of priority (including bridges).
3. For projects outside an incorporated place, insert name of township only.
4. For projects inside an incorporated place, check "yes" and insert name of municipality only.

Deficiencies: Check the deficiencies that exist in this road section. Number 5, "New Location," is to be checked only if there is need for a new road which does not now exist.

Data on Existing Road:

1. Type: Describe briefly kind of surface and base.
2. Traffic Volume: Insert the figure shown on the classification map as corrected. If there is a major change, explain source of data and reasons under "Remarks."
3. Construction Standard No: Refer to Table 1 and insert the Code No. applicable to the standards required and on which the estimate is based.

Proposed Remedy: Check which of the five remedies is proposed and indicate briefly the new surface type and width, and the grade width proposed.

Definitions: (G. & D. S. means "grading and drainage structures." Drainage structures include all structures up to 20' span length.)

1. New Construction:
   a. Change of surface to higher type, including G. & D. S.
   b. New location construction, including G. & D. S.
2. Reconstruction: Rebuilding to the same or similar type, including base improvement, minor widening, and G. & D. S.
3. Widening: Existing road left in place. Major increase in width of surface, including G. & D. S.
4. Resurfacing: Placing new surface of at least 1" in thickness over existing surface, including minor widening.
5. Grade Widening only: G. & D. S. only, without Items 1, 2, 3 or 4.

When widening and resurfacing of the existing pavement is planned, both are to be checked. The width of each is to be indicated in proper space.

Estimated Cost: The costs are to be based on per mile estimates and current prices. Your cost estimates are to be used. The committee's estimate shown on Table 1 is only intended to be descriptive of the kind of road, and is not necessarily correct for your general or specific conditions. However, if these or lower costs are used, no further explanation is required.

1. R.O.W.: Show the estimated cost for purchase of needed right-of-way for the project. This is not included in the average cost estimates shown on Table 1.
2. G. & D. S.: Cost of grading and drainage structures necessary for the completion of the project. This has been included in the average cost estimates on Table 1.
3. Surface: Cost of surface and base (if necessary). For "Grade Widening only" projects, write "None."

Special Reasons and Remarks: Check the appropriate reasons for improvement and explain under "Remarks." Do not check "High Surface Maintenance" if its cost is less than $600 per mile per year. Add any other reasons which justify the need for this improvement. Use an extra sheet if necessary.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

CN-2

COUNTY STRUCTURE NEEDS

on January 1, 1948

County Washington Road System B ____ C x Job No. 12

Township Name Walnut (for rural projects only)

Is this project inside a municipality? x No ____ Yes: Name ____

Stream Crossing x R.R. Overpass ____ Year Built 1915

Hwy. Separation ____ R.R. Underpass ____ Design Load Unknown

Type of Structure Steel truss, wood deck Traffic Volume 125

No. & Length of Spans 2 - 40' Total Length 80' Roadway Width 16'

DEFICIENCIES

1. Load Capacity	x	Safe or Posted Load 7 Tons
2. Width	x	
3. Sub-structure		
4. Super-structure	x	
5. Waterway Area	x	
6. Alignment		
7. New Location		

PROPOSED REMEDY

Construction Standard No. 3

		Type and Length	
1. New Construction	___ :		Width ____ ft.
2. Reconstruction	x :	Steel deck girder, conc.deck-2@50'=100'	Width 22 ft.
3. Repair	___ :	Describe	

ESTIMATED COST

1. R.O.W.	$	None
2. Structure	$	33,000
Total	$	33,000

Special Reasons for Required Work
Unusual Traffic Conditions ____
Frequent Train Movements ____
School Bus Route x Milk Route x
Washed Out or Collapsed ____

Remarks: (Explain special reasons and higher than average costs) (No explanation required. Data indicates deficiencies, and costs are reasonable.) However, this is a bridge on the county line and cost will be shared with Lincoln Co. which will not include it in their needs. Instead, they will report entire cost of another cooperative project.

Date June 15, 1947 Prepared by J. Jones, Engr.

INSTRUCTIONS FOR USE OF FORM CN-2

General: This form is to be used for individual structure (bridge or grade separation) projects which have been determined to be needed according to instructions in Section I. Use check mark or "x" wherever applicable. See example on opposite page. Any bridge or separation of 20 feet or more in span length is a structure. All drainage structures under 20 feet are condiered culverts and are not to be reported on form CN-2. Culverts are to be included in road estimates on form CN-1.

Items not mentioned in these instructions are self-explanatory. Do not include as a present need, any project which is contracted for or to be constructed during 1947.

Identification: Location and job numbers--same as instructions for form CN-1. Report only one structure on each form CN-2.

Data on Existing Structure: Check kind (stream crossing, etc.). If known, state year built and design load. Describe type of structure (steel girder with concrete deck, steel truss with plank deck, etc.). Traffic volume is that shown on the corrected map.

Deficiencies: Check the kinds of deficiencies that exist in this structure.

1. Load Capacity: Check, if the structure does not meet the conditions shown on Table 2.
2. Width: Same as (1).
3. Sub-structure: Check if the condition is such that repair of reconstruction is required now.
4. Super-structure: Same as (3).
5. Waterway Area: Check if the cross-sectional area between abutments and from stream bottom to bridge girders is frequently inadequate for stream flow.
6. Alignment: Check if alignment is unsafe for traffic or inefficient for stream flow.
7. New Location: Check only if there is need for a new structure which does not now exist at or near this location.

Proposed Remedy: Check which of the three remedies is proposed and indicate briefly the new type, length and clear roadway width proposed. Definitions:

1. New Construction: Building a new structure not replacing an existing one.
2. Reconstruction: Replacement of an entire existing structure.
3. Repairs: Existing structure remains. Abutments repaired, truss strengthened, deck replaced, etc.

Estimated Cost:

1. State the estimated cost of right-of-way required (if any) for the structure and its approaches.
2. State the estimated cost, at current prices, of the new structure or repairs, including approach spans or short approaches. (See "Recommendations for estimating costs of structures" page 18).

Special Reasons: Check appropriate spaces and explain these or any other reasons which will justify this project. Explain unusual conditions producing high costs.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

CN-3

COUNTY ROAD NEEDS

on January 1, 1948

CLASS C ROADS

County Washington

Group	Total Miles in County	Miles Deficient	Proposed Type	Average Cost 2/ Per Mile	Total Cost
Average Daily Traffic over 150 1/	75	25	3. Light Blacktop or Surf. Treated Gravel	$3,000	$ 75,000
Average Daily Traffic 50 - 150	185	70	4. Standard Gravel	7,000	490,000
Average Daily Traffic up to 50	300	40	5. Minimum Gravel	3,000	120,000
Platted Streets in Suburban Areas	15	5	6. 18' Gravel 30' Grade	2,000	10,000
Platted Streets in Resort Areas	30	8	7. 12' Gravel 24' Grade	3,000	24,000
Seasonal Resort Trails	95	x x x	x x x x x	x x x	x x x x
Total	700	148	x x x x x	x x x	$719,000

1/ Class C roads having high traffic volumes with higher than average estimated construction cost should be excluded on this form, and shown as separate jobs on form CN-1.

2/ Explain higher than the average cost per mile (shown on Table 1): other remarks:- 3. Grade and gravel base now constructed to adequate standards. Requires only surface treatment and some drainage improvement, so cost is less than shown on Table 1. 4. Grade widening and high cost of gravel in this area will require $1,000 per mi. more than Table 1 average. 6. Low cost is possible because grades are adequate and 9' of gravel is now in place.

