A METHOD OF RURAL ROAD CLASSIFICATION

MICHIGAN STATE HIGHWAY DEPARTMENT
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Road classification has been recognized as a practical necessity in Michigan ever since roads began. The initial necessity was tied in with the need for the roads themselves: Who should have the job of building them? As soon as roads were built there arose the need to assign jurisdictional authority including the duty of maintaining them. These needs, together with the ever pressing requirement for firmly established financial responsibility, have been the bases for many subsequent experiments in classifying roads.

For a long time Michigan highway authorities have been dissatisfied both with this empirical method and with its results. They have been convinced that conflicting jurisdictional and financial considerations and interests do not constitute a stable or intelligent basis for this purpose. Some years ago they came to the conclusion that the roads themselves and their functional uses were the proper sources for sound classification criteria. They believed that, once roads were classified by that means, many of the other attendant problems would find natural and just solutions.

The State Highway Department now has a rational and practical method for classifying highways and it has made a classification of rural roads and of a significant part of urban streets in conformity with it. This classification was accepted by the Michigan Highway Study Committee and was incorporated as a fundamental part of its 1948 report, "Highway Needs in Michigan."

In the course of the study project, the method and its results were submitted to state, county, and municipal highway officials and agencies who approved and used them. Moreover, legislation proposed to carry out the findings

of the Committee's report, provided for application of this method. This legislation was not passed, but it is safe to predict that any future revision of Michigan's highway laws will include a similar provision.

BACKGROUND AND BASIS OF CLASSIFICATION

Exploratory sutdies in highway classification were begun by the Planning and Traffic Division more than six years ago. These studies soon made evident in what direction and by what means a more thorough investigation should proceed. In 1944, the project which produced this present method was organized and launched. In spite of the distracting demands of the war and postwar years, it continued in intensive operation until its virtual completion in 1947. Refinements of its techniques and extensions of its application are still in progress, but the main work is done and the basic principles are established.

The Michigan method is founded on a functional concept of highway service and operation; it classifies roads and streets on the basis of traffic attraction. The basic theory of this approach to the task of classification is stated in the following paragraphs:

1. Highways exist to serve the economic and social organization which consists of individual dwelling, farm, business, industrial, service and other units, and successive accumulative groupings of these units into communities of increasing extent and function.

2. The organization functions by means of a constant movement of people and goods between and to the units and within and between the communities. The highways carrying these movements are classified by their predominant usage as determined by the character of the places they principally connect:
   a. Highways used predominantly for traffic movement between and to the various land-use units, are local highways.
   b. Highways used predominantly for traffic movement within communities, are community highways.
   c. Highways used predominantly for traffic movement between communities, are transportation highways.

3. The relative importance of a transportation highway is indicated by the degree and range of the traffic attraction exerted by the communities it principally connects; this traffic attraction, in turn, is governed by the magnitude of the communities' operations and resources, and by the extent to which these operations and resources are integrated with those of other communities.

The purpose of this paper is to describe how, on the basis of this fundamental concept, various types of economic and traffic data were used and analyzed to establish and prove the relative traffic attraction of some 1,300 places in Michigan. The paper also describes how this place classification was used to classify the state's primary and secondary rural roads, and points out how this method can be used for the classification of urban streets.

PRELIMINARIES AND PROCEDURES OF STUDY

Earlier studies had revealed what appeared to be significant relationships between the trade, industrial, and other economic and social operations of cities and towns, and the traffic that flows to and from them. They also had delineated roughly the areas within which the trade and traffic influences of these individual places seemed to be predominant.

In this phase of the earlier studies, definite knowledge was gained of the character and influence of trade centers. The relationship of these places to traffic generation and therefore to road classification was found to be so vital that it was necessary to define them very exactly.

The trade center was defined as that area within which the daily economic and social activities of the local population are carried on through a common system of local institutions. It consists of the central community, which is its nucleus, and any adjacent "built up" sections in which the provision of basic public services is a common problem.

The immediate retail trade area consists of the trade center and the surrounding rural area within which there is a large daily movement of population

to and from the center for work, trade, amusement, or other such purposes. It includes all of that area which is dependent on the center for a majority of its daily social and economic requirements. Retail trade is the primary element integrating these areas; it is such a potent factor in generating traffic that the low volume points on radiating roads between the center and neighboring centers are found at, and can be used to locate, the immediate trade area limits.

The area of influence is that area within which a trade center occupies a dominant position as the provider of the goods and services which are not available locally nor sought in other competing trade centers. At the lowest level, the area of influence is identical with the immediate retail trade area. Usually, however, it is made up of several of these smaller economic structures all of which are dependent on the single dominant trade center for their economic stability. The boundaries of an area of influence are marked by the minimum traffic points on roads leading to competing trade centers of equal or greater magnitude.

THE CLASSIFICATION STUDY

The present classification study covered some of this same ground and adopted some of these early findings, but it used more exact information with a better understanding of its meaning and proper employment. It consisted of analyses of two sets of data: social-economic facts from the census reports and other authoritative sources; and traffic information derived from the traffic surveys, road use studies, and origin-destination studies initiated by the Highway Planning Survey.

The studies in these two fields had the same objective--to determine the relative traffic importance of places in the state. For the most part they proceeded as parallel projects, but their operations were closely related. This was necessary because certain economic findings were required for traffic attraction analysis and in the end the results of the two studies were correlated and combined.

