HIGHWAY RESEARCH BOARD

BULLETIN No. 6

REPORT OF COMMITTEE

ON

USES OF HIGHWAY PLANNING SURVEY DATA

INCLUDING

SPECIAL PAPERS

PRESENTED AT THE
TWENTY-SIXTH ANNUAL MEETING
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HIGHWAY RESEARCH BOARD
DIVISION OF ENGINEERING AND INDUSTRIAL RESEARCH
NATIONAL RESEARCH COUNCIL

WASHINGTON 25, D C - JULY 1947

NATIONAL RESEARCH COUNCIL

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The charter of the National Academy of Sciences passed by Congress and approved by President Lincoln in 1863 provides that "the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment and report upon any subject of science or art "

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TABLE OF CONTENTS

REPORT OF COMMITTEE

ON USES OF HIGHWAY PLANNING SURVEY DATA

By Thomas B. Dimick, *Secretary*
Public Roads Administration

The Committee on Uses of Highway Planning Survey Data, a joint committee representing both the Department of Traffic and Operations and that of Economics, Finance and Administration was formed in the summer of 1945. The aim of this committee is to develop plans for more fully utilizing all available information, and to enhance the value of the planning surveys to the highway organizations of which they are a part.

In order that all might capitalize fully on the opportunity offered by this committee, it was decided at the initial meeting which was held in Oklahoma City in January 1946, that all state planning survey organizations should be invited to pool their ideas concerning the use of this information. In accordance with the committee's decision, a letter was sent to each state highway department, and to other engineers interested in this work, asking them to submit full descriptions and discussions with samples, where available, of all uses of planning survey data which had been made in the state and which had proved of value in (1) the development of over-all programs, (2) the planning of construction projects, maintenance programs, and traffic operations, and (3) the guidance of highway policy and legislation.

The letter explained that by the term "planning survey data" reference was made to any and all of the original and continuing studies of traffic volume, composition and loading, origin and destination, road motor-vehicle ownership, use and tax payments, state, county, and local highway finance, and allied subjects.

Most of the states furnished complete and well-developed reports concerning the uses of this material that had been developed and tried by them. Several outlined new uses or variations in the old methods that they would like to try when time would permit, and a few volunteered some criticism concerning collection or analysis procedures with their suggestions for improving the quality of information or methods of collection which they censured.

The uses which have been made of the data collected in these surveys have been found to be many and varied. While the survey was planned primarily to furnish facts and figures for the use of the engineers and officials of the various states

and of the Public Roads Administration, much of the information has been used in arousing an interest in highway matters or in molding public opinion. Many other government agencies, chambers of commerce, consulting engineers, transportation associations, advertising agencies, educational, research, and scientific institutions, corporations, and others have requested miscellaneous survey information such as maps, traffic charts, and other related data. By furnishing the information requested, insofar as is possible, the planning divisions are able to act as public relations units and thus benefit their respective departments or commissions. This collateral use of the informations, while important and valuable to the general public might be said to constitute a "byproduct" of the prime purpose of the survey. The fact is that planning survey data form a reservoir of highway transportation knowledge of which many items are constantly being used, these adding to a significant total, although the individual items are often minor in nature.

While the states have varied in their uses and applications of planning survey data, several broad major categories may be defined.

Road inventory surveys have indicated the existing condition of road surfaces in an area, and by throwing the spotlight on critical deficiencies in width, gradient, alinement, and sight distance, have helped to guide the planning of highway improvements into the most useful channels.

Many valuable uses have been found for the several classes of data generally bracketed under the term "traffic studies" - volume counts, both manual and automatic; vehicle-loading or traffic-composition studies; and traffic-operations studies, including those of traffic capacity, lateral distribution, passing characteristics, gradability, highway signs, signals, striping, and speed. The greatest progress, perhaps, has been made in the application of traffic data to highway location and geometric design - the adaptation of the roadway to the functional requirements of the traffic which passes over it. The use of actual or predicted traffic volumes in the planning and design of individual projects has passed from the domain of research into that of accepted routine. In the field of structural design there is increasing recognition that studies of the magnitude and distribution of axle loads, first considered important in connection with size-and-weight restrictions, are essential to continued progress in bridge design, in the treatment of subgrades, and in the design of road surfaces, both rigid and non-rigid. Both weight and volume data have been found useful in determining the likelihood that individual road sections may soon require improvement, either through structural deterioration caused

by an undue frequency of heavy loads, or through functional obsolescence caused by an excessive number of obstructions to the free movement of traffic.

Origin-destination surveys provide the basic data for determining the desired directions of traffic flow. During the past two years the application of the origin-destination survey techniques to the problems of urban congestion and the location and design of urban expressways, other arterials, and distribution routes, has been an outstanding feature of planning survey work. Not all of the numerous city surveys have been equally successful, equally well-recieved, or applied with equal diligence to the problems of the individual cities. Nevertheless, there seems to be a widespread agreement that this type of study is one of the most promising fields of research in highway planning, both rural and urban.

The basic fiscal studies, supplemented by the continued annual collection of data on the highway income, expenditures, and debt of the state and its political subdivisions, provide the data for the long-range financial planning which must accompany engineering planning in order that the latter may be carried through successfully. Fiscal data alone are not sufficient for this purpose, but must be combined with data from such studies as the motor-vehicle allocation, road-use, and road-life surveys. A number of states, by combining data from these several studies, have made useful comparisons between the requirements for maintenance, replacement, and new construction over a period of years in the future and the highway revenues which may reasonably be anticipated during the same period. Another question which has engaged the attention of a number of the states, and to which highway cost and revenue data are directly applicable, is that of what proportion of the total highway plant can be adequately supported as a state highway system.

The motor-vehicle allocation studies have been found useful in determining the distribution, or incidence, of the motor-vehicle tax burden among vehicles of different types, sizes, and classes of use, and among motor-vehicle owners with respect to rural and urban residence, and size of urban place. Data of this sort are essential to the guidance of highway tax policy.

The road-use studies, which were designed primarily to determine the distribution of highway expenditures, have not been used as extensively for this purpose as was anticipated at the time they were put into operation. However, many states have found the results of the road-use studies useful in making estimates of total miles traveled, the distribution of travel over several systems of roads and streets, average annual mileage and miles per gallon by type of vehicle, and the

frequency distribution of trips of different lengths.

The road-life studies are essential to the analysis of highway costs. They provide an historical basis for estimating the rates at which the several elements of the highway plant--surface, structures, and grading--will require replacement. When combined with studies of maintenance costs, and evaluation of the standards to which replacements and new construction will be built, they furnish the necessary data for the prediction of future annual expenditure requirements.

From all of the different studies listed above, together with minor or collateral studies, facts have been gathered and combined in order to supply information to the administrative authorities and legislatures on which to base an equitable distribution of highway funds among the several classes of roads and streets. The allied problems of economic justification and the priority rating of projects also require the combination of all data from all branches of the planning survey work.

The main phases of highway planning research are, in general, included in the above subdivisions of the data-collection and analysis problem. Many other items containing valuable information may be obtained along with the more important data at little or no additional cost and generally should be collected if a possible or probable use of these can be foreseen. Many of these items that might ordinarily be classified as minor can sometimes be used to supplement and strengthen data of greater consequence. Generally, thought concerning minor items should be confined to a means of their integration into factors that indicate proper variables to be used in dealing with allocation and priority problems, and by this means provide a coordinated, factually determined, and continuous plan for the development of the highway facilities of the area.

The usefulness of the data when collected depends largely on the ease and length of time required to prepare them for any given purpose. It is commonly found that an arrangement of data for one study is unsuited for another so that rearrangement becomes necessary. Again, it is frequently necessary to blend data from two or more different studies. Accordingly, it has been found desirable that all basic information should be placed on tabulating cards since control of the work is simplified and consistent answers will be produced at different times from the same data with something approaching a minimum of effort.

One very simple suggestion that was made by several states and which should prove beneficial to all, is the advertising of the information stored in the planning survey files by means of indices published periodically, and listing

reports, maps, and miscellaneous data available. In such case, the highway department is establishing a library of such information from which any citizen, corporation, or governmental agency may draw the material available. Such an index appears to be an excellent idea to broaden the use of the information that has been gathered in these surveys.

One of the most generally accepted uses of the data was in connection with the establishment of the Interstate System, the Federal-aid secondary system, and of upward and downward revisions of the state system or systems. Selections and revisions generally were based on traffic volumes, mileage of rural roads carrying an excess of certain average daily traffic, vehicle miles, area in farm lands, rural population, motor vehicle registration, and other related data.

Rural highways are being divided into permanent control sections in several states, and the interest in this activity is spreading. The termini of control sections are most commonly placed at important intersections and at county lines (the latter for administrative as well as for analytical purposes). Subsections within each control section can also be established to provide for more detailed reporting where desired by a particular operating division of the highway department. Thus, subsection breaks may be made at points where there are surface type changes, differences in terrain, special construction features, city limits, etc. The control sections are used as the major units in the reporting and assembly of construction and maintenance costs, traffic volumes, accident frequency, critical features, and other data which are necessary for the proper planning, operation, and administration of the highway plant.

A clever device for demonstrating in a simple way the economic justification of any section of highway has been developed in one state. A map has been prepared showing the cost in cents per vehicle-mile of the traffic using the facility, and this information plotted on a map in a manner similar to that in which traffic volume is shown.

Many plans have been developed for calculating the proper sequence of road improvement by control sections or other subdivisions of rural highways of the country. These plans vary from elementary procedures based mainly on traffic and width of highway to more complex methods using a complete economic analysis. All of these methods have been used advantageously by the states sponsoring them. It has been suggested that a uniform plan should be prepared by which standard priority indices could be calculated for all construction projects. Such a plan, in all probability, would include many of the features of the present methods but with all of the

non-quantitative elements omitted, and the entire scheme standardized. It is believed by many that a formula of this nature is necessary in order to minimize guesswork and counteract the effects of political influence in the planning of construction programs. Such a method is being studied by a committee of the AASHO, who hope to publish it in the near future.

It has been found in some states that the use of the words "planning survey" is frequently misunderstood, not only by the layman, but in some instances by highway administrators who confuse these surveys with those made with transits and levels. A suggestion has been offered that the name of this work should be changed to "highway research". The term "survey" has quite generally been dropped from the title of the division handling this type of work, but there is a tendency to retain the concept of "planning", which is, after all, the justification for highway research.