Date July 1, 1947 Prepared by J. Jones, Engr.

INSTRUCTIONS FOR USE OF FORM CN-3

General

This form is to be used for groups of roads in the Class C system as described on page 2. Special cases of the Class C system are not to be included in mileage or cost data on this form.

Use form CN-1 for such cases. (See note 1/ on form CN-3). Work on "Seasonal Resort Trails" is not to be included as a need (see Table I). In this study, only the total mileage of such trails is to be shown.

Needs of platted streets will be stated for only the existing plats in which road improvement is the responsibility of the county. It is assumed that new plats will be required to provide graded and graveled roads meeting these standards.

Mileage Data

Your best reasonable estimate of the total and deficient mileage in each group is satisfactory. The estimates should be checked to avoid duplication of mileage.

Average Cost Per Mile

Use the "Average Cost Per Mile" figures shown in Table I, or explain the extra cost required. It may be that the "Proposed Type" (listed on this form according to Table I) is not adequate for your conditions, in your opinion. Nevertheless, it is required that the "Average Cost Per Mile" shown on this form CN-3 be not greater than stated in Table I, unless extra costs for the "Proposed Type," as printed, can be justified.

Total Cost

Multiply the number of "Miles Deficient" by the "Average Cost Per Mile" and place the result in the "Total Cost" column.

RECOMMENDATIONS FOR ESTIMATING COSTS OF STRUCTURES

Cost of structures, based on current prices, will vary between $14 and $22 per square foot.

To find the structure area, multiply the overall length of a structure by the width (roadway width plus curbs or walks).

Structures of moderate length (30 to 40 feet), with moderate height from footing to floor (12 to 16 feet) and without piling will cost near the $14 per square foot price. Longer structures, with similar conditions, should be lower in price.

Structures of shorter length (20 to 30 feet) and requiring piling will cost near the $22 per square foot price.

Engineers should determine the estimated cost of a structure, within the above limits, based on the required design features and foundation difficulties. For estimated unit costs above $22 per square foot, an explanation should be made.

MUNICIPAL STREET REQUIREMENTS

CLASSIFICATION AND INVENTORY

Prepared By

The Municipal Engineering Committee

and the

Staff of the Highway Study Committee

1947

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

MUNICIPAL STREET REQUIREMENTS
Classification and Inventory
May 1, 1947

OBJECTIVE

In the statement to the Governor and the Legislature "The Highway Transportation Problem in Michigan" the Highway Study Committee said:

> "Engineering analysis of facts now must determine:
>
> The type of service each class of highway and street is called on to provide.
>
> Standards of construction required to achieve safe and adequate traffic service on a practical basis.
>
> The gap between present conditions and desirable standards which adds up to total needs.

When these needs, measured by recognized engineering standards, are determined and related to each other, it will be possible for the people of Michigan and their public officials to decide intelligently to what extent they wish to meet the needs, and how quickly.

Some preliminary material on urban highway needs is available. But the gathering of data on a uniform and complete basis, so they can be analyzed and interpreted as a whole, is a major part of the present study."

The objective, therefore, is to provide an engineering analysis of needs of the urban systems which will be practical, uniform and acceptable. A suggested method is outlined for your guidance.

If the objective is to be achieved, each municipality must determine its needs for improvement under the guidance of the Municipal Engineering Committee.

METHOD

The work of gathering the engineering facts is divided into several progressive steps. The information requested at this stage involves:

I. The classification of municipal streets

II. An inventory of the present street system.

<u>The street classification and inventory map and tabulations when completed should be mailed to J. P. Buckley, Engineer Director, Highway Study Committee, Michigan Good Roads Federation, 512 Tussing Building, Lansing, Michigan.</u>

At a later date more information related to highway needs will be requested.

Each municipality is requested to return a city map and retain a copy for future use showing:

I. CLASSIFICATION

The arterial street system is to be shown by coloring. Those cities which have an approved arterial street plan may transfer the information on a city map using the standard color designation described below and indicate the approval. Cities which do not have an approved plan may proceed according to "Criteria for Classifying City Streets," (Page 5). In general the system will be composed of:

1. MAJOR THOROUGHFARES

   a. All state trunklines shown in red

   b. All other major thoroughfares shown in orange

2. SECONDARY THOROUGHFARES shown in green.
   (Some cities may not have this classification.)

3. LOCAL STREETS (all other streets)

   Not indicated by color on the map. These will be shown by total miles on the inventory form. (See Section III)

4. ALLEYS

   Shown only on the inventory form by total miles.

II INVENTORY

On the same map an inventory of only the major and secondary thoroughfares shall be shown and include the following information by street sections.

A section will be considered as a continuous strip of pavement within the same width group and the same surface type. A section shall end and a new section begin where the index width or the surface type changes. Each section of street shall indicate width by index number, type of surface by letter and a length of section by a mileage figure:

A. Street width

Width of street curb to curb is to be indicated by width groups. For streets without curb use the width of traveled way.

All various width pavements will be included in groups and classified as follows:

Width Group	Map Index Number
10 feet to 19 feet	1
20 feet to 29 feet	2
30 feet to 39 feet	3
40 feet to 49 feet	4
50 feet to 59 feet	5
60 feet to 69 feet	6
70 feet and over	7

B. Surface types shall be classified in four categories and designated on the map by letters as follows:

HIGH TYPE Code Letter (H)
including
Concrete
Brick or other block on concrete base
All bituminous types on concrete bases

INTERMEDIATE TYPE Code Letter (I)
including
All bituminous types on gravel, stone or similar base

LOW TYPE Code Letter (L)
including

Gravel	Crushed Stone
Cinders	Mine Rock
Slag	W. B. Macadam
Stamp sand	and similar surfaces

EARTH ROADS Code Letter (E)

C. THE LENGTH of the section will be expressed in miles and decimals thereof.

Examples 1.56 0.39 0.04

D. TYPE OF PARKING

Type of parking shall be indicated on the map for only the major and secondary thoroughfares by the use of two symbols. Where a symbol is not used it will be assumed that normal parallel parking is permitted. The symbol ////////////// shall represent areas where angle parking is permitted and .NO shall represent areas where no parking is permitted. The no-parking symbol shall not be used for short sections such as building and theatre entrances, driveways or loading docks, cab or bus stands.

III. INVENTORY TABULATION FORM

An inventory form (M-1) is provided to consolidate and total all information (except parking regulations) shown on the map. It is necessary that this form be filled out completely in order that the totals for the state-wide classification and inventory may be ascertained rapidly and uniformly. An additional form (M-1) is provided for your record.

1. All figures to be placed on the form shall be in miles and decimals thereof. Where a classification does not apply to your city, mark with an X to indicate the classification has not been overlooked.

2. Structures (bridges) are divided into three classes. The structures shall be recorded as number of units regardless of length, width or number of spans.

3. Local streets shall be recorded in total miles for your city and shall not include any other classification. (Do not duplicate intersections in the mileage total.)

4. Alleys shall be recorded in total miles.

SUGGESTIONS

It will be necessary that you prepare two maps, one for your own reference for determining needs at a later date and one to be presented to the Highway Study Committee. In order to obtain uniformity and ease of interpretation it is requested that you follow the same color designation found on the sample.

For those cities and villages which do not have printed copies or tracings of the city map it is suggested that photostatic copies be obtained.