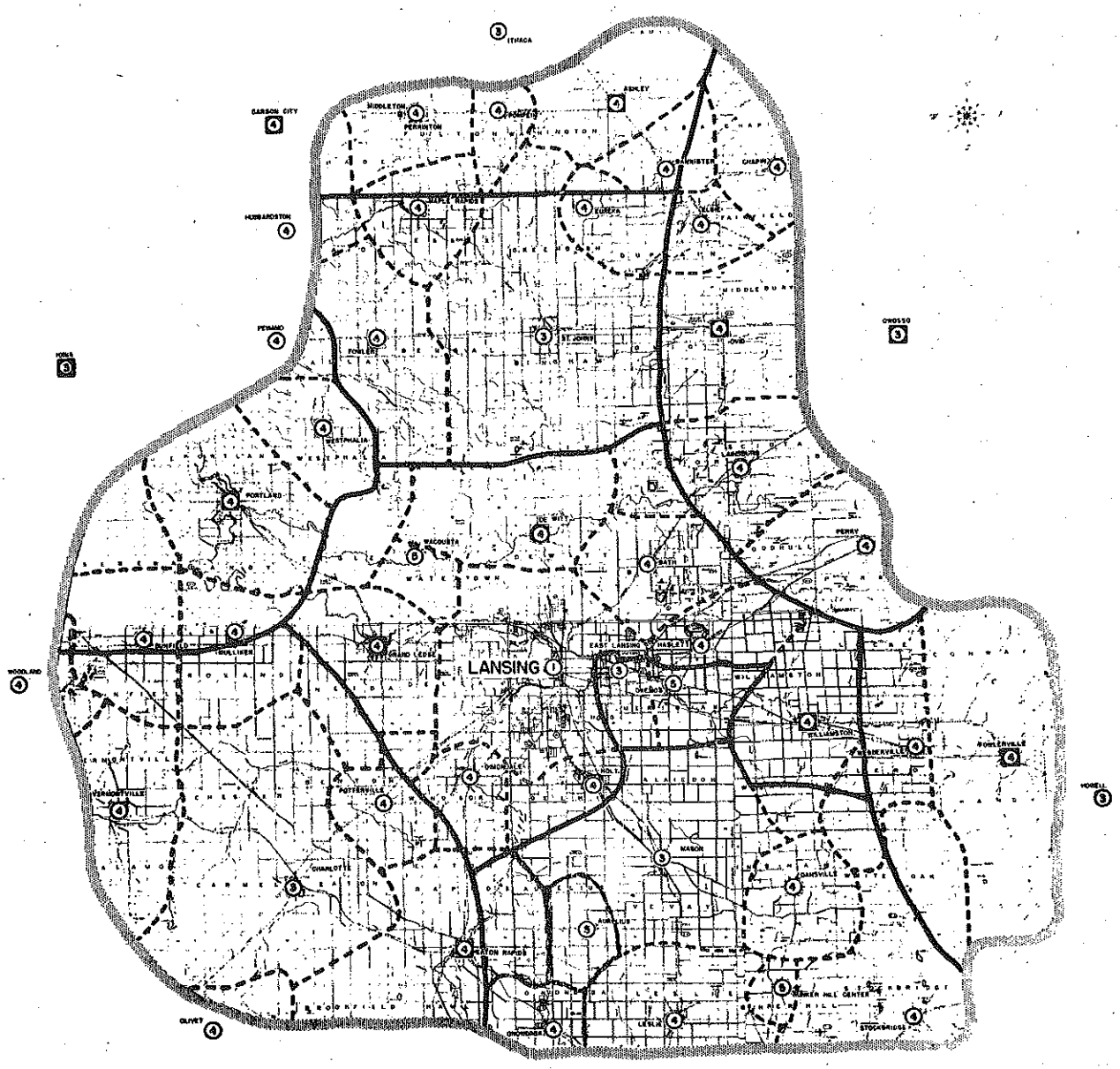

Figure I.--LANSING'S AREA OF INFLUENCE AND ITS CONTAINED TRADE AREAS.

The Lansing area includes several intermediate market areas, delineated by solid lines, and numerous immediate trade areas, delineated by dash lines. Metropolitan, regional, intermediate, minor, and neighborhood centers are numbered 1 to 5 in the order named.

THE STUDY OF ECONOMIC FACTORS

A rather wide variety of factual information was available bearing on the economic and social operations and resources of incorporated places in the state. It included such items as city and village populations, the population of the immediate retail trade areas and the areas of influence, assessed valuations, banking resources, wholesale and retail trade totals, industrial employment and production, newspaper circulation, etc.

All of these types of data were used in certain preliminary surveys of the problem, but many of them were only available for places in the higher population groups. It was particularly unfortunate that retail trade information was not available for more places and in greater detail inasmuch as such data is essential in determining the affiliation of farm and non-farm rural populations with the correct trade centers.

For a state-wide classification analysis, however, it was necessary to select criteria which could be obtained in whole or in part for each of some 3,000 places which were listed for examination. After a number of tests for correlation of results, four indices were selected which were found to represent a basically characteristic distribution of all significant economic factors. These are: the population of the immediate retail trade area, assessed valuation, banking resources, and newspaper circulation. For the final classification study, economic analysis was limited to these four types of data.

One other compensating adjustment was made necessary by the very divergent characteristics and development of the various parts of the state. It was evident that the relative importance of trade centers in the highly industrialized and urbanized southern counties and of those in the sparsely populated sections of northern Michigan is not determined by a direct comparison of their respective operations and resources. The importance of places in these different sections is relative to the area which each serves and not to each other.