Nearly all the states complying with the committee's request have emphasized the widespread and valuable use of both the traffic volume studies and the road inventory data. Next in order of frequency of use, 70 percent of the states have declared the worth of the origin and destination studies and the composition and loading data, while highway finance and use and tax payment information has been applied to fiscal problems in about two-thirds of the states. Half of those reporting have employed material concerning motor vehicle registration and ownership characteristics, and a lesser proportion have reported use of road-life, construction, and maintenance costs data. As a whole, the great majority of states appeared well pleased with the value of the data collected in the planning surveys and its present employment in the various phases of highway development. It is to be commendably noted that many of the states reported active planning for the more extensive future use of planning survey materials and methods. While in some areas it was thought that the function of the planning survey was to collect basic data and prepare it for study by the administrative officials, others completed the analysis of the data and recommended a division of funds and a sequence of construction priorities with mathematical reasons for the recommendations which could be accepted by the administrative officials or revised slightly in the consideration of social or other non-quantitative factors which are better known to the staff than to the planning survey.

The immense volume of data collected by planning surveys has provided information used as a basis for the findings of non-governmental investigating and research organizations. The various states have drawn heavily from this wealth of facts, have coordinated the results of the survey data, and have

prepared and published a number of comprehensive reports designed for informational purposes. These are often published exclusively for the use of the legislature in dealing in a more enlightened manner with proposed legislation pertaining to the furtherance of a system of highways adapted to the needs of today and foreseeing those of tomorrow.

USES OF HIGHWAY SURVEY PLANNING DATA IN HIGHWAY FINANCE AND TAXATION

By Charles M. Noble
State Highway Engineer
New Jersey State Highway Department

The mere collection and tabulation of highway survey planning data serves no useful purpose unless the information is analyzed and put to work on the primary problem of planning, designing, and constructing highway systems as elements of transportation, that such systems may inject new vitality into the economic and social life of America. Transportation is the new dynamic factor in modern American life.

The past thirty years have witnessed the rapid and magical development of the motor vehicle to a state of near perfection and a corresponding expansion from a standing start of a system of highways of national extent to such effect that the economy of the United States is irrevocably bound up with motor transport.

Early in the development of the motor age, highway planning was comparatively simple, for the need to connect centers of population with passable roads through rural areas was obvious, and instinctive engineering judgment was adequate to meet and promote the development of the motor car. That this task was well done is attested by the great highway network which stretches from the Atlantic to the Pacific, and from the Mexican border to Canada, and which is a tribute to American engineering.

But as motor transport integrated itself with American life and industry, the problem became more complex until today the instinctive approach will no longer suffice and more analytical methods are required in order that the highway transportation system will pace the tempo of industrial and social development. Thus it is vital that the continued development and expansion of this system should be wisely, carefully, and scientifically planned, utilizing all available data. Highway

planning surveys as presently organized under the able guidance and leadership of Public Roads Administration collect much of the data required to plan and design modern highway transportation facilities. But these data must be analyzed and applied to the practical problems associated with planning, designing, and financing highways.

The New Jersey State Highway Department has recognized the necessity and has recently organized a division of planning and economics headed by a director and deputy and composed of two principal bureaus: (1) the bureau of planning and economics, and (2) the bureau of planning survey. The latter bureau gathers highway planning (traffic) data in the field and collates it, while the former analyzes the information and applies it to practical highway planning problems having due regard for the principles of economics.

One of the important duties of a planning and economics division is to assist in the field of finance and taxation as applied to the highway transportation system. This problem is particularly acute in the state of New Jersey where public sentiment, in view of critical unemployment distress and believing that sufficient highways had already been constructed to adequately fulfill transportation needs, sanctioned by referendum vote of the people the diversion of motor vehicle revenues to other than highway uses. The total diversion amounted to the sum of $159,000,000 over the past 16 years. This diversion sentiment came largely from the cities and urban areas where a large portion of motor vehicle revenues were were collected and where land tax distress developed during the depression years. The people of the urban areas felt that motor vehicle revenues collected from them were being used largely in rural areas and that they were deriving little benefit from such taxes. Therefore an equitable balance between highway expenditures in rural and urban areas is essential. It is interesting to note that in the three-year period from 1940-1942 inclusive, 12 percent of the total motor vehicle revenue in the sum of $615,000,000 was diverted from highway uses in the United States.

Consequently it is necessary to take stock of highway construction and maintenance needs and to relate those needs to anticipated revenues in order to determine whether such revenues will be sufficient to meet requirements as rapidly as required by expanding traffic, or if additional motor vehicle taxes or possibly a bond issue is necessary.

In order to determine scope in financial planning, the first broad objective contemplates the blueprinting of an overall statewide highway transportation system which will be required by the state to assure its economic vigor, health, and continuous progressive development, looking forward a

reasonable period in the future. In the state of New Jersey the system is being developed on a 30-year basis. To accomplish this task it is necessary to gather data from national, state, and local agencies in order to integrate the development plans of these groups into the highway net. It is necessary to learn the trend of industrial and agricultural development, to ascertain where water power and water supply reservoirs, airfields, canals, railways, recreation areas, state and national forests, and military installations are planned in order that the highway system will serve these facilities effectively and not conflict with them. It is then necessary to relate these data to predicted traffic volume and trends.

In the planning and determination of the amount and location of highway facilities it is advisable to cut cross-sections across traffic sheds and compare the present traffic volume with the number of traffic lanes presently available thus establishing whether there is a current deficiency or adequacy of traffic capacity. The traffic volumes may then be projected ahead 30 years and the number of traffic lanes needed at the end of that period determined. With this data, suitable future routes are laid out. In the development of a statewide 30-year plan, consideration should also be given to opening up undeveloped areas for growth and recreation.

It is estimated that the state highway portion of the 30-year system, which should be constructed in New Jersey in order to meet transportation needs so that the state may retain and advance its economic vigor and prosperity, will cost in excess of one billion dollars.

Upon the completion of the long-range 30-year plan conceived on a realistic basis of actual state needs, a definite goal of accomplishment is established, based on a thoughtful reasoned analysis of all the factual data available. Actual construction can then proceed with the assurance that each project forms a part of the ultimate master plan. This results in overall economy, avoidance of duplication and costly scrapping of expensive highway facilities.

With the ultimate goal blueprinted, it is then necessary to establish priorities for the actual construction based on factual data and having due regard for anticipated available funds. In order to utilize engineering personnel effectively to perform the field surveys, prepare plans, specifications, and to plan construction operations properly, it is the purpose of the New Jersey highway department to establish these priorities five years in advance. In this way planning for actual construction can be kept continuously five years ahead and schedules (time tables) can be worked up so that the program may be executed smoothly.

In a state where traffic has continued to grow apace in

spite of curtailed highway construction, there is inescapably a tremendous backlog of new highway construction virtually in an emergency category due to acute strangulation of highway transportation. This ten-year backlog of emergency projects in New Jersey amounts to more than $200,000,000 at the present time. That this has reached alarming proportions is indicated by the condition of one highway which has a satisfactory maximum capacity of 35,000 vehicles per day and which now carries an average daily traffic of 66,000 vehicles. This route has carried 102,000 vehicles per day. The economic loss due to congestion and delay is enormous. In the traffic shed served by this route there is a roadway deficiency of over 95,000 vehicles per day at the present time. This is big business in the economic field and in view of the intimate relationship such facilities have on the welfare of the state, it is essential that priorities for construction and financing be based on a careful and intelligent use of traffic and economic data gathered by the highway planning survey. The establishment of these priorities is difficult, however, because of the tremendous backlog of urgently needed highway improvements. Consequently, it will be necessary in New Jersey to use the yardstick of traffic congestion as a measure of urgency in establishing priorities for construction. Because the heaviest concentration of excessive and sustained congestion is confined to one section of the state and in fairness to the state as a whole, it is proposed to divide the state into zones and establish relative priorities within the zones. Since the anticipated future motor vehicle revenues will not be sufficient to provide all the highway facilities needed to bring the state abreast of traffic needs at once, it is considered equitable to establish construction priorities within these zones in order that relief may be afforded throughout the state rather than be entirely concentrated in one area alone.

Inasmuch as the work of the highway department is carried forward on a fiscal year basis it is necessary to prepare a yearly budgetary statement for consideration by the state budget commissioner, approval by the Governor, and submission to the legislature for final approval and action. The projects included in the budget for state highway construction can be selected in the order of priority from the five year highway priority list within each zone.

A necessary fiscal responsibility is to set up an annual program for the replacement of worn out pavements and other physical units of the highway structure and to establish a fiscal program for the rectification of traffic hazards on a priority basis. The use of highway planning data is fundamental in developing these programs.

Another important use of highway planning survey data in the field of finance and taxation is the determination of an equitable distribution of motor vehicle taxes over all classes of vehicles. In conjunction with this work a study may be made of maximum desirable vehicle size and weight with the objective of submitting model drafts of legislation for the consideration of the legislature and the Governor.

It is considered that this is a most important assignment, for the role of the motor truck is so interwoven with the economic and industrial welfare of the state, not to mention the dependence of vast populations on the truck for the delivery of food, that any adverse unbalance in the economy of truck haulage would have an immediate and unfavorable effect on the people and business interests of the state.

During the last session of the New Jersey legislature, a bill was introduced increasing the motor vehicle license fee for the heavier trucks. Before it was put to a vote, advice was requested of the highway department as to whether the new rates were equitable in relation to the additional original highway construction cost and the wear and tear caused by heavy trucks on the highway.

The department did not have any answers ready nor was it in a position to produce realistic answers in time to be of assistance. After considerable calculation the best that could be done was to advise that heavy trucks would require an increase of about two inches in the thickness of concrete pavement, some increase in bridge costs, some additional maintenance costs on pavement and shoulders, and that in some cases costs had been increased due to constructing lower rates of grades for trucks. It was concluded that trucks did not cause any increase in cost for right-of-way, width of pavement lane and total number of lanes of pavement, grading (except as influenced by lower rates of grades), width of bridges, width of shoulders, and traffic interchanges. No data were available to indicate the ratios of these various costs as related to truck weights and classes and in turn related to the proper share of motor vehicle taxes that should be borne by passenger cars and the various truck classes.

It was evident that the department needed to develop more information in order to advise on equitable rates of taxation. This information can be obtained by proper utilization of data derived from highway planning surveys.