The scale of the map is not important but should be large enough to include inventory data but small enough for desk use. Larger cities may present the map in sections.

A sample of the "Method for entering data on the map" is attached.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

CRITERIA FOR CLASSIFYING CITY STREETS

The need for classification of streets in urban areas has long been recognized. As a foundation for a system of thoroughfares there must be a street plan, and particularly a major street plan dealing more especially with the most important routes of travel within the city. Such a plan provides the basis for sound financing and progressive development of the system of streets.

The activities of a city naturally group themselves around focal points of special interest. Since these focal points determine the positions and directions of the principal streets, they play an important part in the city plan. The principal focus for the main arteries is the central business district and for that reason traffic facilities are usually made to favor that important place. Other focal points of traffic importance are subordinate business centers, major industries, major parks and recreational areas and terminal areas and public buildings. Just as these focal points within a city determine the location of the principal arteries, the city itself becomes a dominant focal point and determines the location of the principal transportation routes that converge toward the city.

City streets are usually classified according to the degree of their relative importance in the transportation system as follows:

DEFINITIONS

1. Major Thoroughfares -- A primary transportation artery which connects the focal points of primary traffic interest within the city; a primary artery which provides communication with other communities and the outlying areas; a primary artery which has relatively high traffic compared with other streets within the city.

   *Note: At this stage, expressways will be considered major thoroughfares.

2. Secondary Thoroughfares -- A secondary transportation route that serves to connect the lesser important focal points within the city or to provide communication with points of traffic interest in the outlying areas. In addition to the above, they are those routes which serve to collect and distribute traffic from the major thoroughfares onto the local streets.

3. Local Streets -- A local street is limited primarily to providing access to the abutting property. It is tributary to the major and secondary thoroughfares, is expected to serve only limited areas and discourages through traffic.

4. Alleys

Traffic tends to select the most direct, wide streets and follows the line of least resistance. Through experience and observation, city officials know which are the main thoroughfares and which are purely local streets. There may be some question as to which routes should be classed as secondary thoroughfares or feeder routes. There may also be some doubt as to whether the existing known major thoroughfares are located to best serve the traffic needs. The following suggestions will help to define the classification.

SUGGESTIONS FOR DETERMINING MAJOR AND SECONDARY THOROUGHFARES

In absence of a well considered and accepted major street plan with which to identify the various classes of streets, the existing pattern may be accepted. This pattern can be identified in general by showing on a work map for your own use: (The final selection will be transcribed on the map to be presented.)

1. The principal transportation routes through the municipality, such as the state trunklines.

2. Streets which connect the principal county roads with the main business areas or which connect two or more county roads.

3. The through streets at which traffic is required to stop.

4. Crosstown and circumferential routes.

5. Location of the focal points of traffic interest.

    a. Business centers
    b. Major industries
    c. Major parks and recreational areas
    d. Transportation terminal facilities
    e. Other focal points of traffic interest

Having indicated on the work map the existing thoroughfares and the focal points of traffic importance, it will be possible to classify the existing system in accordance with the stated definitions. Where available, a traffic map will furnish additional criteria for identifying the street pattern. Where not available, approximations of traffic volumes should indicate the relative importance of the various streets on the major street plan. Streets which carry relatively large volumes of traffic compared with other streets in your city are usually on the major thoroughfare street system.

A study of the map may indicate that certain areas lack sufficient feeder routes. In the larger cities, such feeder routes may be necessary every six to eight blocks. A knowledge of the area to be served according to the density of population, continuity of other routes, etc. will indicate such need. Such routes should be added, where thought necessary, regardless of whether or not it is now a through street. Certain other routes may be necessary to provide connections for an integrated system of highways.

M-1

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

INVENTORY OF CLASSIFIED CITY STREETS

County_____ City of_____

Total City Area_____Acres

MILES BY WIDTH GROUPS AND SURFACE TYPES

			By Width Index Number						
		Totals	1	2	3	4	5	6	7
Major Thoroughfares 1. State Trunkline	High Type								
	Intermediate								
	Low								
	Subtotals								
2. Other Major	High Type								
	Intermediate								
	Low								
	Earth								
	Subtotals								
Secondary Thoroughfares	High Type								
	Intermediate								
	Low								
	Earth								
	Subtotals								
Major and Secondary Thoroughfares	TOTALS								

Local Streets
- High Type _____ Miles
- Intermediate _____ Miles
- Low _____ Miles
- Earth _____ Miles
- Local Streets Total _____ Miles
- Total All Streets _____ Miles

Divided Highways Included in this tabulation _____ Miles

County Roads within the city included in this tabulation _____ Miles

Main Line R. R. Grade Crossings _____

Number of Structures
1. R. R. Separations _____
2. Stream Crossings of more than 20 feet span _____
3. Road Separations _____

Alleys_____Miles

Prepared by:

_____

Title_____

Date_____

M-1

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

INVENTORY OF CLASSIFIED CITY STREETS

County_____ City of_____

Total City Area _____ Acres

MILES BY WIDTH GROUPS AND SURFACE TYPES

			By Width Index Number						
Major		Totals	1	2	3	4	5	6	7
Thoroughfares	High Type								
1. State	Intermediate								
Trunkline	Low								
	Subtotals								
2. Other	High Type								
Major	Intermediate								
	Low								
	Earth								
	Subtotals								
	High Type								
Secondary	Intermediate								
Thoroughfares	Low								
	Earth								
	Subtotals								
Major and Secondary Thoroughfares	TOTALS								

Local Streets	High Type	_____ Miles
	Intermediate	_____ Miles
	Low	_____ Miles
	Earth	_____ Miles
	Local Streets Total	_____ Miles
	Total All Streets	_____ Miles

Divided Highways Included in this tabulation _____ Miles

County Roads within the city included in this tabulation _____ Miles

Main Line R. R. Grade Crossings _____

Number of Structures

1. R. R. Separations _____
2. Stream Crossings of more than 20 feet span _____
3. Road Separations _____

Alleys _____ Miles

Prepared by:

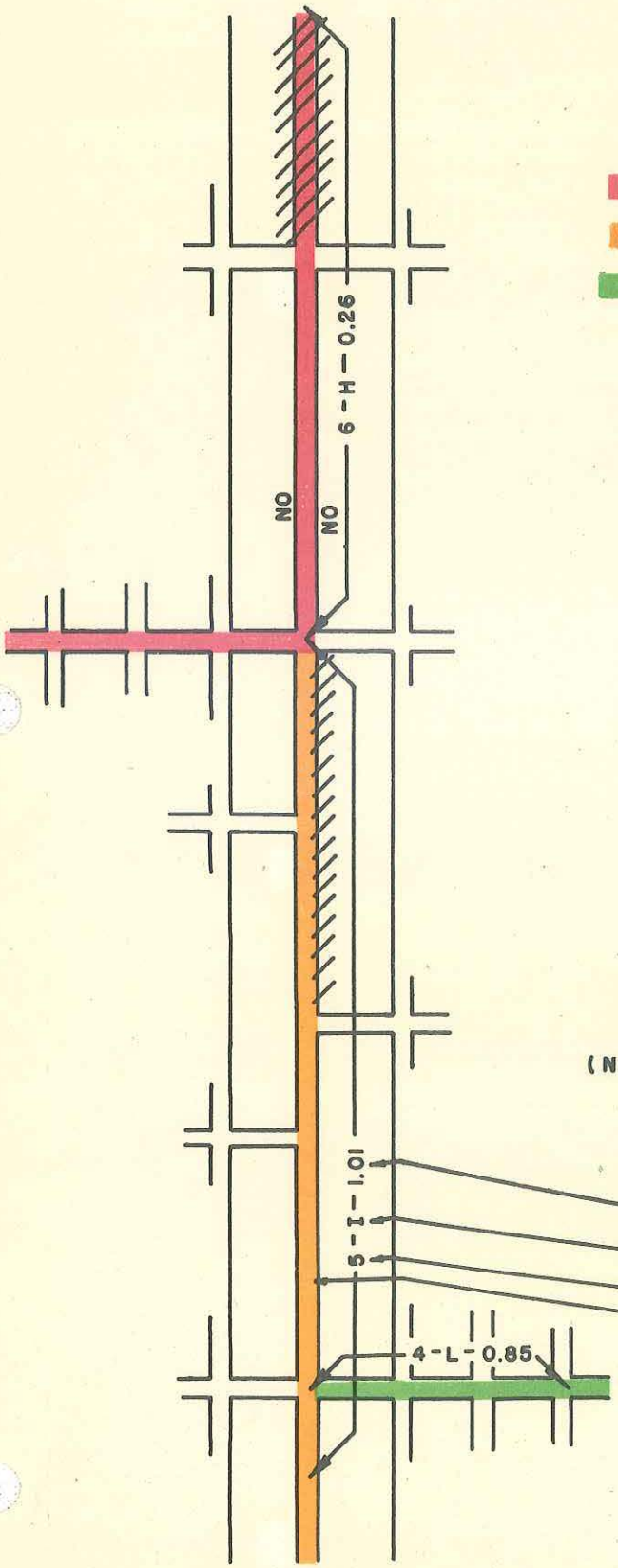
_____

Title _____

Date _____

MICHIGAN GOOD ROADS FEDERATION
HIGHWAY STUDY COMMITTEE

METHOD FOR ENTERING DATA ON THE MAP



NOTE: THE COMMENT BELOW WILL NOT APPEAR ON THE MAP

STATE HIGHWAY (MAJOR THOROUGHFARE)

OTHER MAJOR THOROUGHFARE

SECONDARY THOROUGHFARE

1 TO 7	WIDTH INDEX NUMBER
	1 = 10 FEET TO 19 FEET
	2 = 20 FEET TO 29 FEET
	3 = 30 FEET TO 39 FEET
	4 = 40 FEET TO 49 FEET
	5 = 50 FEET TO 59 FEET
	6 = 60 FEET TO 69 FEET
	7 = 70 FEET AND OVER

SURFACE TYPE

H	HIGH TYPE SURFACE
I	INTERMEDIATE TYPE
L	LOW TYPE SURFACE

0.26 MILES – LENGTH OF SECTION

BOUNDARY OF SECTION

TYPE OF PARKING

////	ANGLE PARKING BOTH SIDES
(NO SYMBOL)	PARALLEL PARKING BOTH SIDES
///	PARALLEL PARKING ONE SIDE ANGLE PARKING OTHER SIDE
NO	NO PARKING

MILES – LENGTH OF SECTION

INTERMEDIATE TYPE SURFACE

WIDTH INDEX NUMBER

NO SYMBOL – PARALLEL PARKING

PROCEDURE AND INSTRUCTIONS
FOR DETERMINING
MUNICIPAL STREET NEEDS

Prepared By

The Municipal Engineering Committee

and the

Staff of the Highway Study Committee

1947

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PROCEDURE AND INSTRUCTIONS FOR DETERMINING MUNICIPAL STREET NEEDS
June 16, 1947

The Municipal Engineering Committee has established the method by which the present deficiencies and needs of municipal streets are to be determined. The procedure is necessary to provide a sound, uniform, acceptable and yet practical estimate of the actual existing needs. State and county roads are being analyzed by similar processes.

Deficiencies and needs are to be determined on the basis of physical facts and sound judgment without consideration of methods of immediate financing. Estimates are to reflect only those needs which can be justified.

OUTLINE OF PROCEDURE (Explained on pages 2-6)

I. Refer to your copy of the "Classification and Inventory Map" recently submitted in reply to letter from J. P. Buckley, dated May 8, 1947.

II. Determine the deficiencies:

A. Pavement type and condition

B. Inadequate traffic capacity

C. Traffic Control

D. Structures

III. Determine the needs:

When deficiencies of streets or structures require improvement

A. An estimate on form M-2 is to be prepared for each project on the major and secondary thoroughfares, including state trunklines.

B. An estimate on form M-3 is to be prepared for groups of projects on the local streets.

C. An estimate on form M-4 is to be prepared for each structure on any street.

IV. A summary of all needed projects is to be recorded on an estimate sheet, form M-5.

V. Upon completion of the determination of needs the following items are to be forwarded to J. P. Buckley, Engineer-Director, Highway Study Committee, Michigan Good Roads Federation, 512 Tussing Building, Lansing 7, Michigan, on or before August 15, 1947.

1. City map showing location of each project with job numbers.
2. One copy of each estimate, forms M-2, 3 and 4.
3. One copy of the summary, form M-5, expressing the total municipal needs.

EXPLANATION OF PROCEDURE

Note: This is a step by step process. Questions which arise in the first parts may be answered by continuing to later parts and the instructions for each form.

I. CLASSIFICATION AND INVENTORY MAP

The street classifications referred to in these instructions are those which you recently submitted.

II. DEFICIENCIES ARE TO BE JUDGED AND INDICATED AS FOLLOWS:

Include state trunklines inside city or village limits.

A. Pavement: Type and Condition

1. Major and Secondary Thoroughfare System:-mark in green on a work map the locations of streets which need:-

a. Construction to provide a high type pavement, when a lower type now exists.
b. Reconstruction of present base and surface.
c. Recapping or resurfacing of 2" or more in thickness, and base repair.

Note: Indicate the location of each of these conditions by symbols as shown in the sample, page 9.

2. Local Streets:-estimate, without marking on the map, the total mileage in each of the five classes shown in Table 1 which require:-

a. Construction to provide a higher type pavement than now exists. (Refer to Table 1.)
b. Reconstruction of base and surface.
c. Recapping or resurfacing of 2" or more in thickness, and base repair.

Note: Local streets having very little traffic and located in lightly populated areas will ordinarily be considered satisfactory in their present condition.

B. Inadequate Traffic Capacity

In those cities where traffic congestion is a problem:-

1. Mark in red on the same work map those locations where there is traffic congestion on the major and secondary thoroughfare system.

2. To judge the needs for improvement to relieve congestion, it is necessary to use traffic data. Available traffic data should be brought up to date and converted to the average 24-hour traffic figures, which should then be placed on the map at the proper locations.

If no data is available, short traffic counts can be made and expanded to show the average daily traffic. A brief explanation of the method is on page 7.

If no data can be secured, your best estimate of the average daily traffic volumes should be shown.

C. Traffic Control

Major and secondary thoroughfares should have efficient highway lighting for traffic safety. The Illuminating Engineers Society has established acceptable standards. Thoroughfares should have adequate signalization for safe, efficient traffic flow. Table 1, "Standards" also indicates two kinds of local streets (Nos. 4 and 5) which should have traffic control. Deficiencies in these items should be considered.