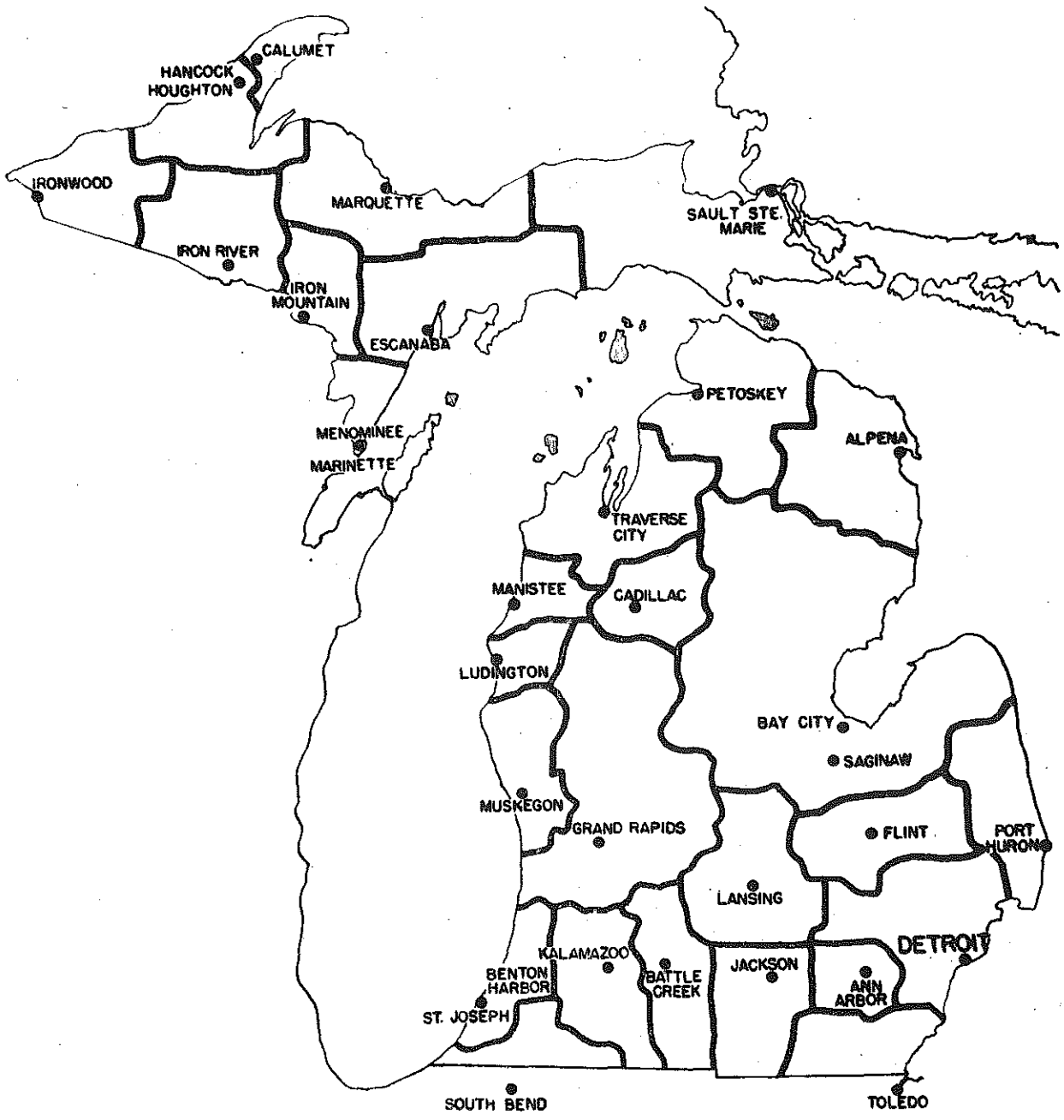

Figure II.--MAJOR TRADE CENTERS AND THEIR AREAS OF INFLUENCE.

The geographic pattern of Michigan's economic organization in which retail trade is the most potent factor--is indicated by these 28 trade areas and their focal centers.

A balanced relationship was secured by utilizing the division of the state into six characteristically developed regions which had been made for the purposes of the Highway Planning Survey. The portion of the regional total of each kind of criteria represented by each of the contained trade centers was made the index of its regional importance. The indices in the several regions were then correlated in such manner that state-wide comparisons could be made.

The succeeding analysis of economic factors produced a register of some 380 places arranged in the order of their indicated significance. The classification process on this basis was completed by tentatively dividing the places listed on this register into groups. This latter step was accomplished by reference to preliminary analyses of road use data which indicated the traffic significance of a number of selected cities of various sizes in different parts of the state.

It should be pointed out that a classification of places can be established using only the economic factors. However, an intimate knowledge of local conditions affecting each place would be necessary. This would be particularly essential in classifying those places where such non-economic factors as governmental and educational institutions and recreational resources exist and contribute to traffic attraction. And it should be remembered also that the analysis by economics, is based primarily on a regional and not a state-wide approach to the problem.

Experience gained in working out the Michigan project makes it clear that all available data for place classification should be carefully examined before a specific method is decided upon. It was found that the use of economic data alone does not provide certain information relative to actual motor vehicle use which has special and direct meaning relative to the function of the highways connecting the classified places.

DETERMINATION OF TRAFFIC ATTRACTION

The method of determining traffic attraction was devised as a means of classifying roads according to their specific functions in relation to traffic movement. It was undertaken also as a means of providing a test of the validity of the economic analysis. It is by no means a simple method; it requires discriminating selection from a large amount of data, and the analysis of data involves detailed and complex computations. It takes time, but it obtains results which appear to be accurate and valuable.

The traffic attraction study grew out of two pieces of information which had been revealed in preceding work with trip data. It had been found that distance is an important factor affecting the frequency of trips to the several kinds of trade centers. And it had been found that there are significant differences in this respect between trips coming to a given destination, depending on whether they originate within or outside of the destination's area of influence. All trips have the characteristic that their frequency varies in reverse ratio to their length, but the pattern of this variation differs as between these two classes of trips.

The significance of these differences to the classification of places and roads on the basis of traffic attraction, becomes evident when the characteristics of the two classes of trips are examined.

Trips that are made to a trade center from origins within its area of influence are what may be called routine interest trips. These trips are from places of limited economic and social services to places where these services are available in greater variety and of higher quality. They are made for the purpose of satisfying customary social and economic requirements which cannot be satisfied in the place of origin. The frequency with which a motorist makes these trips is practically identical for a given distance regardless of the state-wide importance of the trade center which is his destination.

These routine interest trips reflect only that type of traffic movement developed within an area of influence. The number of such trips having destination in a trade center indicates both the character of the area of influence and the importance of its trade center in terms of the volume of operations generated within the area. But since these trips are confined to that area, they cannot be used to measure the trade center's traffic attraction relative to other centers outside its area. For that purpose, it is necessary to study trips coming to it from beyond its area limits.

Trips which originate outside the areas of influence of their destinations are called special interest trips. They represent a type of traffic movement generated by influences entirely different from those of the day-by-day operations of the local economic and social organization. To a much greater degree than is the case with routine interest trips, the individual motorist makes these trips from choice; he does not have to make them to satisfy immediate essential needs. In relation to those trips he is a relatively free agent subject to attractions separate and different from the daily, routine compulsions of economic and social necessity.

The special interest trips reflect the traffic generated to provide intercommunication between the social and economic activities of the state as they are carried on in and from the various trade centers. These trips, which integrate the different places and areas into the state-wide economy, extend beyond the limits of local geographic patterns. The more important the place and the greater its activities in the state's economy, the greater will be the frequency of these trips to it from any given distance.

The material analyzed in studying these trips was derived from the Highway Planning Survey's Road Use Study. The character of this study and of the information it produced are too well known to require further description in this paper. The data used from this source consisted of the record of each

special interest trip made to each destination studied, its length in miles, and the number of interviews taken in the place of origin. These data, together with certain factors to be described later, were punched on the IBM cards used to perform the massive computing job which the analysis required.

The relative state-wide traffic attraction of each place was established by analyzing the characteristics of the frequency-distance relationship of the special interest trips for which that place was the destination. These relationships are expressed in terms of the annual average number of trips to the destination, per passenger car interview in each place of origin. The trip-frequency-by-distance data contained on each card was arranged and reproduced to facilitate analysis of this relationship for each destination.