It is essential, therefore, that a sound fiscal policy be formulated based on highway transportation needs as determined by traffic data and met by annual motor vehicle revenues equitably adjusted in differential rate among all the various classes of vehicles and set at a level that will yield sufficient revenue to meet the needs of motor transportation adequately,

but such rate structure must not exceed ability and willingness to pay. A policy contemplating motor vehicle tax rates above ability to pay will result in diminishing returns, and more serious still, will have a tremendously adverse effect on the economy and social welfare of the state.

The American motorist and the trucking industry have shown an extraordinary willingness to pay motor vehicle taxes but it cannot be expected that they will continue in this mood if the monies collected from them are diverted away from highway construction and maintenance or if a hit or miss or inequitable fiscal program is adopted. Highway planning surveys provide the data and furnish the key to the establishment of a sound fiscal policy based on the use factor. In the establishment of a policy, care must be exercised in avoiding blind acceptance of traffic volume density as the sole criteria. There should be a recognition of the necessity to open up undeveloped areas in a state and to "subsidize" such areas with an adequate road system to stimulate development in order to effect an increase in land tax ratables on a state-wide basis, to spread out industry and population and to open up recreation areas. Such a policy must be carefully balanced against the highway transportation needs of presently developed areas, otherwise industry, population and business will be sucked away from these areas resulting in blighting them with subsequent loss in land tax ratables and a staggering loss in physical investment in schools, hospitals, playgrounds, parks, water supply, sewerage, and street systems as well as other public utilities. The cost of government in these fully developed areas does not decline when there is a loss in land ratables, but rather increases. Consequently, communities with declining ratables face almost certain bankruptcy.

A fertile field where economic analysis based on highway planning survey data will yield large dividends in state-wide prosperity is in developing an equitable fiscal policy establishing the ratio of available motor vehicle funds that should be spent on the main state highway and urban system to that spent on the secondary or feeder system. It is clear that the purely land service road provides access to property and is almost entirely of direct benefit to the abutting owners, while the trunk highway is an element of transportation and is of large benefit to the region, the state, and in many cases to the national economy. This is a large and pressing problem since state legislators are constantly subjected to pressure from rural areas for a larger "cut" of state motor vehicle revenues to be spent on local land service roads. It is difficult for the landowner bogged in the mud in an isolated rural area to understand benefits accruing to him by the

expenditure of millions on express highway facilities in highly developed urban areas. It is essential that there be a fundamental clarification of what land service roads should be supported entirely by land taxes collected from local land owners, what land service roads should be supported partly by the land owner and by motor vehicle revenues, and an equitable ratio set up. Where there is state participation in local road construction and maintenance using motor vehicle revenues, a determination should be made by the state as to which roads should be improved on the basis of the service to be rendered by such roads to the state-wide feeder system of highways. This indicates the necessity of developing a state-wide feeder system of highways properly integrated with the main system. It may be of interest to note that of the 3,000,000 miles of highways in the United States, approximately 80 percent carry an average daily traffic of 22 vehicles or less. Assuming the improvement of such a low traffic road at a cost of $8,000 per mile and assuming the investment is charged off in one year, the cost is at the rate of $1.00 per vehicle mile, while an express route carrying 60,000 vehicles per day and costing $2,000,000 per mile could be charged off in one year at the cost of ten cents per vehicle mile. In 1921 nearly three-fourths of all money spent for highways was derived from local land taxes, while in 1941 only one-quarter was furnished locally. It is noted that an "at grade" local access main state highway is still a land service and the adjacent property reaps a great benefit when the highway is improved and traffic increases. It would appear equitable therefore that such specifically benefitted land owners bear a share in the cost of such roads. The same reasoning applies to express highway facilities constructed to relieve traffic congestion in urban territory. In New Jersey where limited access express highways are involved, the thinking to date has tended to the opinion that the loss in land tax ratables due to destruction of buildings and the withdrawal from the tax books of the land occupied by the new highway constitutes a sufficient local contribution to the cost of the express facility. Often, even this contribution involves small fully built up communities in a serious financial problem particularly during the period required to effect an increase in ratables on the remaining properties in the town induced by the expansive effect on such properties by reason of the construction of the express facility. This thinking may be untenable in states not as heavily urbanized and industrialized as New Jersey.

It is the opinion of the writer that the surface has only been scratched in utilizing the tools made available by highway planning surveys. This is particularly true in the field of finance and taxation and it is hoped that the scientific

reasoned approach to these problems will be given definiteness of direction and be pressed with vigor. The stakes are high, for the economic and the social welfare of the United States is dependent on an adequate highway transportation system developed on a sound fiscal policy.

PROGRAM AND PROJECT PLANNING

By Roy E. Jorgensen
Director of Highway Planning
Connecticut State Highway Department

Discussion of Program and Project Planning will be limited to some aspects of Connecticut's highway planning which it is believed are somewhat different in character from planning survey activities in most other states.

Program Planning. A $99,000,000 five-year state highway construction program has been planned and there is only $31,000,000 in sight to accomplish it.

The first year of the five-year program ended on June 30, 1946. The second year is the fiscal year ending June 30, 1947. The third, fourth, and fifth years will be the fiscal years of 1948, 1949, and 1950. If the $99,000,000 program is carried out according to plan, it would mean that all projects contemplated would be completed or under way by July 1, 1950.

The biggest "program" job at the moment in Connecticut is to present the five-year program of $99,000,000 and the latter program, involving another $200,000,000, in a manner that will assure that its importance and urgency are recognized by the legislature whose responsibility it is to establish the basis for financing Connecticut's road program. It is important to make clear the character of the major improvements being planned in and adjacent to cities, to indicate the value these improvements will have in the relief of congestion and reduction of hazard, and, above all, to establish a recognition that the program is a fact and not a proposal. Whether construction proceeds rapidly or slowly, whether there are $31,000,000 or $99,000,000 available in five years, the characteristics of the individual projects will be unchanged because they are based on the traffic to be served and not fitted to potential revenue. This must be made clear. *There is no uncertainty about a soundly planned program except the rate at which it will be undertaken.* The Connecticut highway planning unit has just completed and is now distributing a program report. Some of the illustrations from this report will show how the state

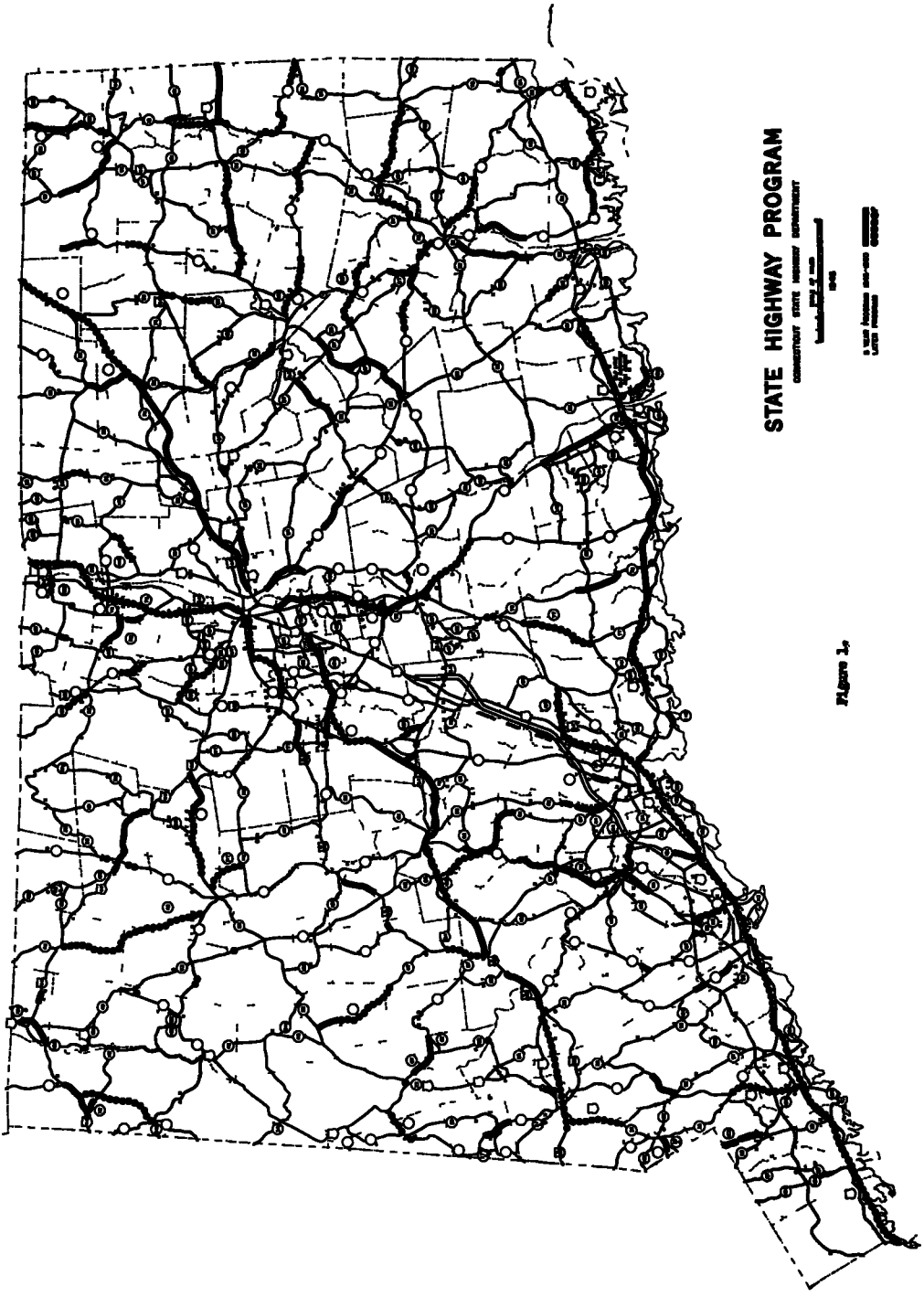

Figure 1.

highway program is being presented.

The state highway program has been shown on a state map, Figure 1, to indicate the geographic distribution and approximate location of projects. The solid lines are the projects given top priority - the ones included in the five year program and all that can be financed with $99-million. The remainder of the program is shown with dotted symbolization. The extent and importance of projects in the later program are helpful in demonstrating the urgency of meeting the proposed five-year schedule of improvements. From the map, it will be apparent to the representatives in the legislature and other interested individuals that it has been necessary to defer many important improvements beyond the period of the five-year program. If the five-year program is not financed to permit its realization for eight or ten or 12 years the whole program will be postponed accordingly and the deferred important projects will be even further removed from initiation than they are under the proposed schedule. If no additional funds become available, the 5-yr program will stretch into a 16-yr program and the long-range program, estimated to cost $300,000,000, at present prices, will become a heritage for future generations.