D. Structures on <u>all streets</u>, both thoroughfares (including trunklines) and local.

All structures (defined as grade separations and bridges of 20 feet or more in length) are to be examined to determine:-

1. Deficiencies in roadway width.

2. Deficiencies in structural condition and load carrying capacity.

Judgment can be guided by the appropriate standards for structures stated in Table 1. Structures in good condition which meet these standards within reasonable limits can be considered satisfactory.

III. DETERMINATION OF NEEDS

A review of the deficiencies shown on the work map will indicate the extent of need for improvement. Your determination of those needs will be subject to a review by the Municipal Engineering Committee and by the staff of the Highway Study Committee which may include a field check of the stated needs.

When the need for an improvement is determined, the selection of standards should take into account further traffic increases.

Projects are not to be established, or estimated as a need, for work which would normally be accomplished by maintenance operations.

A <u>job number</u> is to be assigned to each needed project on the thoroughfare system, and each structure project. The job numbers are to be placed on the map and on the forms M-2 or M-4 correspondingly. The assignment of these numbers should be approximately in accordance with your present idea of the priority of the project, including all streets and structures. This statement of priority will <u>not</u> constitute a commitment or a program. It <u>will</u> show in general, the kind of work most urgently needed by all the municipalities.

Suggestions for estimating the per mile or square yard costs of pavements and the costs of structures at present prices are given on page 14. Other costs such as right of way, signalization, etc. should be a reasonable estimate based on the present price levels. Your own estimates are preferred. If your costs are less than those suggested, no further explanation is required. The entire cost should be stated, regardless of any present or proposed division of the cost between governmental jurisdictions or property owners.

A. Major and Secondary Thoroughfares (including state trunklines)

The work map will indicate the locations on major and secondary thoroughfares where deficiencies exist. Cost estimates of corrective measures are to be prepared on form M-2 or M-4 according to the respective instructions, and the following:-

1. Where traffic congestion is not a problem, the following paving operations may be required:-

   a. Provide a high type pavement.
   b. Reconstruct existing high type pavement.
   c. Recap or resurface existing high type pavement.

2. Where traffic congestion is a problem, the proper pavement width should be determined before estimating cost of surfacing.

   At congested locations, the traffic data shown on the work map can be used to determine the pavement widths required under various operating conditions, by examining Table 2. For example:-

   > An existing 48-foot pavement (curb to curb) in a business area is carrying 8,000 vehicles per day and congestion is frequent. Parallel parking and right and left turns are permitted.

   Under these conditions, if continued, it would require a pavement 66 feet wide to relieve congestion. Table 2 indicates that parking would have to be prohibited to relieve congestion on the existing pavement.

   In this case, an estimate could be submitted for the cost of:-

   1. Widening the pavement to 66 feet, or
   2. Improving a parallel street, or
   3. Providing off-street parking facilities sufficient to permit the prohibition of parking on the pavement.

   The most economical, yet feasible, means of relieving traffic congestion should be examined. Other means of congestion relief are suggested on page 8, and they should be considered before deciding to submit an estimate of need on form M-2.

   It should be realized that the cost of relieving traffic congestion by any of these means may not be materially different. A good estimate for any one of these solutions will be satisfactory.

Existing pavements which are about 10 percent less in width than indicated in Table 2 will carry the same traffic volumes under conditions which can be tolerated and an estimate should not be submitted.

However, when a decision is reached to widen a street, the estimate of cost should be based, whenever practicable, on the standard widths stated in Table 2 and include necessary right of way costs and other items, stated separately, as shown in Table 1 and on form M-2.

Off-street parking facilities may be the means of relieving traffic congestion on a particular street. If so, the estimated cost, including property (separately stated) may be reported on the form M-2 relating to that street. The same form may include costs for other items of work also necessary on that street.

Where additional off-street parking facilities are needed, a separate form M-2 may be submitted for a group of such facilities. Reasons for including such facilities should be stated.

3. Highway Lighting or traffic control devices or both, (if not otherwise included in project estimates) may be separately estimated and submitted on form M-2.

Referring to Table 1, it will be noted that "Highway Lighting" and "Traffic Control Devices" are considered necessary on thoroughfares. Suggestions for estimating the cost of the additional signal lights needed are stated on page 14.

B. Local Streets

Deficiencies in surface type or state of repair will have been determined for each of the five classes of local streets shown in Table 1.

Standard widths to which local street pavements should be constructed are also indicated in Table 1.

Estimates of needs for local street improvement are to be made without regard to whether the work might be done by budgetary appropriation or by special assessment. The estimates are to show the entire cost, and are to be segregated in three groups on form M-3, as follows:-

1. Cost estimates of needs for
   a. construction to provide a higher type surface than now exists, or
   b. reconstruction of base and surface
   can be computed by multiplying the lineal feet of street deficient for these reasons by the standard width, dividing by nine and multiplying by the square yard price shown in Table 1, for each class of street.

This procedure assumes that local streets requiring such construction will be constructed to the standard widths, and at the assumed prices. If these prices are not approximately correct for your community, please adjust to the correct figure. If the unit price used is higher than shown in Table 1, explanation should be made on the reverse side of form M-3.

2. Cost estimates of needs for:-
   c. recapping or re-surfacing (at least 2" thick) of pavements on local streets

   can be computed by multiplying the mileage of such deficient streets in each class by the average cost to you for the present average widths.

3. Some local street pavements may be considerably narrower than the indicated standards. Where widening should be included in the needs, follow the standards shown in Table 1, and mark the locations in yellow on the map.

C. Structures

An individual estimate is to be submitted for each deficient or needed new structure including those on the local streets. The estimates are to be stated on form M-4 in accordance with the instructions relating to that form.

Reasonable differences in width or load capacity from the standards stated in Table 1 can be tolerated if the structure is in generally good condition.

New structures should be planned to the stated standards. Suggestions for estimating the cost of new structures are given on page 14. A brief justification should be stated for any new structure.

IV. SUMMARY

A summary of all needed projects is to be recorded on an estimate sheet, form M-5.

V. REPORTING

Upon completion of the determination of needs the following items are to be forwarded to J. P. Buckley, Engineer-Director, Highway Study Committee, Michigan Good Roads Federation, 512 Tussing Building, Lansing 7, Michigan, on or before August 15, 1947.

1. City map showing location of each project with job numbers.
2. One copy of each estimate, forms M-2, 3 and 4.
3. One copy of the summary, form M-5, expressing the total municipal needs.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

Special Instructions for TAKING SHORT TRAFFIC COUNTS

For the average city there will be no great difficulty in obtaining satisfactory 24-hour traffic volumes from short counts taken through the peak hour. Traffic counts may be of public interest as well as a necessity for determining needs for improvements.

Procedure:

1. Pick out the location along the street between intersections where the apparent traffic volume is greatest.

2. Counts should continue for at least two hours and cover the traffic peak (usually 4PM to 6PM). They should be totaled by 15-minute periods. The high hour may occur and include parts of two clock hours.

   Note: Longer counts will relieve doubt as to the high traffic hour and 24-hour counts will not need to be expanded.

3. Counts should include traffic for both directions requiring two manual counters working simultaneously.

4. A Thursday not preceeded or followed by a holiday will give an average count. Carnival or festival days should be avoided.

5. The 15-minute counts should be arranged chronologically in two columns, one column for each direction of traffic flow. The greatest sum of any consecutive four 15-minute periods will give the high traffic hour.