The traffic attraction of any specific place is indicated by the manner in which the average frequency of trips to the place varies according to the distance of the trips. When the trip frequencies were plotted against their corresponding distances, it was found that the attraction of the place in terms of trip frequencies varied inversely as the distance. It was also found that for any given distance, the attraction to the more important places was greater than to places of less importance.

This experience led to the hypothesis that the attraction of a place measured in terms of trip frequencies is directly proportional to the importance of the place and inversely proportional to the length of the trips. Subsequent analyses proved that the frequency-distance ratios of special interest trips differ for different places and that for any selected destination the ratios for the various distances have a definite mathematical relationship.

It was concluded that, by plotting the average frequencies of trips to places against the corresponding lengths of those trips, curves could be produced which would indicate the relative traffic attraction of those places. However, the task of translating the mass of individual trip data into formulas for the production of such curves, involved extensive multiple computations.

In the first place, the number of road use interviews taken at the places of trip origin varied from several hundred in the larger cities to only a few in the smaller places. In the second place, due to the nature of motor vehicle travel, the data for a destination when spotted on a curve diagram, formed not a curve, but a scatter pattern.

Statistical studies of the curve data indicated that the frequency-distance relationships represented by traffic attraction curves could best be expressed by a single equation of the form $y = ax^b$, where "y" is the average trip frequency and "x" the trip distance. The method of least squares was found to be most adaptable for machine computation of the problem of finding the values of "a" and "b" and adjusting the scatter of observational values. In making the computation, the values of "x" and "y" were weighted by the size of the sample in each place of origin to offset any possible bias from that source. Other appropriate procedures were devised for processing the road use data punched into IBM cards, and for applying to this data the formulas selected for computing the traffic attraction of places.

As the results of these computations came off the machines, the corresponding curves were produced for the final classification analysis. The curves were plotted on logarithmic scales which were particularly suited for accommodating the wide ranges of critical values involved. These scales likewise facilitated the interpretation and analysis of the curve data as well as comparisons of the traffic attraction characteristics of the various places.

CLASSIFICATION OF PLACES

The individual curves representing the relative importance of all places in the state, depicted every degree of traffic attraction within very broad limits. To complete the classification of places, it was necessary to group the curves so that they would indicate the distinguishing traffic attraction characteristics of the several place classes that had been tentatively determined by the preliminary economic and traffic studies.

Originally, ten place groups had been established by analysis of economic and road use data. Subsequently, however, these had been combined to form five classifications with two groups in each class. These five classes are:

Class I	--	Metropolitan Centers
Class II	--	Regional Centers
Class III	--	Intermediate Market Centers
Class IV	--	Minor Market Centers
Class V	--	Neighborhood Centers

Each of these classes was subdivided into two groups reflecting differences of importance or character within the class. For instance, Detroit and Chicago are Metropolitan Centers in Class I-A, while Grand Rapids which is the distributing center for a very large region, Lansing which is the state capitol, and Ann Arbor which is the seat of the University of Michigan and its services, are in Class I-B and are called Limited Metropolitan Centers.

Recognition was given to the recreational advantages and activities of places in all except the three highest groups by determining their classification on the basis of their combined economic and recreational attractions and by then adding the letter "R" to their class designation. In the three upper groups the economic factors were of such preponderant influence that the recreational aspects of their function were not considered significant for classification purposes.

The five classes were adopted as a logical classification framework to which places could be assigned by means of the traffic attraction criteria. To accomplish this assignment, as has been pointed out, the traffic attraction curves had to be grouped in such a manner that they would be representative of these classes. This was done by mathematically deriving traffic attraction curves that represent the characteristics of all places in each classification group.

In order to establish these characteristic group curves, it was necessary to select arbitrarily places from each classification group as being typical of the relative importance of all places in that group. Using only observational data for the selected places, the summated values of the frequencies of trips