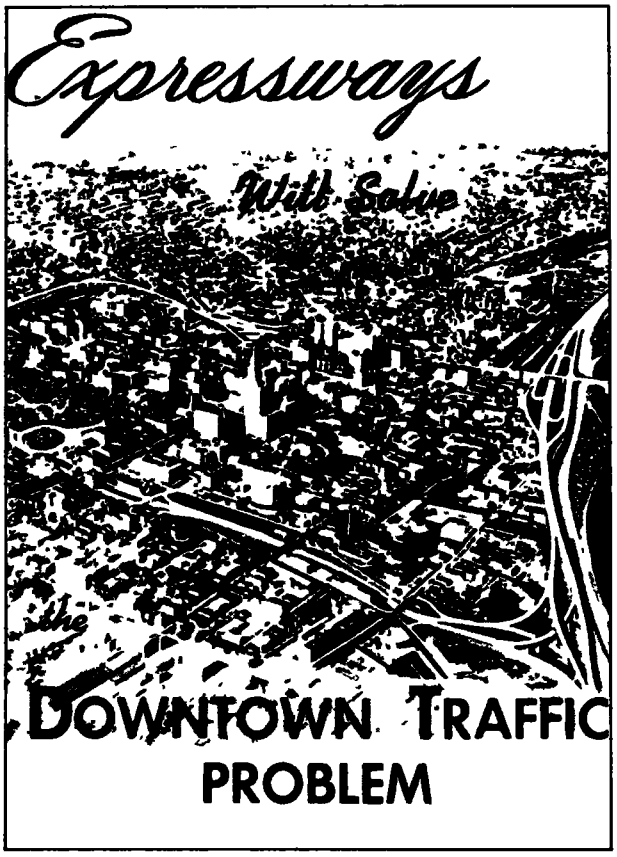

Figure 2

Figure 2 illustrates the manner in which the planned expressways, which account for a large part of the cost of the program, will serve the central area of one of Connecticut's cities. Origin and destination studies have shown conclusively that the central business areas are by far the most important generators of traffic and that relief of congestion can be

accomplished only by serving these areas directly. 1/

There is presented in Figure 3 a comparison between gasoline consumption, elapsed time, and stops on alternate routes between the New York state line and the New Haven city line, based on test runs made this year. The "old route" is U. S. No. 1 which passes through the several cities and unincorporated communities close to Long Island Sound. In large part it is no different in its physical characteristics from any other city street even though it is U. S. No. 1 and an important traffic artery. The "Expressway" is the Merritt Parkway, which is a four-lane, divided, limited access highway with no impedances to prevent high, uniform travel speed except for toll station stops.

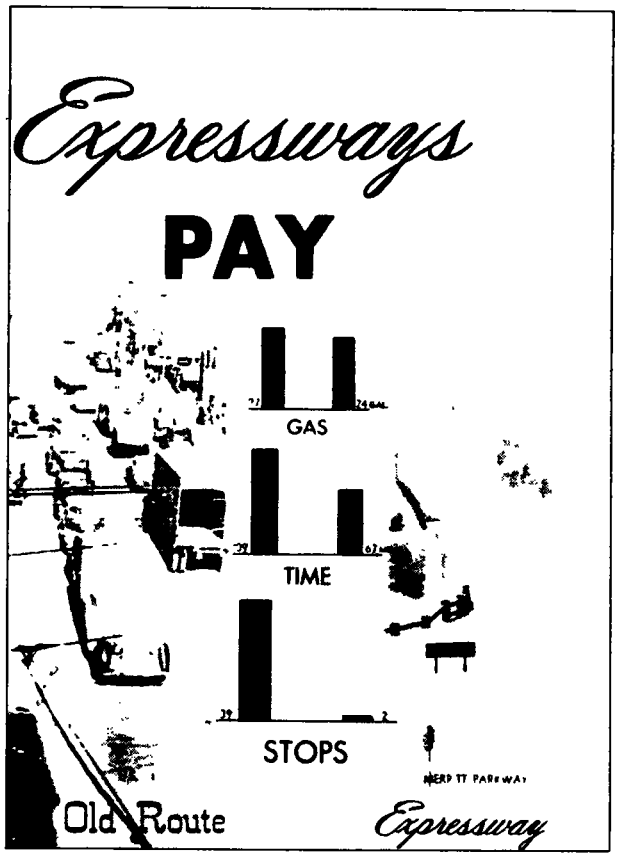

Figure 3. Expressways Provide Both Comfort and Economy

Details of the test runs which were made on the same day for each route are shown in Table 1. It is very evident from this tabulation that the "Expressway" route provides economy of motor vehicle operation and freedom of travel without the attendant irritation of those impedances so abundant on "old routes."

It is important to show what the development of an adequate network of main highways is going to mean in the reduction of hazards. In the program report comparisons have been made between accident rates on expressways and on the road system generally. Tables 2 and 3 give comparative data for

1/ *"Highway Planning Survey and Traffic Engineering in Connecticut, American Association of State Highway Officials' Proceedings, Papers and Discussions, page 119, 1944.*

Table 1

	Expressway (Merritt Parkway)		Old Route (U.S. No. 1 - Boston Post Road)	
	1st Trip	2nd Trip	1st Trip	2nd Trip
Time of Day	8:30-9:30 AM	10-11 AM	2-4 PM	4:30-6:30PM
Time of Trip	1 hr 6 min	1 hr 8 min	1 hr. 41 min	1 hr 57 min
No. of Stops	2	3	37	41
Mileage	48.3	48.3	47.7	47.7
Gas Consump. (gals.)	2.35	2.35	2.60	2.70

accidents and fatalities respectively. These can be translated into potential accident reduction resulting from the transfer of traffic from existing roadways to expressways.

There were 415 people killed in traffic accidents in Connecticut in 1941. What would have been the situation had the expressways program been completed and serving as the main traffic arteries? The 415 deaths represented a rate of 8.0 for every 100,000,000 vehicle-miles of motor travel in the state. Records on existing express highways indicate a reduction to about 3.5 is a reasonable expectation. Using this value and applying it to the estimated traffic that would have been diverted to the express highway system, had it been completed in 1941, it is found that there could have been saved the astounding total of 94 lives. And these figures don't stop with 1941. This year, had the system been completed, 80 to 90 people might have been saved from death in motor vehicle accidents, and next year an additional 90 or more, etc.

Figure 4 compares the fatalities which occurred on paralleling sections of the Merritt Parkway and U.S. No. 1 between 1940 and 1944, during which period the total traffic using each was reasonably comparable. The death rate was 4.5 times greater on U.S. 1 which had 103 traffic deaths as compared with 23 on the Merritt Parkway.

Figure 5 shows the extent to which the long ignored but now fully recognized urban traffic problem has expanded the state highway program. The rate of state highway construction must be expanded greatly if the most urgent of the accumulated improvement needs are to be met. In large part the necessary expansion must be directed at the urban traffic problem - at breaking the bottlenecks in the cities through the provision

Table 2

ACCIDENTS PER 100 MILLION VEHICLE MILES [a]

Description	Present Length Mi	Period	Avg. Daily Traffic	Accident Rate
Expressways				
Merritt Parkway -- passenger cars	37.5	7-38 to 1-45	8,900	170[b]
Hartford Expressway -- 14 percent trucks and buses	4.2	10-42 to 10-46	6,150	97[b]
Other Routes				
Conn. State Highway Average	2,880	1940-1944	2,360	303
Route 15, E. Hartford-Glastonbury, Suburban Area, 2 lanes	8.4	" "	6,530	520
Route 15, E. Hartford-Industrial Area 4 lane divided	1.0	" "	20,000	1,150
U.S. 1, New York-New Haven, Urban and Suburban 4 lane undivided	46.0	7-38 to 1-45	10,800	440

[a] Reported to Motor Vehicle Department.

[b] Rates computed on total traffic and accident experience. Length was not complete throughout this period.

of expressways which can move large volumes of traffic with safety and dispatch.

In the five-year program, urban projects will cost $47,000,000 out of the $99,000,000 total, or almost 48 percent of the program. In the over-all program, urban improvements will make up 58 percent of $174,000,000 of the $300,000,000 total. It is noteworthy that the amounts shown for the pre-war period, 1937 to 1941, which total $45,000,000, represent pre-war construction dollars. The five-year program totals

Table 3

FATALITIES PER 100 MILLION VEHICLE MILES

Description	Length Mi	Period	Avg. Daily Traffic	Fatality Rate
Expressways				
Merritt Parkway -- passenger cars	37.5	7-38 to 1-45	8,900	3.5[a]
Hartford Expressway -- 14 percent trucks	4.2	10-42 to 10-46	6,150	2.7[a]
Arroyo Seco Parkway California	5.8	1941 to 1944	27,200	3.5
Other Routes				
Conn. State Highway Average	2,880	1940 to 1944	2,360	8.0
U.S.No. 1, New York-New Haven, Urban and Suburban 4 lane undivided	46.0	7-38 to 1-45	10,800	11.2
California State Highway Average (rural)		1941 to 1944		14.0
Figuoro Street Los Angeles	5.35	1941 to 1944	25,100	14.0

a Rates computed on total traffic and accident experience. Length was not complete throughout this period.

$99,000,000 at post-war prices. To make a comparison of accomplishment between the $99,000,000 program and the pre-war program of $45,000,000, the $99,000,000 must be scaled down to about $70,000,000. It is also true that if current price levels do not prevail it will be possible to accelerate the program proportionately.

Figure 6, which is based on a nation-wide analysis by the Public Roads Administration to obtain composite mile index

values, shows the influence of high post-war prices. The post-war construction dollar buys only 82 percent as much as the 1925-1928 dollar. In contrast to this is the period 1932 to 1941 during which the value increased to over 120 percent.