6. The high traffic hour multiplied by <u>ten</u> (10) will give an approximate value for the 24-hour traffic volume.

7. If longer counts reveal a number of hours (4 or 5) flow at more than 80 percent of the high hour, the factor 10 may be increased but not to exceed 12.5 to determine the 24-hour traffic volume.

8. If directional flow is apparent, counts may be necessary in the morning and afternoon to determine the high hour.

9. Resort areas should make allowance for seasonal high traffic hours which occur more than 30 times a year.

COMMENTS ON THE RELIEF OF TRAFFIC CONGESTION

BUSINESS AREAS create undesirable conditions for the orderly flow of through traffic.

CURB PARKING does not constitute an economical use of the street where high traffic volumes prevail.

ANGLE PARKING reduces the street efficiency and should be used only in low speed areas where parking requirements take precedent over the smooth operation of through traffic.

"TRAFFIC CONTROL SIGNALS erected at low accident rate intersections and particularly where the traffic volume is rather light, do not perform useful functions from the standpoint of accident prevention or the proper regulation and control of traffic."

Providing OFF-STREET PARKING is generally more economical than STREET WIDENING through business areas.

Development of other thoroughfares which can relieve traffic on the business street.

Bypasses entirely outside the smaller cities which lie on heavily traveled major state trunklines may relieve congestion on the main business street and allow more freedom for shoppers.

ONE-WAY STREETS paralleling the major thoroughfare business streets provide relief of congestion in the business area and add high traffic volume streets to the system for the following reasons:

1. Traffic signal lights can be synchronized to provide higher traffic volume and more desirable driving conditions.

2. Left turn off from and on to the one-way street does not materially reduce its capacity.

3. Center friction caused by vehicles in opposing directions is entirely absent thus increasing the street capacity.

4. Accidents are reduced and certain types of accidents are impossible.

5. One-way streets more easily permit segregation of commercial traffic.

COMMENTS ON ONE-WAY STREET DESIGN

1. One-way streets should extend for considerable length in order to attract through traffic from the business street.

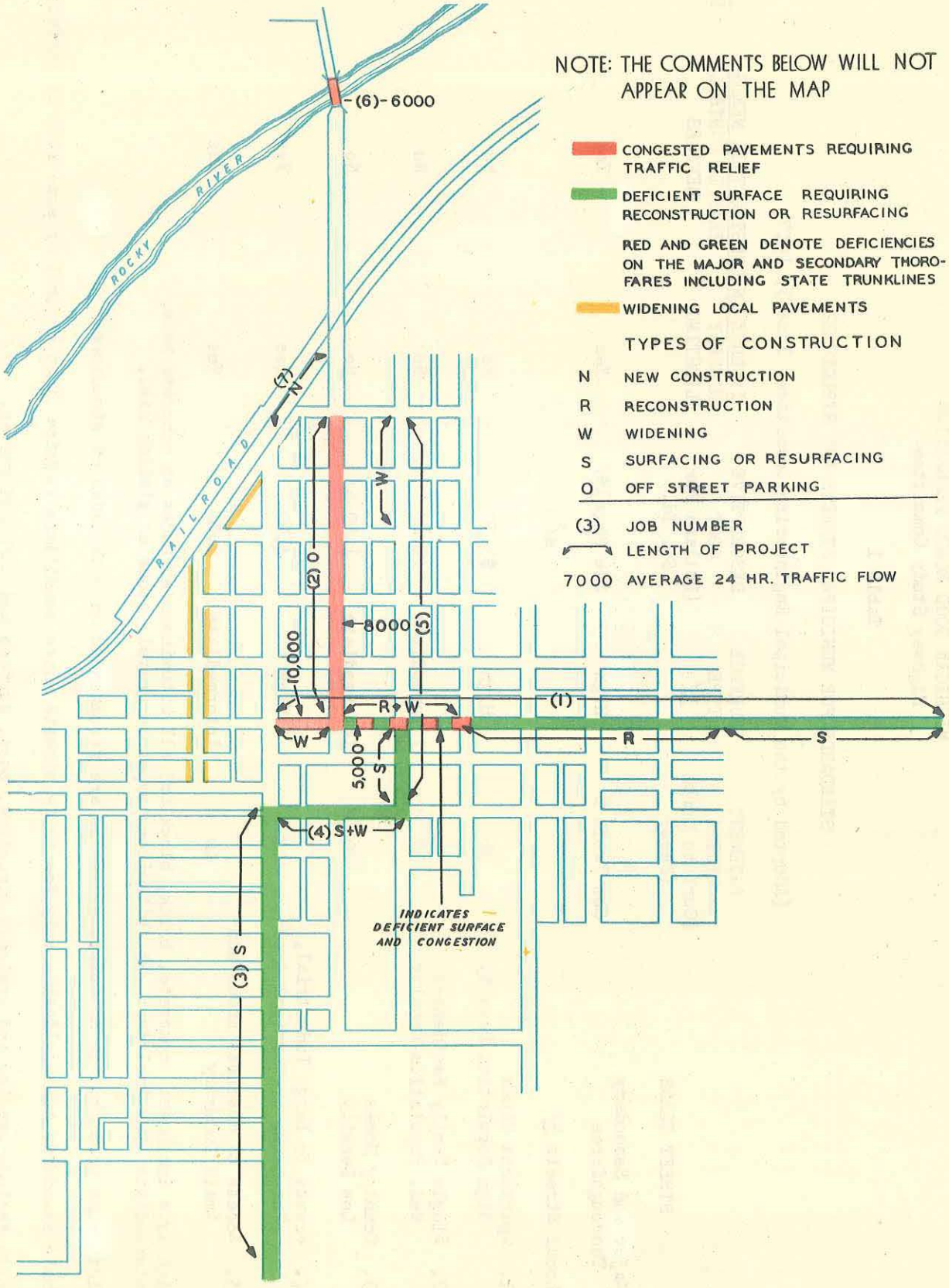
2. Well designed connections from the one-way street to the major thoroughfare beyond the business district or at the city limits will allow traffic to pass through the city or reach its destination within the city with reasonable speed.

3. Economies may be shown by street openings to produce a continuous one-way street system.

MICHIGAN GOOD ROADS FEDERATION

HIGHWAY STUDY COMMITTEE

METHOD FOR ENTERING DATA ON MAP



NOTE: THE COMMENTS BELOW WILL NOT APPEAR ON THE MAP

CONGESTED PAVEMENTS REQUIRING TRAFFIC RELIEF

DEFICIENT SURFACE REQUIRING RECONSTRUCTION OR RESURFACING

RED AND GREEN DENOTE DEFICIENCIES ON THE MAJOR AND SECONDARY THOROFARES INCLUDING STATE TRUNKLINES

WIDENING LOCAL PAVEMENTS

TYPES OF CONSTRUCTION

N	NEW CONSTRUCTION
R	RECONSTRUCTION
W	WIDENING
S	SURFACING OR RESURFACING
O	OFF STREET PARKING

(3) JOB NUMBER

LENGTH OF PROJECT

7000 AVERAGE 24 HR. TRAFFIC FLOW

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

Table 1

STANDARDS FOR MUNICIPAL STREETS AND STRUCTURES

(Adopted by the Municipal Engineering Committee, June 3, 1947)

STREET CLASS	PAVEMENT WIDTHS (Curb to Curb) (Feet)	SURFACE TYPE 1/	DESCRIPTIVE COST (Dollars Per Sq. Yd.)	INCLUDE IN CONSTRUCTION NEEDS: HIGHWAY LIGHTING	INCLUDE IN CONSTRUCTION NEEDS: TRAFFIC CONTROL DEVICES	STRUCTURES: DESIGN LOAD	STRUCTURES: ROADWAY WIDTH 2/ (Feet)
A. Major and Secondary Thoroughfares	See Table 2	High	See Page 14	Yes	Yes	H-20	Same as Pavement width
B. Local Streets 3/			4/				
1. Apartment House High Population Density	36	High	$3.50	No	No	H-15	36
2. Single Family Residences Med. Population Density	30	Intermediate	2.20	No	No	H-15	30
3. Country Homes Low Density	20 5/	Intermediate	1.50 5/	No	No	H-15	24
4. Access to Large Industrial, Warehouse or Terminal Areas	44	High	4.00	Yes	Yes	H-20	44
5. Access to Business Areas and Small Industry	40	Intermediate	2.20	Yes	Yes	H-20	40

1/ High type includes: concrete, brick, block and all bituminous surfaces on concrete base.
Intermediate type includes: all bituminous types on gravel, stone or similar base.