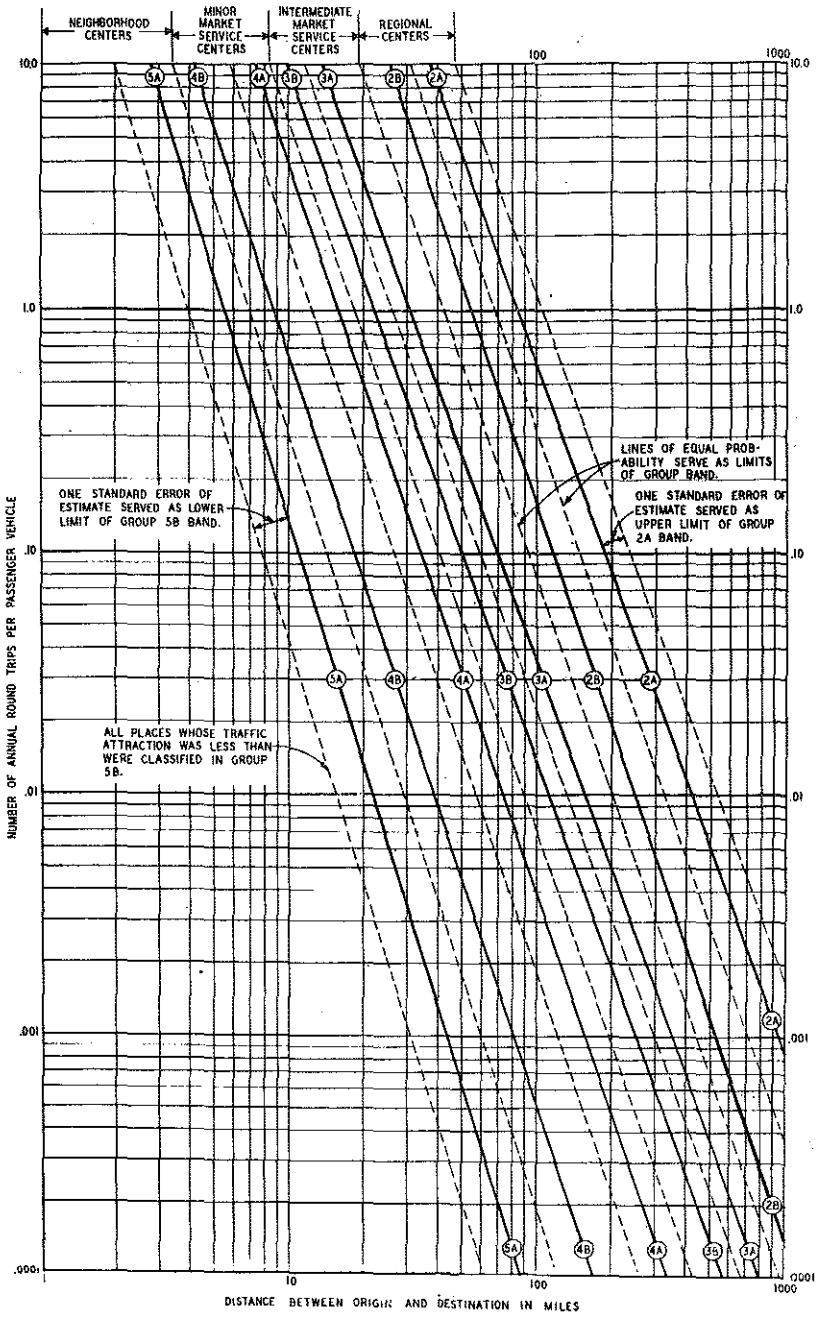

Figure III.--TRAFFIC ATTRACTION CURVES OF GROUPS OF PLACES

These curves assemble the results of the analyses of frequency-distance trip data for use in the classification of places. The curves for the Class I groups are omitted because their characteristics locate them so far to the right of the Class II-A curve that they could not be shown conveniently.

to those places and of the corresponding trip lengths, were substituted in the weighted normal equations of $y = ax^b$. This established a typical traffic attraction curve formula for each group of individual curves.

The five resulting pairs of curves, plotted on logarithmic paper, represented the relative state-wide traffic importance of the five place classifications and their 10 contained place groups. Lines of equal probability plotted between these curves established the limits of the traffic attraction bands for each group and class.

The allocation of each place to its proper classification group was based on the traffic attraction characteristics revealed by its individual curves. Over 1,300 places were classified by this process, each place being individually analyzed and its assignment determined by the band to which its individual traffic attraction curve most nearly conformed.

Of the places whose traffic attraction was established, 381 had been classified previously and independently on the basis of economic data. In most instances the results of these two types of classification analysis approximated closely. To measure comparatively the two results, the ratings and positions of these 381 places as determined by each method, were arranged in the decreasing order of their state-wide importance and then correlated statistically. This resulted in a correlation index of 0.85, which is relatively high; it probably would have been higher had more complete economic data, particularly regarding retail trade, been available for the economic classification of all the places.

In the last stages of the classification process, both types of data were brought to bear on the problem. Any differences were logically adjusted with consideration given to all factors. In general, the traffic attraction was the determining factor because it was based on relatively complete data. This was especially true in the case of recreational places for which traffic data revealed a degree of traffic attraction which was not always indicated by the economic analysis.

The classification process was brought to completion by an over-all analysis of all available sources of information. Those places for which there was no economic data were classified by weighing the traffic attraction classification against all other facts and conditions that reflected the state-wide importance of each place.

It was fortunate that the cities and villages whose classification had been established by both traffic attraction and economics were well distributed throughout the state, for this permitted reference to these places as controls supplementing the information available for other places. Among the influences considered were the effects of nearby places of equal or higher classification, the general economic function of the area, and the strength and reliability of the samples used.

The place classifications have been reveiwed by local highway officials who have found them generally acceptable. Where differences of opinion developed, further studies were made and the final decision was made on the basis of all information.

CLASSIFICATION OF RURAL ROADS

The theory of this method of road classification has already been stated. It may be well, however, to recall that it is based on the belief that the functional operation of places generates movements of traffic to them, and that the classification of roads is therefore determined by the functional importance of the places they principally connect.

The sound basis of this theory was established by the traffic attraction analysis and the application of its results to the classification of places according to economic factors. With practically all of the places of traffic significance in the state classified as to their national, state-wide, regional,

or local importance, the groundwork was laid to classify the roads that connect them in conformity with this theory.

The road classification was performed as a step-by-step process. The place classifications were used as the criteria for determining the lines of traffic desire. Then the locations of the actual routes were established in accordance with certain principles of road location that had been drawn from studies of traffic movement between the various trade centers and within the various trade areas. These principles are as follows:

1. Routes between places of similar importance should be so located that they serve the predominant function of that route and also provide suitable connection with places of lower classification that lie between its major termini. Special studies will be required in some instances to determine whether more than one road is needed to connect two major places.

2. The most efficient network of roads connects the points of traffic interest by extending roads in the four cardinal directions from the centers of these places.
   But routes may follow the desire line between two major places if traffic volumes warrant it, and may follow existing diagonal routes in sparsely populated areas.

3. Roads should be so located that they will serve existing and develop potential uses of land.

4. Spur routes supplementary to the basic network should be provided to points of significant traffic interest.

5. At the county level, routes supplementary to the basic grid system should provide complete access to points of traffic interest and provide adequate intra-county mobility. These routes should be laid out on a rectangular grid pattern with spacing of:
   Three or four miles in agricultural areas,
   One mile or less in extensive residential areas, and
   As required in sparsely settled areas.

6. Topographical conditions must necessarily be considered in the location analysis of each roadway section. In general, large lakes require secondary roads around their shores and wide rivers require routes on both banks.

The classification of roads and the designation of classified systems of highways located in accordance with these principles, was accomplished by

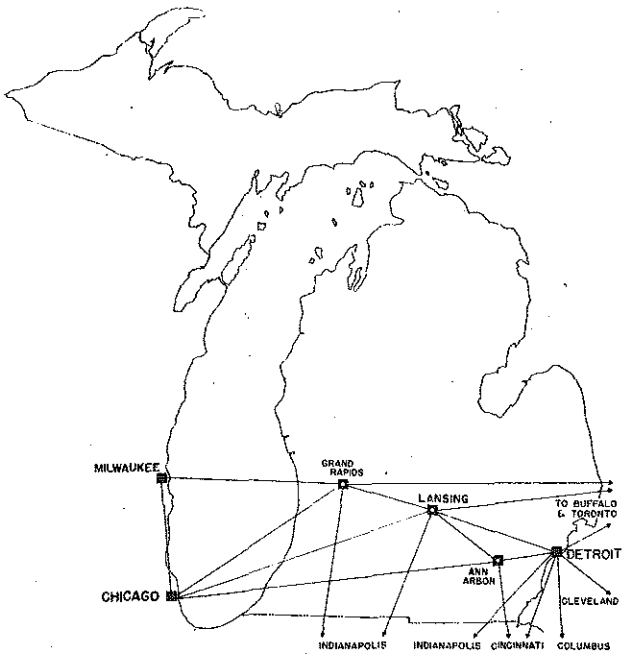

Figure IV.--DESIRE LINES OF TRAVEL BETWEEN PLACES IN CLASS I. Desire lines are drawn to indicate all desired directions of movement except where such desires are satisfactorily expressed by other closely parallel lines.