Figure 4

Illustrated by Figure 7 is one of the urban highway improvements being planned for early construction in the city of Middletown, population 26,500, to break a long existing bottleneck. The proposed new expressway along the Connecticut River parallels Main Street, the wide street in the left of the picture. In addition to being the center of business in the community Main Street is a bottleneck into which traffic from all radiating highways is funneled. Conditions on it are particularly bad during the summer months when through traffic to the shore from the Hartford metropolitan area, north of Middletown, is extremely heavy. Traffic on Middletown's Main Street varies from 16,000 to 20,000 vehicles daily. It has been estimated through origin and destination studies that 11,000 vehicles will be diverted to the improvement. Of these 40 percent will be through traffic or traffic which will entirely by-pass the central business area.

The area through which the new road is to go is not well developed because of the danger of such floods as the very exceptional ones of 1936 and 1938. There are a few low standard dwellings which will be demolished as a part of the project. The State is arranging to finance the proposed highway improvement without aid from the City, but has obtained an agreement from the latter which obligates the City to develop the area between the new road and the river as a waterfront park

The improvement shown is planned to permit its extension both north and south as a later part of the long range

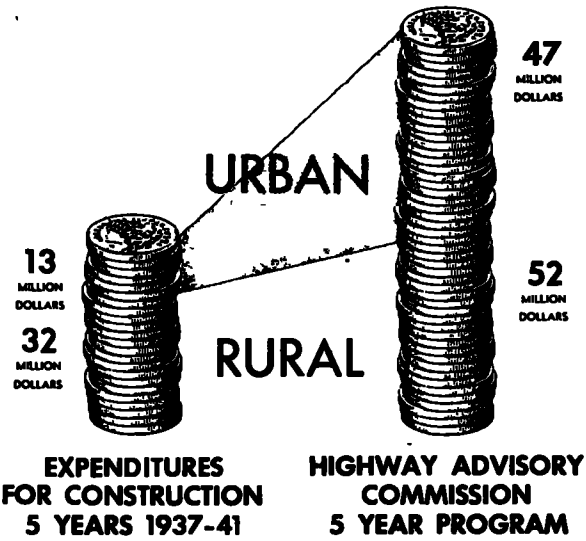

Figure 5. Urban Needs Expand Highway Program

program.

Comparison of the funds estimated to be available for state highway construction and the cost of the five-year program is made in Figure 8. The estimated revenues of the highway department for the five-year period total $117,746,000 of which $15,198,000 represent federal aid allotments. Deducting the $96,052,000 needed for recurring obligations and adding the existing balance at the beginning of the period, there will remain but $31,000,000 for state highway construction.

In Figure 9 there is shown, against the background of traffic growth, the way state highway construction has varied in amount since 1922. The 1946-1950 value indicates what will be available with existing revenue rates. It is obvious that since 1931 the rate of state highway construction has not kept pace with the rate of traffic growth. In large part this is the reason that road needs have accumulated in such great magnitude. It is not intended to imply that highway purpose receipts have not kept pace with the upward trend in traffic. Obviously, receipts from the gasoline tax bear a direct relationship to traffic. However, with specific and increased allocations of funds for expenditure on other than state highways and with greater demands on the highway department in total mileage and in increased cost of maintenance, the proportion of total revenue left for state highway construction has become progressively less. Figure 9 shows, too, the extent to which it has been necessary to resort to bond issue and toll

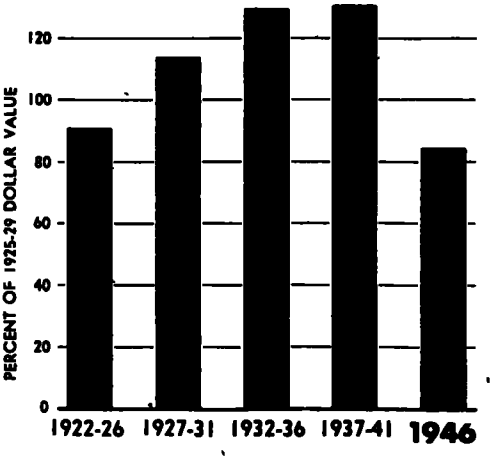

Figure 6. Less Construction per Dollar

Figure 7. The Riverfront Expressway in Middletown

financing to accomplish what has been done since the middle thirties. The bond retirement and interest payments for two of four projects for which bond issues were made are provided for from the regular highway fund. This reduced the amount that might have been spent on normal construction by about $15,000,000 up to the present time.

The foregoing illustrations are all included in the program report. They have been developed, also, as large posters which are to be displayed in the lobby of the State Capitol during the first months of the legislative session in 1947. Brief descriptive captions will be used with the posters.

Two figures, 10 and 11, are not from the program report but they do have a great deal of program significance. Figure 10, and Table 4 from which the figure was developed, compare the cost per mile and cost per vehicle mile for construction projects serving different volumes of traffic. It will be noted that each of the values represents a large mileage of road. The comparison is based on 658 mi of rural state highway construction from 1933 to 1942 and on average daily traffic in 1939. It shows a relation between cost per mile and traffic volume that is generally recognized. The high standard improvements for heavy traffic volumes are the most costly per mile. However, it is not generally recognized that these roads

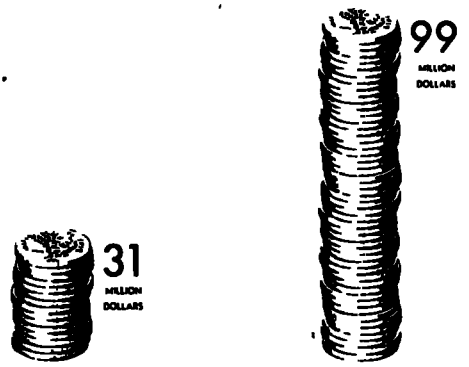

Figure 8. Funds do not meet urgent state highway construction.

are not the most costly in relation to the service provided. It will be seen that the roads with the least traffic - the cheapest in cost per mile - are actually much the more costly per vehicle mile of travel.

It is believed that Figure 10 represents a fair over-all picture, based on a large representative sample, but it will be found that individual improvements may vary greatly from the curves shown. There are locations, for example, where reconstruction on heavily traveled existing roads can be provided by fairly cheap widening within the existing rights-of-way and without great cost for excavation or structures. On the other hand, reconstruction of a road of the same traffic volume may require a complete new road through expensive properties and over difficult terrain.

From Figure 11 it is possible to appraise the rapidity with which the problem of congestion on two-lane, rural state highways will increase with the anticipated increase in motor traffic from 1939 (the year of our comprehensive state-wide traffic survey) to 1955. The line for 1939 shows the miles of two-lane rural state highway with average daily traffic exceeding various volumes. It was plotted directly from the traffic tables developed as a part of the basic state-wide highway planning survey. There were only three miles with 9,000 or more vehicles a day, about 17 mi with 8,000 or more, 30 mi with 7,000, etc. The dashed line for 1955 represents a direct expansion of the 1939 curve

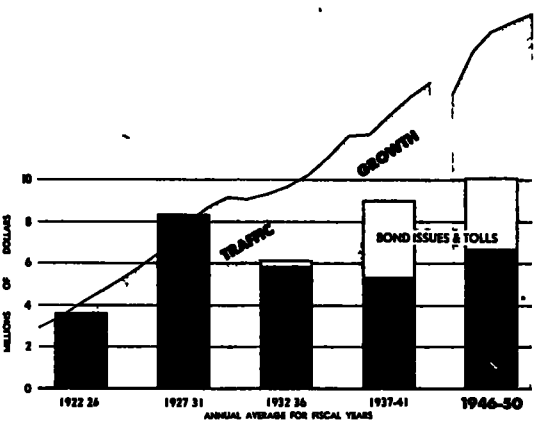

Figure 9. Construction of State Highways

The 1946-50 estimate is based on current revenue rates which do not meet needs of the planned program.

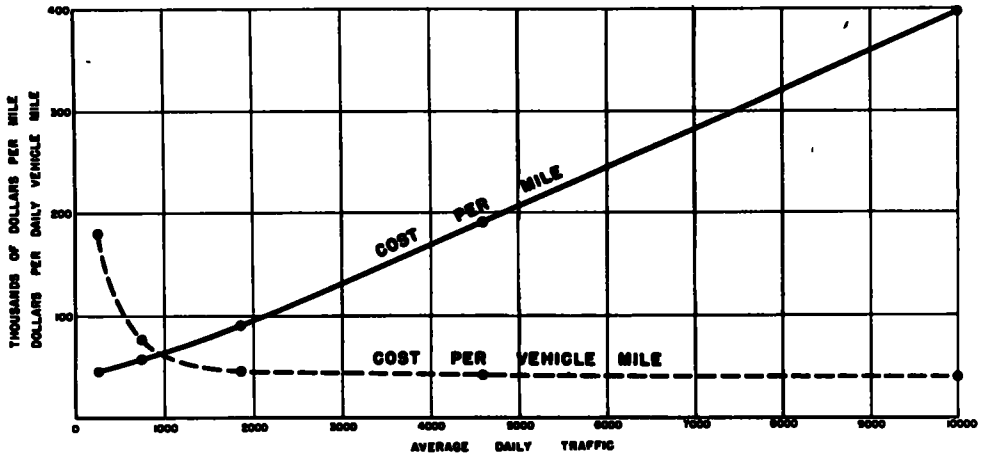

Figure 10. Rural State Highway Construction Cost

to reflect the estimated 53 percent increase in traffic. That such an estimate is conservative is indicated by the 23 percent increase in rural highway traffic actually realized from 1939 to 1941.