2/ Width curb to curb. In addition, sidewalks are recommended on both sides of structures.

3/ These standards are applicable only for those streets where conditions require dust control or some kind of surfacing.

4/ Costs include grading and drainage structure, base, surface and curb and gutter.

5/ No parking on pavement, no curb and gutter, provided drainage will be reasonably satisfactory. If not, use 30 ft. width.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

Table 2

STANDARDS FOR PAVEMENT WIDTHS
ON
MAJOR AND SECONDARY THOROUGHFARES

According to Traffic Flow and Operating Conditions 1/

(Adopted by the Municipal Engineering Committee, June 3, 1947)

AVERAGE 24 HOUR TRAFFIC FLOW	FREE FLOW (EXPRESSWAYS)	INTERMEDIATE AREAS 2/	BUSINESS OR INDUSTRIAL AREAS—HEAVY PARKING DEMAND			
			No Parking on Street		Parallel Parking on Street	
			No Left Turns	20 Percent Turns	No Left Turns	20 Percent Turns
(Vehicles Per Day)	(Feet)	(Feet)	(Feet)	(Feet)	(Feet)	(Feet)
40,000 - 50,000	72	3/	3/			
30,000 - 40,000	48	88	88			
25,000 - 30,000	48	88	88	3/		
20,000 - 25,000		66	66	88	3/	
15,000 - 20,000		66	66	66	88	3/
12,000 - 15,000		44	44	66	88	88
9,000 - 12,000		44	44	44	66	88
7,500 - 9,000		44	44	44	66	66
6,000 - 7,500 4/		44	44	44	44	66
Under 6,000 4/		44	44	44	44	44

1/ For effect of other conditions on pavement width standards, see page 8.

2/ Occasional parking and traffic lights spaced at long intervals.

3/ Wider pavements cannot be operated satisfactorily. Consider improvement of parallel and one-way streets.

4/ Minimum width of thoroughfares is 44 ft.
For state trunklines, width should at least equal width of trunklines entering and leaving the municipality.

Form M-2

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee
MUNICIPAL STREET NEEDS ON MAJOR AND SECONDARY THOROUGHFARES
on January 1, 1948

Street Name Main — City or Village of Oak Ridge

between Maple — Job No. 6 — Length 1.45 Miles

and Elm — County Road ____ No x Yes

STREET CLASSIFICATION

Major Thoroughfares ____
State Highway x
Other Major ____
Secondary Thoroughfares ____

BOULEVARD OR DIVIDED HIGHWAY ___ Yes x No

DATA ON EXISTING STREET

Width of Surface 30 ft.

Year Built (if known) 1923

Type Concrete

Average 24-Hour Traffic Flow 8000

DEFICIENCIES

Present Pavement Type Below Standard ____

Poor Pavement Condition x

Inadequate Traffic Capacity x

Traffic Control Below Standard
Street Lighting ____ Signalization ____

DESCRIBE PROPOSED CORRECTION: Reconstruct with 8" concrete and widen to 44 ft.

WORK REQUIRED (Fill in items that apply)

			Estimated Cost
1. New Construction:	Type ____	Miles ____ Width ____ ft.	$ ____
2. Reconstruct:	Type 8" concrete	Miles 1.10 Width 44 ft.	$ 159,000
3. Widen:	Type 8" concrete	Miles 0.35 Width 14 ft.	$ 14,400
4. Resurface:	Type ____	Miles ____ Width ____ ft.	$ ____
5. Landscaping on Boulevard or Divided Highway:		Miles ____ Width ____ ft.	$ ____
6. Off-street Parking:	Type Lot-surfacing	Capacity 150 Cars	$ 2,000
7. Street Lighting:	Type ____		$ ____
8. Signalization:	Type ____		$ ____
9. Right of Way:	For Parking Lot $20,000 - Widening $10,000		$ 30,000

Estimate assumes curb parking allowed ___ Yes x No Total Cost $ 205,400

Remarks: Off-street parking required to avoid right of way widening for greater surface width in the business district.

Date July 10, 1947 Prepared by J. Jones, Engr.

INSTRUCTIONS FOR USE OF FORM M-2

General: This form is to be used for individual street projects which have been determined to be needed according to instructions in the Explanation of Procedure. Use check mark or "x" wherever applicable. See example on opposite page.

Do not include as a present need, any project which is contracted for or is to be constructed during 1947.

Identification:

1. Check on which street classification the project is located. One project should not involve more than one street classification. Several types of work may be included in one project.
2. Job numbers are to correspond with the work map numbers.
3. Length in miles will be measured from the point of beginning to the point of ending of the project. This can be scaled from the map.
4. For projects on county roads check "yes".

Data on Existing Street:

Type: Describe briefly kind of surface and base.

Deficiencies: Check the deficiencies that exist in this street section.

Check - "Present Pavement Type Below Standard" if failure of the base is evident.
Check - "Poor Pavement Condition" if pavement is the required standard with base or surface failure.
Check - "Inadequate Traffic Capacity" if so determined from Table II.

Work Required

Definitions: (G. & D. S. means, "grading and drainage structures". Drainage structures include all structures up to 20' span length.)

1. New Construction:
   a. Change of surface to higher type, including G. & D. S.
   b. New location construction, including G. & D. S.
2. Reconstruction: Rebuilding to the same or similar type, including base improvement, minor widening, and G. & D. S.
3. Widening: Existing road left in place. Major increase in width of surface, including G. & D. S.
4. Resurfacing: Placing new surface of at least 2" in thickness over existing surface, or replacing a wearing course.

When widening and resurfacing of the existing pavement is planned, both are to be shown. The width of each is to be indicated in proper space.

5. Landscaping on Boulevard or Divided Highways only.
6. Off-street parking will include construction items only, including building construction.
7. Street Lighting will include construction items only.
8. Signalization will include construction items only.
9. Right of Way will include cost of land and required building moving for widening projects or off-street parking projects.

Estimated Cost: The costs are to be based on per mile estimates and current prices. Your cost estimates are to be used. The committee's estimate shown on Table I and Page 14 is only intended to be descriptive of the kind of pavement and is not necessarily correct for your conditions.

NOTE: 1. The estimated cost for purchase of needed right-of-way for the project is not included in the average cost estimates shown on Table I and Page 14.
2. The cost of grading and drainage structures necessary for the completion of the project has been included in the average cost estimates on Table I and Page 14.