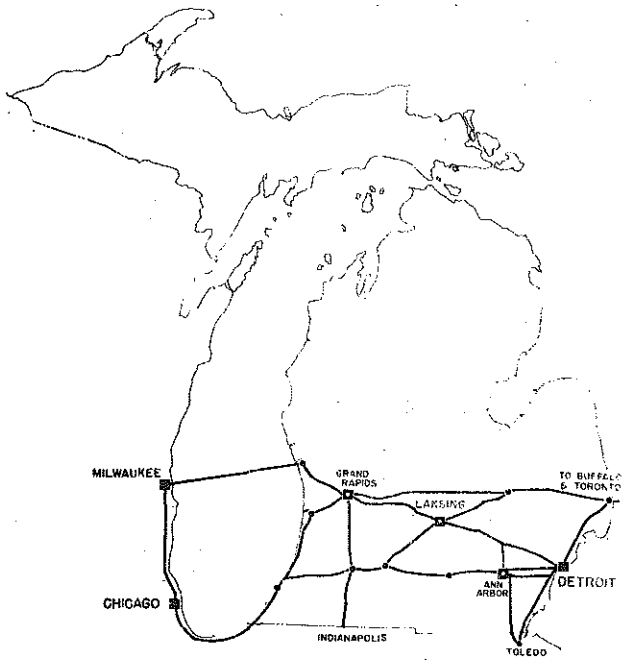

Figure V.--ROUTES SERVING DESIRE LINES BETWEEN CLASS I PLACES. Selection of the routes indicated by the desire lines established their classification to be of the same highest importance as the places they principally connect.

analyzing a single functional increment of the network at a time. Each of these increments serves the places contained in one of the place classification groups.

This is a gradational progressive process. It starts with the group of places in the highest classification class having the highest degree of statewide traffic interest. Straight lines connecting these places with one another indicate the desire lines of traffic. Route locations are then established with reference to these desire lines and to the accepted principles of route location.

With these routes of the highest order classified and located, the places in the group with the next highest degree of traffic attraction, are brought forward for consideration. Again straight lines indicating traffic desire are drawn connecting these places not only with one another, but with those in the

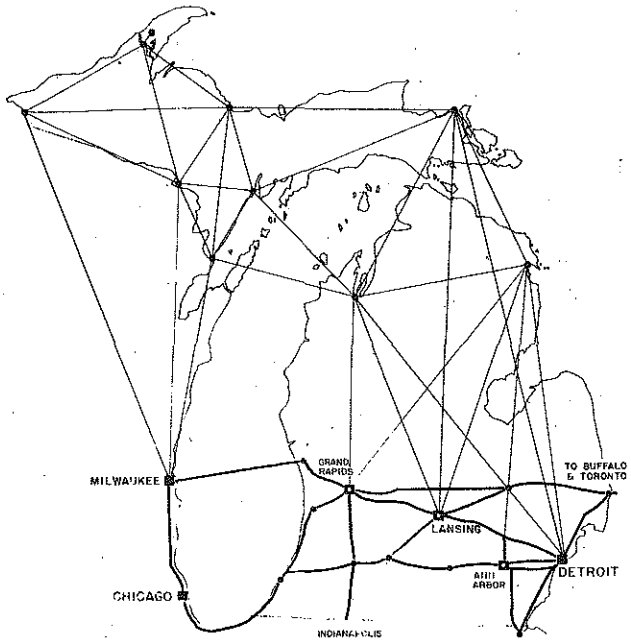

Figure VI.--CLASS I ROUTES AND DESIRE LINES OF CLASS II-A PLACES
The fine lines represent the desires of travel between regional centers in Group II-A and between them and the metropolitan centers in Class I.

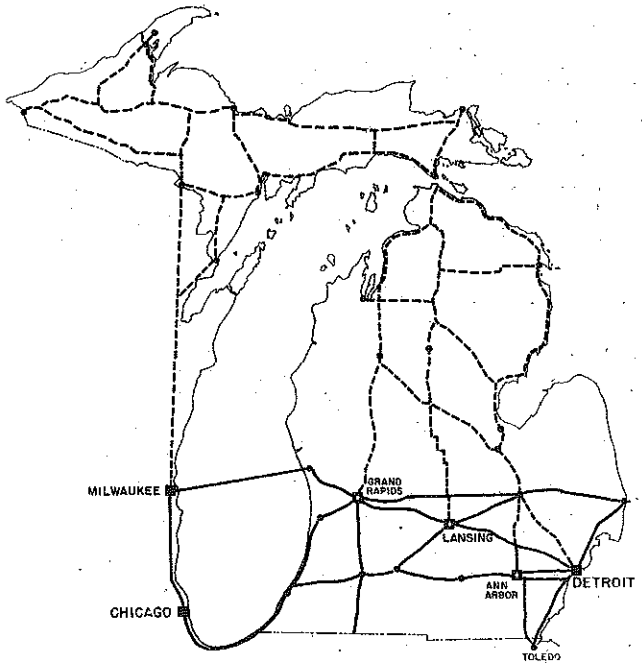

Figure VII.--ROUTES SERVING DESIRE LINES OF CLASS I AND CLASS II-A PLACES.
Additional routes selected according to desire lines on Figure VI are indicated by dash lines. The selected routes take their classification from that of the places they connect.

higher classification which have already been dealt with. As before, these desire lines and the location principles guide in locating the routes.

This process is continued, using successively groups of places of the next lower order of traffic importance as the points for classifying and locating additional increments of the highway systems. As each group is added, the connecting routes utilize to an increasing degree the already located routes between places of higher classification. Also, as the places considered become of less wide traffic influence, the areas within which they require connection with one another become narrower.