The important point that this chart brings out is that a 53 percent increase in traffic means far greater percentage increases in the mileage of two-lane roads needing reconstruction to provide more traffic capacity, and that, if highway traffic congestion is not to become progressively worse, the

Table 4

RURAL STATE HIGHWAY CONSTRUCTION

1933 - 1942 Inclusive

Average Daily Traffic Group	Miles Constructed	Average Traffic	Cost Per Mile $	Cost Per Daily Vehicle Mile $
0 - 500	215	245	44,000	181
501 - 1000	100	750	56,000	75
1001 - 3000	174	1,850	85,000	46
3001 - 6000	69	4,600	190,000	41
6001 and over	100	10,000	395,000	39

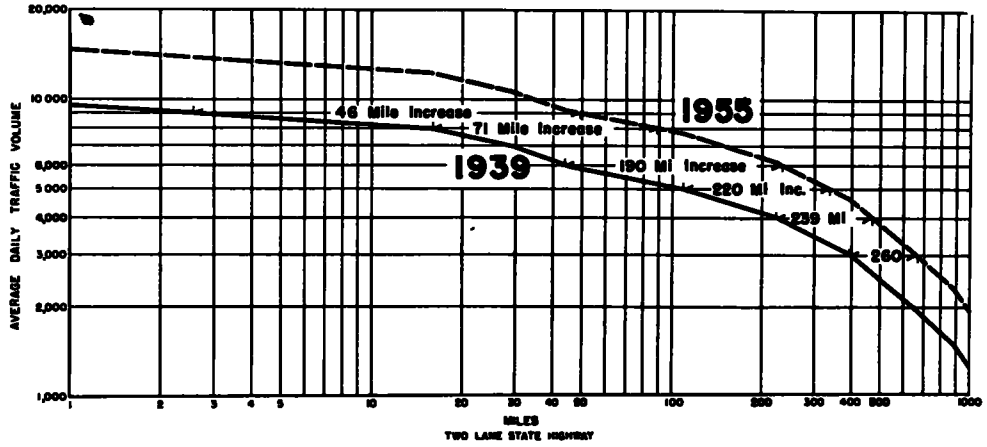

Figure 11. Increase in Miles of Highway Serving Various Traffic Volumes from 1939 to 1955

reconstruction program must be scheduled to keep pace. For example, if the reconstruction program up to 1955 were to be planned to assure that four-lane roads would be provided in cases where 6,000 or more vehicles a day are carried on rural roads, the program would have to include not only the 44 mi in this category now but also the increase of 190 mi which would be added by 1955. If sights should be set on 4,000 vehicles a day - and this is a value adopted by many states for planning purposes - there would be 220 mi as of 1939 and an additional 239 mi added by the 53 percent traffic increase by 1955. The plans for Connecticut's construction program are based, approximately, on meeting the 6,000 vehicles a day value.

Project Planning. It is the conviction of the Connecticut Highway Department that project planning from the traffic standpoint must precede location and design activities and be more comprehensive than it now generally is, if effective planning is to be obtained.

It has been said that highway planning survey data can and should be used to justify programs and project plans. And, in many cases, this is probably all that is being attempted. Locations and designs are being made just as they always have been, with every effort directed toward obtaining good line, and grade, and with thoughtful consideration of the topography, property development, and construction costs. Then, when the project plans have been formulated with definiteness, estimates are made of traffic to be served and, in some cases, comprehensive determinations of road user benefits are calculated. With this done, it is possible to say that the planning survey

data are being used in project planning. It may be possible to show that there will be resultant benefits equivalent to the cost of improvements. Presumably, too, priority will be given to improvements in the order of benefits derived from them.

However, is it not more important to know: (1) that the proposed project will not be found lacking in the years ahead because of the failure to consider the probable future development of adjacent section of the route and connecting routes; and (2) that the location of the project from the standpoint of service and cost is better than other alternative locations? It has been the experience of the Connecticut planning survey organization that these determinations can be made satisfactorily only if they start from a study of traffic origins and destinations, if they consider long range improvements which will be needed on all connecting and supplementary highways, and if each alternative location is analyzed and its benefits related to cost.

Probably it is general practice now for states to make traffic evaluations based on origin and destination studies before deciding whether to by-pass cities and before initiating survey of a line around or through the city. This is advance traffic planning and is an example of the character of traffic planning preceding location and design that the writer advocates. However, in most cases it is believed that this advance traffic planning falls short because it stops with determining whether a by-pass should or should not be built. It would seem to be equally important to be sure that whatever by-pass or city route is built is the best of the various possible alternates. This aspect of traffic planning - the evaluation of alternative improvements - has been found most illuminating in its exposure of preconceived ideas of where and how projects should be laid out.

An example is provided by a study which was made for a project in Connecticut from Glastonbury to East Hartford to establish the character and location of an improvement of the existing two-lane road, which is inadequate for the average daily traffic of 10,500 vehicles (1940).

A preliminary study was made in 1945 without the benefit of traffic origin and destination data and it was concluded that development of a satisfactory improvement along the present location was not desirable, but, because of the lack of detailed traffic data, it was not possible to evaluate the relative merits of several alternative locations.

In October 1945, after the lifting of travel restrictions, origins and destinations of traffic were determined by interviews taken on the existing road near the northern terminus of the project. Several lines were analyzed by working up

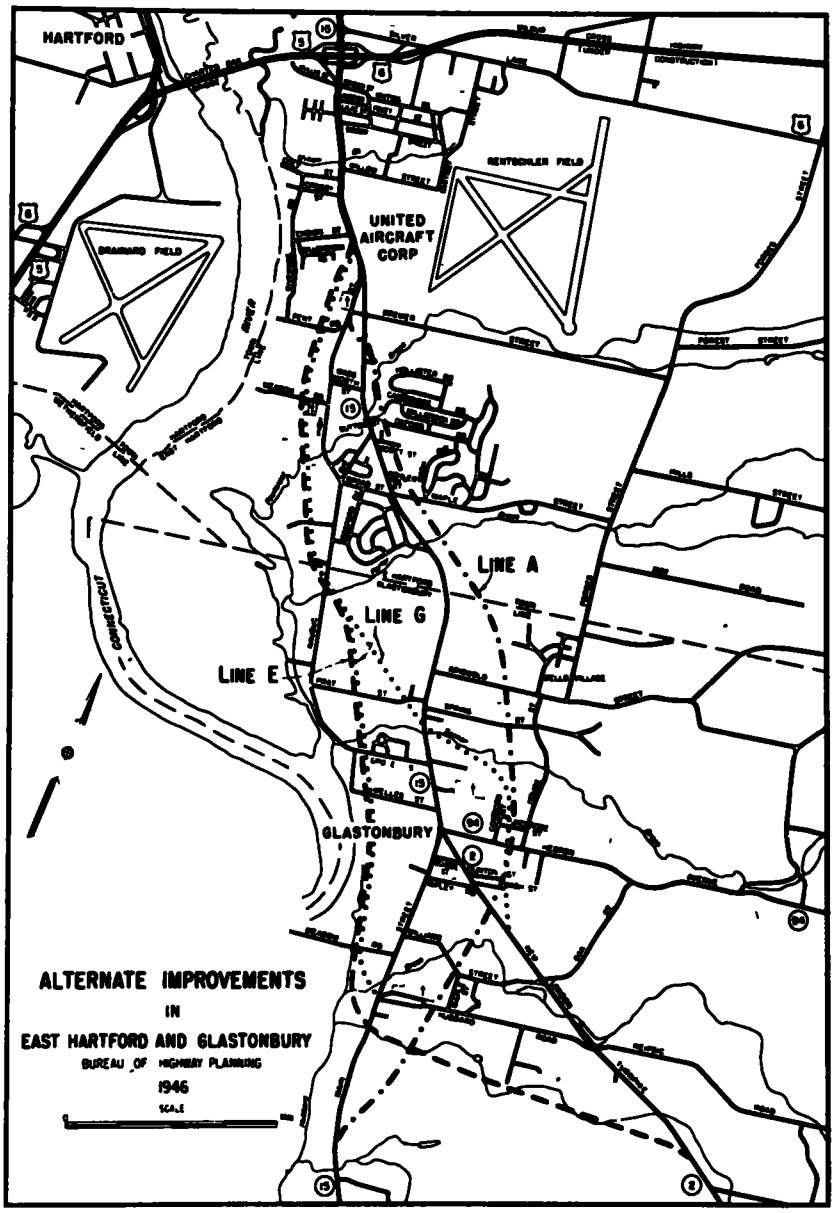

Figure 12

estimates of cost and traffic benefits. The three lines, A, B, and G, as shown in Figure 12, were carried into the final analysis. The other lines possessed no advantages, either in traffic service or economy of construction, that were not possessed by one of the three lines, A, E, and G. A summary of the costs of these alternate lines, A, E, and G, is presented in Table 5. Construction costs for project studies are esti-

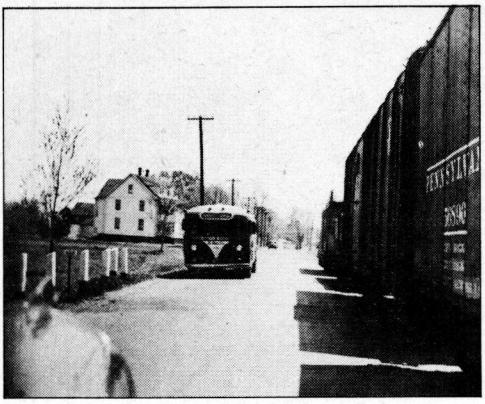

Figure 13

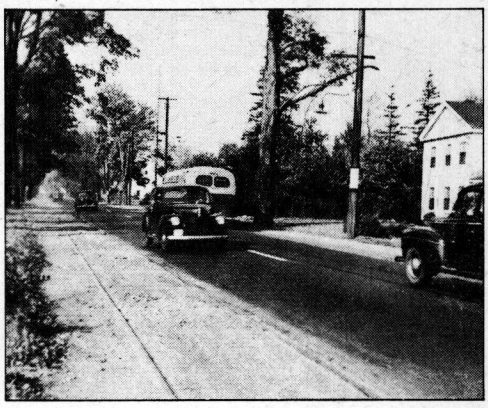

Figure 14

mated by the survey and plans division of the department, based on the character of improvements contemplated and the general locations established by the planning survey organization. Rights-of-way costs are furnished by the bureau of rights-of-

Table 5

SUMMARY OF COST ON ALTERNATE ROUTES

Line	Total Length	Const. Costs	Net Right-of-Way Costs	Total Costs
	mi	$	$	$
A	4.6	1,750,000	420,000	2,170,000
E	5.6	1,790,000	220,000	2,010,000
G	5.7	1,640,000	300,000	1,940,000

Line	Annual Costs (based on 30-yr life)	Annual Maint. Costs	Total Annual Costs
	$	$	$
A	72,300	6,700	78,000
E	67,000	8,000	75,000
G	64,700	7,100	71,800

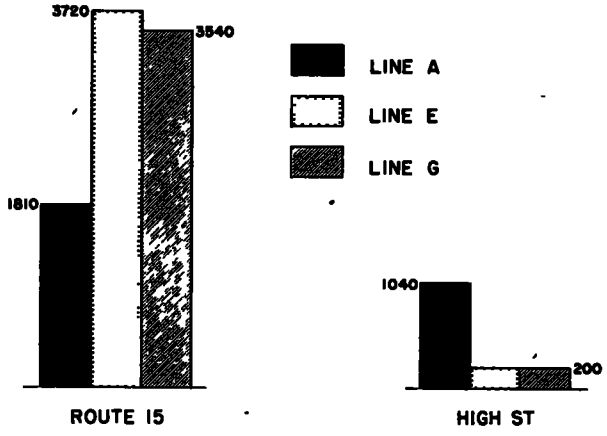

Figure 15. Comparison of Proposed Alternate Routes

way. Maintenance cost estimates are made on the basis of planning survey analyses of current costs for comparable projects. Construction and right-of-way costs are converted into annual values based on the arbitrary and extremely conservative service life value of 30 years. It will be noted that lines A, E, and G have total annual costs of $78,000, $75,000, and $71,800, respectively.