Remarks: Describe briefly any unusual reasons for improvement and extraordinary cost. Use back of sheet if necessary.

SUGGESTIONS FOR ESTIMATING COST OF PAVEMENTS

1. Examination of the cost per mile of expressways which have been constructed covers so wide a range of conditions that any attempt to strike a fair, average cost would have no significance. Costs range from $500,000 to $3,500,000 per mile depending on the type of construction and expenditures for right of way.

2. Average cost of new construction of surface streets including removal of the old surface, excavation, drainage, curb and pavement is estimated as follows:

88 foot pavements not including right of way	$220,000	1/
66 foot pavements not including right of way	$175,000	1/
44 foot pavements not including right of way	$140,000	
Local Streets (see Table I)		

1/ The cost of right of way, including building moving, may exceed the cost of pavement construction.

3. Widening: Cost of widened portion

   Curb $1.50 linear foot
   Surface $5.00 square yard

4. Resurfacing: Asphaltic concrete $2.00 square yard.

5. Signal Lights: $1500 - $2200 per intersection

SUGGESTIONS FOR ESTIMATING COSTS OF STRUCTURES

Cost of structures, based on current prices, will vary between $14 and $22 per square foot of structure area.

To find the structure area, multiply the over-all length of the super structure by the width (roadway width plus curbs or walks).

Structures of moderate length (30 to 40 feet), with moderate height from footing to floor (12 to 16 feet) and without piling will cost near the $14 per square foot price. Longer structures, with similar conditions, should be lower in price.

Structures of shorter length (20 to 30 feet) and requiring piling will cost near the $22 per square foot price.

Engineers should determine the estimated cost of a structure, within the above limits, based on the required design features and foundation difficulties. For estimated unit costs above $22 per square foot, an explanation should be made.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

Form M-3

MUNICIPAL STREET NEEDS ON LOCAL STREETS
on January 1, 1948

City / Village of _____

Total inventory miles of Local Streets _____ Number of miles deficient _____

Local Street Classification	New Construction and Reconstruction		Resurfacing		Widening		Total	
	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost
1. Apartment Houses High Population Density								
2. Single Family Residences Medium Population Density								
3. Country Homes Low Population Density								
4. Access to Large Industrial Warehouse or Terminal Areas								
5. Access to Business Areas and Small Industry								
TOTAL								

Remarks: _____

Date _____ Prepared by _____
Title

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

Form M-4

MUNICIPAL STRUCTURE NEEDS
On January 1, 1948

On Major Thoroughfare

State Highway ____
Other Major ____
Secondary Thoroughfare x
Local Street ____

City / Village of Oak Ridge

Job No. 5

County Road ____ No x Yes

Street Name Water between Mill and First

Stream Crossing x Hwy. Separation ____ Year Built 1915

R.R. Overpass ____ R.R. Underpass ____ Design Load H-5

Type of Structure Steel Truss Average 24-Hour Traffic Flow 2000

No. & Length of Spans 1 Total Length 60 ft. Roadway Width 18 ft.

DEFICIENCIES

1. Load Capacity	x	Safe or Posted Load 3 Tons
2. Width	x	
3. Sub-structure	x	
4. Super-structure	x	
5. Waterway Area	x	
6. Alignment		
7. New Location		New Design Load H-20

PROPOSED REMEDY

		Type and Length		Cost
1. New Construction	___ :	____	Width ___ ft.	$ 61,800
2. Reconstruction	x :	2 Span - Steel girder - 70 ft.	Width 44 ft.	$ ____
3. Widening	___ :	____	Width ___ ft.	$ ____
4. Repair	___ :	Describe ____		$ ____

Right of Way Cost $ None

Total Cost $ 61,800

Special Reasons for Required Work

Unusual Traffic Conditions ___ Frequent Train Movements ___ Washed Out or Collapsed ___

Remarks: Piling and center pier required. Price includes removal and salvage of the old structure.

Date July 10, 1947 Prepared by J. Jones, Engr.

INSTRUCTIONS FOR USE OF FORM M-4

General: This form is to be used for individual structure (bridge or grade separation) projects which have been determined to be needed according to instructions in the Explanation of procedure. Use check mark or "x" wherever applicable. See example on opposite page. Any bridge or separation of 20 feet or more in span length is a structure. All drainage structures under 20 feet are considered culverts and are not to be reported on form M-4. Culverts are to be included in road estimates on form M-2 and M-3.

Do not include as a present need, any project which is contracted for or to be constructed during 1947.

Data on Existing Structure: Check kind (stream crossing, etc.). If known, state year built and design load. Describe type of structure (steel girder with concrete deck, steel truss with plank deck, etc.). Average 24-hour traffic flow is that shown on the project map.

Deficiencies: Check the kinds of deficiencies that exist in this structure.

1. Load Capacity: Check, if the structure does not meet the conditions shown on Table I within reasonably safe limits.
2. Width: Same as (1) above.
3. Sub-structure: Check if the condition is such that repair or reconstruction is required now.
4. Super-structure: Same as (3) above.
5. Waterway Area: Check if the cross-sectional area between abutments and from stream bottom to bridge girders is frequently inadequate for stream flow.
6. Alignment: Check if alignment is unsafe for traffic or inefficient for stream flow.
7. New Location: Check only if there is need for a structure which does not exist at or near this location.

Proposed Remedy: Check which of the four remedies is proposed and indicate briefly the new type, length and clear roadway width proposed. Definitions:

1. New Construction: Building a new structure not replacing an existing one.
2. Reconstruction: Replacement of an entire existing structure.
3. Widening existing structure.
4. Repairs: Abutments repaired, truss strengthened, deck replaced, etc.

Estimated Cost:

1. State the estimated cost, at current prices, of the new structure or repairs, including approach spans or short approaches. (See "Recommendations for estimating costs of structures" page 14.)
2. State the estimated cost of right-of-way required (if any) for the structure and its approaches.

Remarks: Describe briefly any unusual reasons for improvement and extraordinary cost. Use back of sheet if necessary.

MICHIGAN GOOD ROADS FEDERATION
Highway Study Committee

TOTAL MUNICIPAL STREET AND STRUCTURE NEEDS

Form M-5

Prepared by_____ Date_____ City / Village of _____

WORK REQUIRED	MAJOR THOROUGHFARES				SECONDARY THOROUGHFARES		LOCAL STREETS		TOTAL	
	STATE TRUNKLINES		OTHER							
STREETS	(Miles)	(Cost)	(Miles)	(Cost)	(Miles)	(Cost)	(Miles)	(Cost)	(Miles)	(Cost)
1. New Construction		$		$		$		$		$
2. Reconstruct							---	------		
3. Widen										
4. Resurface										
Sub-total										
5. Landscaping	----		----		----		----		----	
6. Off-Street Parking	(Number)		(Number)		(Number)				(Number)	
7. Street Lighting	----		----		----		----		----	
8. Signalization	----		----		----		----		----	
Sub-total	----		----		----		----		----	
9. Right of Way	----		----		----		----		----	
TOTAL STREETS										
STRUCTURES	(Number)	(Cost)	(Number)	(Cost)	(Number)	(Cost)	(Number)	(Cost)	(Number)	(Cost)
1. New Construction		$		$		$		$		$
2. Reconstruct										
3. Widen										
4..Repair										
Right of Way	----		----		----		----		----	
TOTAL STRUCTURES										