Obviously, as this process progresses, not only the degree but the range of the traffic attraction of the places decreases. It is this fact which is

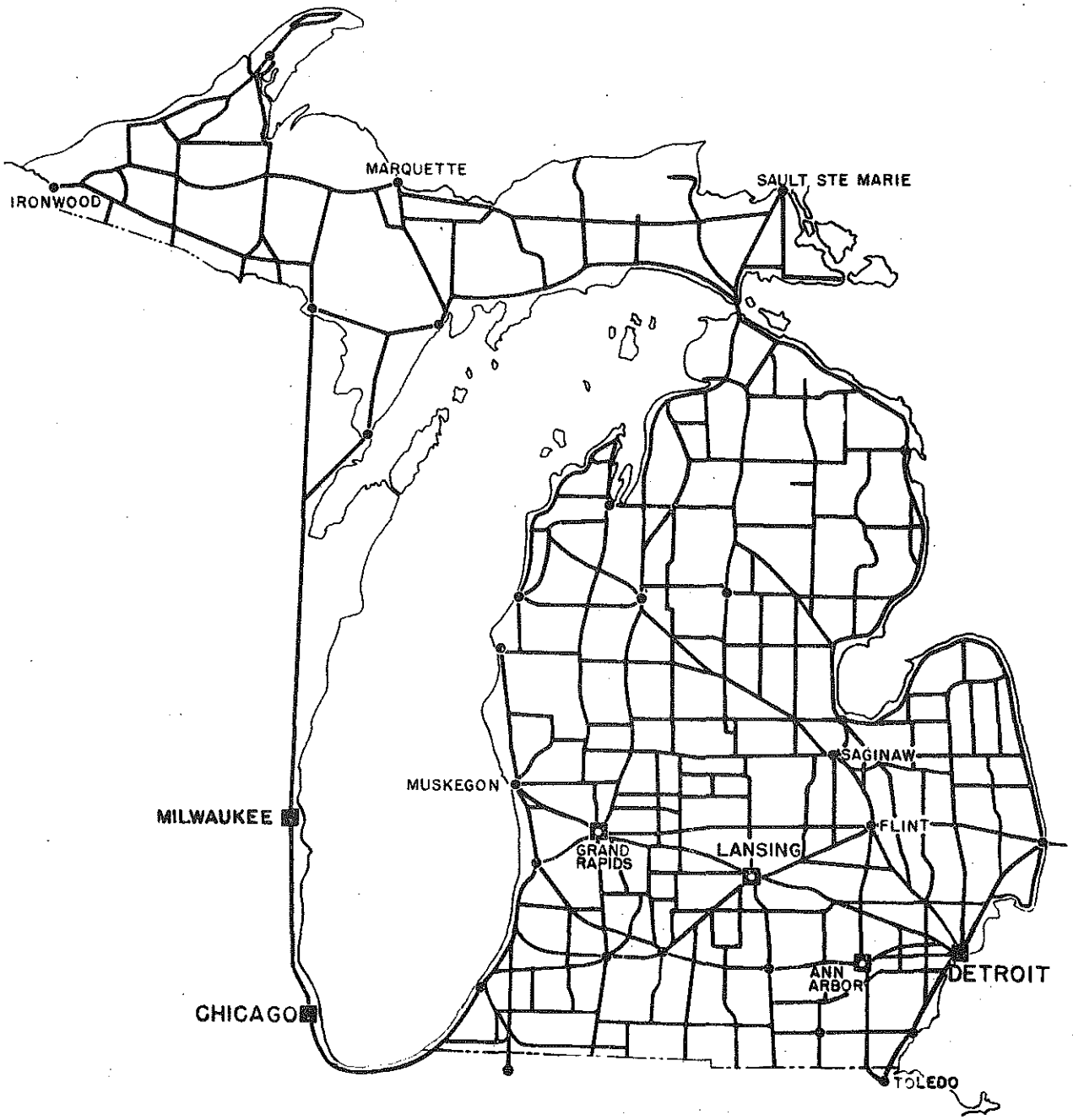

Figure VIII.--ROUTES SERVING DESIRE LINES BETWEEN CLASS I, II, AND III PLACES.

These routes, connecting all places with significant state-wide traffic attraction, comprise a total of 6,930 miles of highway, or 7.44 percent of the state's whole rural road mileage. This map represents the complete selection of highways of interstate and state importance.

the basis both for assigning roads to the major classifications and for determining their relative importance within those classifications.

The five cities--Chicago, Detroit, Grand Rapids, Lansing, and Ann Arbor--in the first class of places attract traffic in differing degrees, not only from throughout the state, but from beyond the state lines. The routes connecting them have, therefore, an interstate as well as a state-wide function.

All the places in the groups of Class II and Class III clearly have a state-wide traffic attraction and influence. They are such cities as: Marquette and Traverse City which serve broad but thinly settled areas in northern Michigan; Flint and Saginaw and Kalamazoo in the populous southern industrial section; lesser places like Owosso and St. Ignace; and still smaller towns like Charlotte and Gwinn. These places all have a range of functional and traffic importance which gives a primary state-wide classification to the highways that connect them.

In some cases, it was necessary to consider service to places of still lower classification in determining the location of primary state-wide highway routes. Generally, however, the towns, villages and places in Classes IV and V were used to delineate and classify the successive increments of rural roads as parts of secondary systems or as community service routes. The economic and social functions of these places and the more limited range of their traffic attraction all indicated that the service they required of highways is of a secondary order.

The places in Classes IV and V are the points of reference for selecting and classifying the secondary roads which are of widest transportation importance. Other roads in the secondary classification have functions more closely connected with the internal operations of the areas and communities they serve. They are the roads that complete the integration of the minor subdivisions of the state by providing inter- and intra-county communication between all places of significant traffic interest.

Figure IX.--ROUTES OF CLASSES I, II, AND III AND ROUTES SERVING DESIRE LINES OF CLASS IV-A PLACES.

Routes connecting the places in the lower classification with the selected interstate and state system are shown in dash lines. The pattern of these routes indicates clearly the secondary and local character of their service. It therefore proves that selection and classification of the state rural trunkline system reached completion with the routes included in Figure VIII.

The basis for selecting and classifying the secondary roads having these special community service characteristics, is the pattern of traffic that moves within the areas and communities. This pattern is revealed by analysis of the routine interest trips. These trips, which were separated from the special interest trips when the latter were used to select and classify the transprotation roads, furnish the essential information for picking out the major arteries of community and area movement.

CHARACTERISTICS OF THE CLASSIFIED PRIMARY SYSTEM.

The first and principal objective of this study was to select and classify the rural routes which properly should be included in the interstate and state-wide transportation system, and to determine the relative importance of these routes.

The process as here described, produces a skeletal network of primary transportation routes. It is a minimum system inter-connecting all places of at least state-wide traffic importance and providing connections which link the system and its principal centers with the routes and centers of interstate transportation movement. Other routes may be added to this selected system as a result of special studies, but it should be made certain that such additions do not reduce the basic efficiency which this minimum selection has attained.