Table 6 presents a summary of the traffic benefits estimated for the three alternate lines and related them to the annual costs. 1/ Annual time savings are about equal on the three lines. All three lines will develop distance losses, although the loss on line A is very small. It will be noted that the benefit-cost ratio for line A is much greater than line E (about 70 percent) and about 15 percent higher than line G.

A further consideration in an evaluation such as this involves an appraisal of what will happen to the existing road, how much traffic will still be using it, and whether it may require further improvements in the future. The situation may be less favorable with one line than with another.

Figures 13 and 14 are pictures of the existing route. They show the narrow pavement and the freight trolley line which monopolizes one shoulder of the road.

Figure 15 shows the volume of traffic in average daily vehicles which would remain on the existing Route 15 at the interview station, as of November 1945, with each alternate location improved. It shows also the volume of traffic remaining on High Street which now provides a parallel alternate means of travel at the location in question. It will be seen that, with line A developed, Route 15 would be brought down to traffic volume much lower than either line E or G could provide. This would be reflected in greater freedom of movement and

1/ The basis for the computation of road user benefits and the development of benefit-cost indices was described in "Origins and Destinations of Highway Traffic -- The Basis for Connecticut Planning," 1943 Highway Research Board Proceedings, page 363.

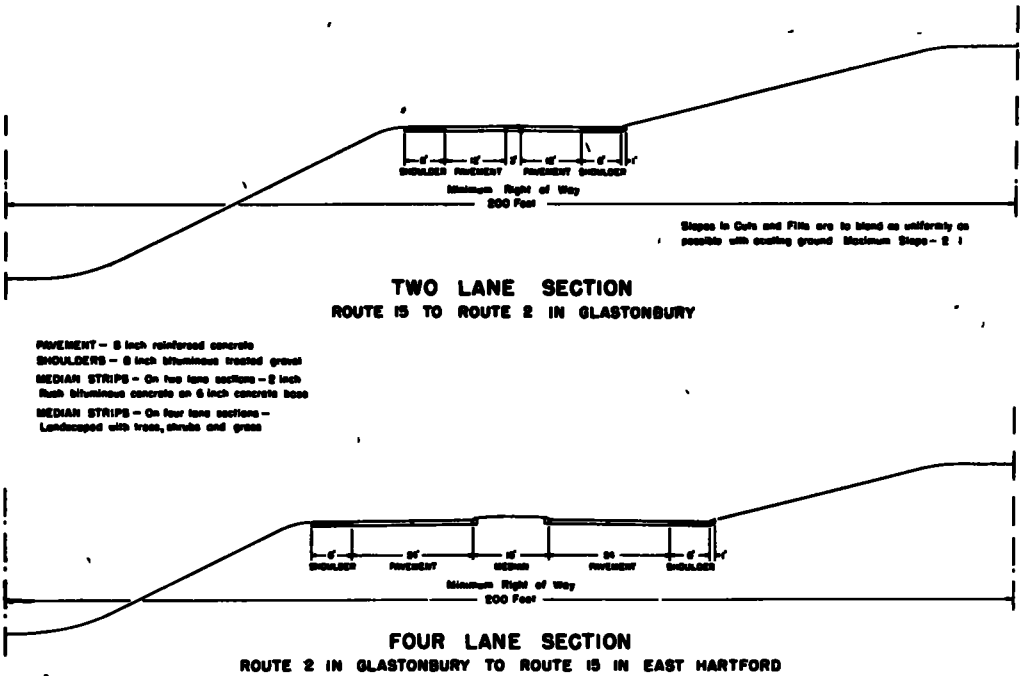

Figure 16. Typical Cross Sections
on Recommended Improvement of Route 15

less hazard on the existing road with line A developed than with one of the others. Also, the likelihood of there being need for improvement of the existing road, simply for the local traffic, would be less in the future with A than with one of the other lines developed. As a result of the project analysis a report has been prepared recommending the construction of line A.

Table 6

SUMMARY OF TRAFFIC BENEFITS

Line	Annual Distance Losses	Annual Time Savings	Net Annual Traffic Benefits	Total Annual Costs	Benefit Cost Ratio
	$	$	$	$	
A	600	87,800	87,200	79,000	1.10
E	36,600	87,300	50,700	75,000	0.68
G	18,400	87,100	68,700	71,800	0.95

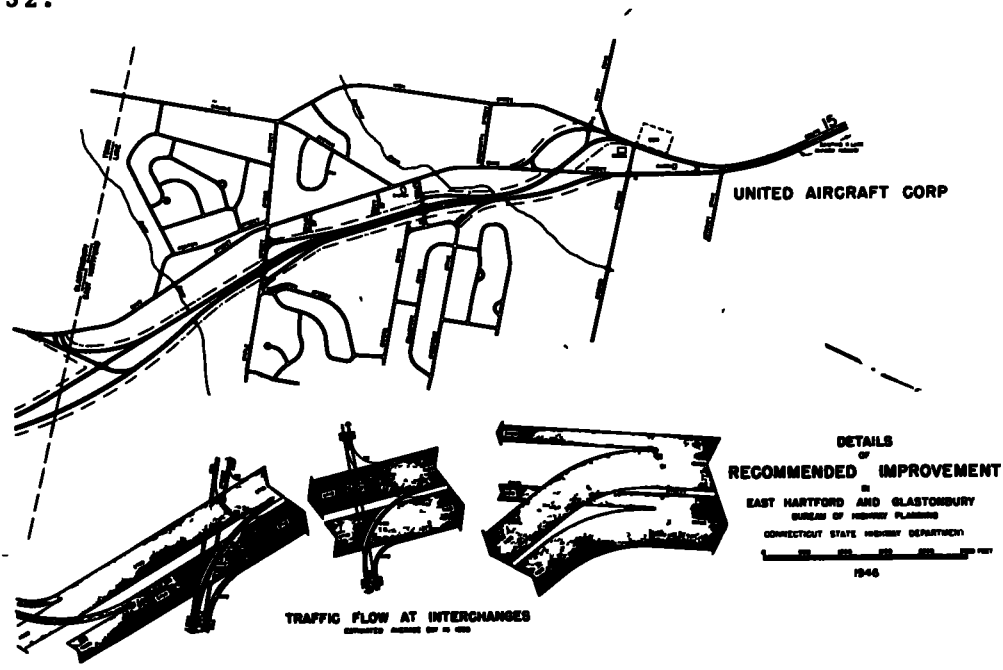

Figure 17

Figures 16 and 17 show the proposed cross-section sheet and a part of the detail layout included in the report. The placing of the flow diagrams for interchanges on the detail plan is an innovation in this report, which it is believed adds a great deal. Heretofore, traffic profiles and flow diagram sheets have been used. The method illustrated in Figure 17, however, puts the traffic diagrams where they become truly significant.

The proof of the need for the kind of project planning here described has been well established. Initial conception of projects and the locations which appear to be "naturals" have frequently been found wanting under the light of intensive traffic evaluations.

In conclusion, it is the writer's opinion that such accomplishments as have been realized, in the application of planning survey data to the administrative and planning problems of the Connecticut State Highway Department, are directly due to:

1. Complete endorsement and active encouragement of the planning survey work by the State Highway Commissioner and the Chief Engineer. It is essential that the Department's administrative heads believe in their planning survey if the latter is to be truly useful.

2. The transfer of experienced and able highway engineers to the planning survey from other Department units.
3. The wholehearted cooperation of the Public Roads Administration in all of the planning activities the State has undertaken.

URBAN PLANNING PROBLEMS

By J. Carl McMonagle, *Director*
Planning and Traffic Division,
Michigan State Highway Department

Planning an adequate highway transportation network for an urban area is now recognized as the basic task in the solution of the larger problem of planning for the many-sided development of the area as a whole. In view of the successful use of data gathered by the highway planning surveys in reaching vital decisions relative to rural highway planning it is reasonable to suggest that the more complex urban conditions can be dealt with by the methods which the surveys have developed.

The present selection of routes for the national system of interstate highways is an outstanding example of using the highway planning survey data for administrative purposes. The relative importance of these intercity routes was determined on the basis of rural and state-wide scope.

It is true that highway planning survey data for comparing the relative importance of routes in the metropolitan areas is sparce. There is not nearly enough information for use in selecting and designating urban circulatory and distributory routes as recommended by the national Interregional Highway Committee. It appears that the final selection and designation of these supplementary routes will have to wait until the additional data for the urban areas now being collected by the metropolitan traffic studies is available.

The states have gained valuable experience in interpreting and using the rural and state-wide data collected by the highway planning survey. This experience can be studied and applied to the urban planning problem with profit and efficiency. The character and principles of state-wide highway planning and urban highway planning are similar but the circumstances of administration and operation are quite different.

The cities are responsible for comprehensive planning, street maintenance, and street operation. In many instances, however, they do not have an adequate understanding of their

own problem. To a large extent this lack can be remedied by intergovernmental cooperation. Such cooperation needs to be developed.

These conditions exist and they have to be recognized in establishing principles, policies, and procedures for attacking the urban highway planning problem.

In view of limitations imposed by these conditions, this discussion will consider the use of the highway planning survey data in approaching the cities and initiating the urban planning studies. It will deal with the Michigan State Highway Department's background of experience for urban highway planning and with the principles and policies which are guiding its operations in this field.

Urban Highway Planning in the War. The Michigan State Highway Department has always cooperated with the urban communities in the construction and the maintenance of urban state trunklines. Before the war it worked with the cities in relieving specific traffic congestion and instituting alternate routes for trucks and for by-passing traffic. It engaged in widening, reconstructing and resurfacing city streets with the cities sharing in the cost.