Functional service was the criterion used to make this selection and classification of roads, but there are other aspects of service than those represented by function. It is important as well as interesting to know to what degree the system chosen on a functional basis meets the demands of these other types of service.

Possibly the two major elements, other than function, which should be considered in measuring the over-all service of a highway system, are its

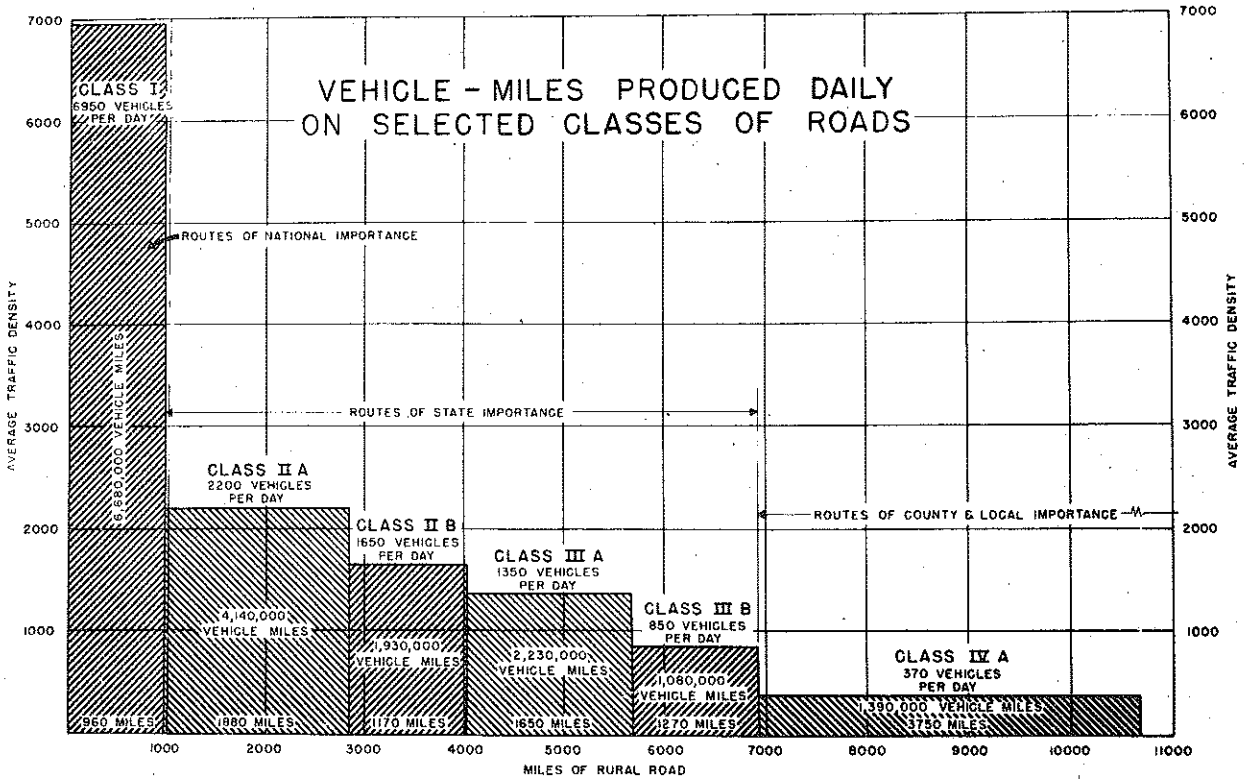

Figure X.--VEHICLE-MILES PRODUCED DAILY ON SELECTED ROAD CLASSES.

This graphic table indicates the service, in terms of traffic densities and quantities, of each of the principal classes of roads. The height of the rectangles indicates the relative average daily density of traffic; their breadth, the road mileage in each class; and their area, the magnitude of the traffic movement on the average day. These traffic quantities were not bases for classification, but they are evidence of the traffic significance of the criteria used in the classification process.

accommodation of traffic movement and its availability to people. Estimates of traffic and population coverage, show that by both of these standards the selected functional system is highly efficient.

The selected rural primary transportation routes comprise 6,919 miles of road, or 7.4 percent of the total of 93,142 miles of rural road in the state. It is estimated, that Michigan rural traffic in 1948 amounted to 9.1 billion vehicle miles of travel. The selected routes carried in that year traffic amounting to 5.7 billion vehicle miles, or 63.1 percent of the year's total rural travel. In other words, less than one-thirteenth of total rural road

mileage carries nearly two-thirds of total rural highway traffic.

This test of the traffic service of the selected system also revealed differences of usage which tend to further substantiate the classification's division between primary and secondary routes. A curve was plotted of the accumulative totals of road mileage and vehicle miles represented by the successive classes and groups of routes. The significant break occurred between the portions of the curve representing the Class III and the Class IV increments. This same condition is reflected in the fact that roads in Group IIIb had an average traffic of 850 trips per day while the average daily traffic on the roads in Group IVa was only 370 trips.

Even more striking but probably less meaningful results were obtained when the selected system was tested for the availability of its service to the state's five and a quarter million people. This test revealed that the selected primary roads connected with communities in which practically all of the state's urban population and 71 percent of the total population had close access to their service. The roads in Class I alone, representing only one percent of the total mileage of rural roads, connected places with 55.5 percent of the state's people.

The curve plotted on the accumulative totals of road mileage and population served, showed its significant break between Class I and Class II, with a secondary break between Groups "a" and "b" of the latter class. This result merely indicates the high service importance of the roads classified as having an interstate function.

CONCLUSION

This method of road classification as developed in Michigan is still undergoing studies to test its accuracy and to refine its technical procedures. The methods are being somewhat improved and simplified, but up to this time, no basic flaw has been found in the theory or results.

If continued examination and use of this classification method prove its soundness and value, it will be because it is based, not on non-pertinent factors, but upon traffic itself and the conditions and activities of community life which generate traffic movement and which that movement serves.

It would appear from the experience of the Michigan State Highway Department's planning and traffic engineers, that the process as here outlined is too long and laborious for very general use in state-wide road classification. This is especially true of the procedures for determining traffic attraction.

The traffic attraction phase of the study was undertaken, as has been pointed out, at least in part to verify and substantiate the indications given by economic and social data. This verification of the significance of economic and social activities in generating traffic could only have been accomplished by such a fundamental and detailed analysis of actual traffic attraction as this method involves.

It is probable that in the future, road classification will lean heavily on economic factors, but with constant reference to the characteristics and meaning of traffic attraction as they have been revealed in this study.