In Detroit a special origin-destination traffic survey was made in 1941 for the location and design of a crosstown expressway that had been planned by the department. Although the results of this study are not completely interpreted, they have been used extensively in the location and design of two expressways: one extending across Detroit, and the other located on a principal radial leading to the central business district. The products of this study were used continuously in planning and locating the Detroit Industrial Expressway giving access to the United States Army bomber plant at Willow Run. Highway planning survey data were used in a series of reports that justified the project and convinced the federal agencies governing critical materials that the expressway had to be built for the plant to operate and produce its four-engine bombers on schedule.

These experiences served to introduce the urban highway planning problem in the state highway department. As a result, the department recognized that there is a problem in the cities and that its solution requires a great deal more than the then current street widening and resurfacing programs.

Highway Needs and Finance. Through its use of highway planning survey data for administrative purposes, the department also recognized the need for intergovernmental cooperation in studies of common highway transportation problems. As a result of this recognition the state highway commissioner initiated a

study of highway needs and finances.

At a meeting of the board of directors of the Michigan Good Roads Federation, he explained the problem and suggested that the Federation sponsor a state-wide study of highway transportation including not only the state, but the county and city systems of highways. The Federation appointed a highway study committee which included representatives of state, county, city, and private transportation interests.

The committee has organized and is now in the process of formulating policies and a work program. It has employed an engineer-director who will outline, correlate, and expedite the study. His work will be financed with highway planning survey funds matched with contributions by the principal public and private agencies involved. The committee has accepted the state highway commissioner's offer of staff and technical assistance by the highway planning survey.

In examining the highway planning survey data to be used in the project, two serious deficiencies have been found:

1. There are few basic values for determining either the operating costs of highway transportation or its part in the functioning of Michigan's economy, particularly the automotive industry.

2. There is very little highway planning survey data for use in the urban phases of the study.

The solution of Michigan's total highway problem is urgent and its careful and understanding consideration by the legislature is essential. The immediate objective of the committee is to inform the legislature of the problem in such fashion that it will sponsor a thorough and comprehensive study of the whole subject.

Transition Planning. Since the end of the war the department has expanded the planning and traffic division for better traffic engineering service and for initiation of the highway planning survey in the study of urban planning problems. An urban planning section is one of three sections that have been added to the division.

The data from the 1941 origin-destination traffic survey which demonstrated the need for a crosstown expressway in Detroit are now materializing in the Edsel Ford Expressway and are being used in the location and traffic design of that modern crosstown artery. The Detroit traffic engineering bureau conducted a series of traffic surveys and made a study of the data collected by the various wartime committees concerned with the transportation of workers. The data compiled by the bureau and the department is being used in the traffic design features of both the John C. Lodge and the Edsel Ford expressways.

These data are compiled in tabular-graphic form and are furnished to the design groups for interpretation and use. All local traffic design and structural design plans are reviewed by committees comprised of representatives of the state, county and city who are concerned with administration, planning, and design.

In reviewing the plans the individual members of the committee suggest changes they believe will result in greater economy and efficiency. In this fashion a large number of desirable changes are recognized and authorized.

An important product of the committee work is the broadening viewpoint of its members and the realization that a complete origin-destination traffic survey for the Detroit metropolitan area is needed to complete the planning of these two expressways and integrate them in the future expressway and arterial street system of Detroit. They are becoming convinced that highway planning survey data are needed for urban expressway planning and for efficient progress in the location and design of such arteries.

Some of the members of the committee realize that the comprehensive city plan should be advanced to the stage where the desirable land uses are known and where the expressway and arterial plan can be approved by all interested agencies. Many of the changes of design initiated by differences of opinion can be attributed to the fact that the Detroit city plan lacked the sound factual support of these basic features, such as complete origin-destination data.

In the fall of 1945 a metropolitan area origin-destination traffic survey was conducted in Port Huron, a small but important city at the outlet of Lake Huron on the principal international route to Canada and the New England states. This year a survey has been conducted in three other cities: Kalamazoo, Muskegon, and Lansing. Four more cities are scheduled for similar studies in 1947.

The initiation of the surveys and the progress of the field work have been very satisfactory. The usual difficulties have been encountered in analyzing the results and preparing the tabulations for interpretation. The greatest difficulty is encountered in finding and employing highway engineers and planning technicians qualified by training for this new field of highway planning.

This short experience has developed principles, policies, and procedures that are essential for the use of the data in the study of urban planning problems. They are expected to produce results that will be mutually satisfactory to the city, the state, and the Public Roads Administration.

Principles. The provision of highway transportation road and street facilities, and their maintenance and operation, are government functions. It has long been recognized that the nation and the state have a vital interest in those highways that have a predominately transportation function. In recent years it has been realized that this interest extends over the transportation highways into and through the cities. This recognition is the result of using the state-wide highway planning survey data to identify state and national highway problems. It was found that a large part of highway transport is between the cities; a smaller portion is between the cities and their contributory rural areas for marketing, shopping, social recreation, and the distribution of goods; a small fraction is entirely rural.

It can be presumed that the states are primarily interested in the arterial streets that radiate from the center of the city and extend through suburban and rural areas to similar cities and metropolitan centers. There are undoubtedly other interests for the state highway department in the cities. Highway planning survey data should be collected and used to identify these interests. Parking and terminal facilities are a part of highway transportation. Currently it appears that the study of these two elements should have a high priority in any state highway planning survey program.

A majority of the traffic on the radiating arterial streets is composed of local movements between and among the districts of the city and the outlying population centers that comprise the marketing area. These arterial streets for the most part have been planned and constructed by the cities. The cities maintain them and they direct and control their traffic.

Each urban transportation problem is primarily a local problem that can be solved most satisfactorily by local administrative action with counsel and assistance by the state. Moreover, the magnitude of the urban transportation problem in most cities is so great that the local government needs technical assistance in planning, enabling legislation, and financial aid. The highway transportation arteries in the cities have a state-wide and nation-wide importance.

The approach to the problem will be particularly difficult in those states where there is urban-rural antagonism and where the cities lack confidence in the sincerety of the state administration. The approach in these circumstances requires an intelligent, sound administrative policy. The plan of procedure should be sufficiently flexible to permit changes that will improve intergovernmental relations as the work progresses.

Policy. In the metropolitan areas, comprehensive highway planning is a function of local government. It is an activity that requires public understanding, cooperation, and contribution for success. The highway transportation arteries constitute the framework of the comprehensive city plan and the means for circulation in the city. The state highway departments should contribute their experience and knowledge and all the highway transportation data available for the formulation of the arterial street plan by the city planning agencies. The city planning agency can cooperate with the department in adjusting the arterial street plan for the most efficient and economic service to both local and state highway traffic.

In the city the people depend on their local government for adequate and satisfactory service. They expect their government to secure counsel, guidance and assistance from the state and federal agencies in the solution of problems involving state and national interests. Administrative decisions should be made by local authorities in cooperation with the state in such a way as to assure equal consideration of all the interests involved. Satisfactory results will be a credit to the local authorities, but they also reap the criticism resulting from mistakes. This is an element of the political economy to be given first consideration in the urban highway planning policy.

The support of the public is required to successfully carry on an arterial street plan. The informed public will support the plans when they understand the needs and their interest in highway transportation. The press, the radio, and the local leadership should be kept informed of the results of the work as it progresses.

In Michigan, it is the policy of the state highway department to require city assistance in financing the field work of a metropolitan area origin-destination survey. It is believed that a financial interest, though small, will encourage local responsibility and interest in using the results of the survey in the solution of their problems. The Michigan Highway Planning Bureau analyzes the results, produces the tabulations and makes the interpretations involving state trunkline traffic interests. As this information is produced, it is furnished to the city without charge. The city is free to call on the Highway Planning Bureau to make any machine tabulation of information that they want.

The cities are told that the state highway department is anxious to cooperate in the solution of their urban highway transportation problems in any fashion satisfactory to the city. In the discussion of their problem, the merits of a metropolitan urban area origin-destination survey are explained. The department recommends the survey as a good means for

collecting the information needed for the study. It is explained that the city is free to decide on a survey or attempt a solution with usable existing information. They are told that the state recognizes the necessity for an initial arterial street plan based on existing information. The state is willing to review, mutually adjust, and approve these plans without a survey. The city of Detroit chose the latter method.

Procedures. Michigan cities are becoming interested in the metropolitan area origin-destination studies. They initiate inquiries for information and their local leadership encourages state representatives to come in and explain the surveys to interested groups. In this manner the local government officials become interested in and then anxious for a survey. The uses and benefits of the survey are explained to the local legislative body and they formulate and pass a resolution requesting that a survey be made with financial participation by the city.

The state manages the survey with experienced supervisory personnel and it operates the external stations with experienced crews. Some local group satisfactory to the city administration is advised of the qualification requirements for internal survey interviewers and for office workers, and suggests local women for employment. So far the cities have placed the responsibility for city cooperation with the city engineer or the city planner.

The results of the survey are assembled and coded by temporary employees in the city offices of the survey. When the survey is completed and the coding finished, the files are transferred to the highway planning survey office in Lansing where the tabulating cards are punched and verified. The results of the survey are analyzed from all feasible angles to derive expansion and adjustment factors. These factors are incorporated in the tabulating cards and the prescribed tabulations prepared.

A report, explaining the characteristics found in the analysis, the derivation of the expansion factors, and the formulation of the tables, is written and copies are furnished the city. This report, which includes the tabulations, has a single objective: to inform the persons who will use and interpret the data. It is believed that a thorough understanding of the characteristics, deficiencies, and derivations, is required for intelligent use in making interpretations.

The first phase in using the data involves a series of graphic and tabular analyses. Methods are being designed that will assure sound interpretations that are based solely on data. They should not be influenced by bias or slanted by preconceived opinion. When interpretations are satisfactorily completed, they will be incorporated in a second informative

report for use by city planners, highway planners, and highway engineers

When the state trunkline and arterial street plan have been worked out and approved by the interested agencies, a comprehensive report for public information will be published In the interim it is likely that specific project informative reports will be required to secure public support for a major improvement.

Conclusion Sound arterial planning is a basic element in any practical city plan To be sound, an arterial plan must be built on a thorough study and comprehensive understanding of the traffic requirements of the community, its people, and its business. Such factual information can and should be obtained and interpreted by employing the proved methods of the highway planning surveys In this work the state and urban highway authorities can find a field of common interest where their cooperative efforts will yield results of lasting benefit to both.