HIGHWAY RESEARCH CIRCULAR

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COMMITTEE ACTIVITY
Committee on Origin and Destination
Department of Traffic and Operations
Highway Research Board



# Report on Research Needs
# Research Problem Statements

## Contents



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HIGHWAY RESEARCH BOARD • NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL
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## Contents



## Introduction

The following discussion and submission of research problem statements was solicited as a part of the Highway Research Board's activity in developing a current statement of research needs in highway transportation.

Presented in this Circular is a distillation of material compiled by the Committee, through its members and from other sources, on the apparent research needs within the subject area of origin-destination surveys and directly related activities. Problem statements are listed here under three main subject headings: survey techniques, travel characteristics, and traffic assignment. Statements on other subjects were submitted, but are not published in this Circular, since they were judged to be of less significance than these items of greatest concern.

HIGHWAY RESEARCH BOARD
Committee on Origin and Destination
Research Needs

## Committee Procedure

The assessment of the principal research needs in the origin and destination field was made through an "ad hoc" four-man subcommittee designated by the Chairman. This subcommittee, as part of its work, developed several research statements from the individual members of the group. However, the bulk of the proposals came from solicitation of the Origin and Destination Committee members at large.

In all, some 40 statements were submitted to the subcommittee. These were reviewed and assessed for significance. Surprisingly little duplication of subject matter occurred. However, proposals ranged in scope from those suitable for investigation at a graduate student thesis level to those few exceptionally "far out" proposals that appeared unmanageable to the entire subcommittee. Here the subcommittee served as a screening organization representing a range of interests for effective evaluation. Such a procedure for identifying the principal needs within the Committee area of activities was evidently more effective than a procedure of assembly and review by only one committee member.

All statements were rated for significance and priority by each subcommittee member. The collected statements were then grouped in seven categories. In addition to the three cited earlier, which are the prime concerns of the committee, there were the following: models and trip distribution, system planning, economics, and a miscellaneous grouping including three proposals. Of the sixteen statements in the latter four groups, none rated better than a unanimous "low priority" rating. Most reviews of proposals in these groups showed mixed priorities. As a result, none of the sixteen has been listed in this submission. Similarly, statements falling in the first three categories but receiving a low or very mixed set of evaluations have also been excluded.

## Research Problem Statement Groupings

A. Survey Techniques.

Four proposals dealing with survey techniques are attached. That this subject area is of the greatest concern to committee members is shown by the fact that it attracted the greatest number of proposals, which in turn received the highest and most nearly unanimous rankings from the subcommittee. Concern is evident here in the matters of cost, coordination the the Bureau of the Census, and standardization of procedures - to make comparisons of data between different studies more feasible.

B. Travel Characteristics.

This subject area is closely akin to that of surveys, in that better understanding of travel characteristics can only derive from better knowledge, hence more surveys. Two proposals are listed in this area. One concerns weekend and recreational travel, which seems to be developing as significant a role in urban areas as it has traditionally held in rural highway systems. The second concerns work trips to the central business district, the source of most urban transportation problems because of the associated trip density. Certainly, better understanding of these trips should assist particularly on the difficult problem of providing balanced transportation systems.

C. Traffic Assignment.

The use of traffic assignment techniques is an important part of the origin and destination process in evaluating the accuracy of surveys against observed traffic volumes, as well as in later stages of testing and developing highway proposals against the anticipated traffic characteristics. The three proposals listed here do not repeat subject areas presently under study in one or more NCHRP contracts, but are closely allied. The work proposed clearly seems to merit consideration as a possible further advancement of the art.

## Other Research Proposals

Additional proposals were submitted for research on related matters under the foregoing and other subject headings. While not submitted here, they are part of the files of the Origin-Destination Committee. They will be made readily available upon request at any time to the secretary of the committee.

## A-1 Home Interview Sample Size

### 1. The Problem

A great part of the total cost of urban transportation studies is chargeable to origin-destination surveys, of which the home interview survey is the costliest. Each urban area study continues to be done according to the original statistically correct and tested technique; the sample size is keyed to size of the urban area; and each study is made independently of all others with little regard for the information gathered from previous such surveys.

The home interview study is only one phase of an urban transportation study, but it is the most time consuming and costly. Is too much emphasis being placed on it, in view of the limited use that can be made of the data and considering the lesser investment in the planning phase?

Home interview surveys may run as high as 1/3 to 1/2 the total cost of the transportation study. Too often, in an effort to reduce costs there is a tendency to reduce the sample size without regard to the effect on the reliability of the data.

### 2. The Problem Area - Home Interview Surveys

### 3. Objectives

The objective of the research would be to develop a less costly technique of home interviewing by investigation possibilities as:

A. The correlation of generation factors by land use, by study area size, by regions of the United States.

B. The use of a larger sample of only a few typical zones in a study area in place of a given sample size of the entire area being used now.

### 4. State of Knowledge

Revious research indicated that each city studied had some uniqueness about its traffic characteristics that would prevent direct application of trip generation factors from one city to another.

There is now available a vastly greater amount of data from recently completed studies in cities of all sizes for further research in this field.

## RESEARCH PROBLEM STATEMENT

### A-2 Standardization of Data Collection Areal Units

1. The Problem

Many different agencies collect data essential for transportation planning. Population, employment and automobile registrations are just three examples. Unfortunately, these data are seldom available in a form suitable for transportation planning analysis. A major problem is that, even if available, data may not be aggregated to areas suitable for traffic analysis.

It is believed that a standard area data collection system should be developed to maximize usefulness of data and minimize the need to duplicate data collection effort.

2. The Problem Area - Data Requirements for Transportation Planning

3. Objective

To compare the area units used to aggregate the wide assortment of data collected within states and metropolitan areas to determine their compatibility and suitability for transportation planning requirements. On the basis of the examination, to consider and propose methods for better coordinated efforts.

## RESEARCH PROBLEM STATEMENT

### A-3 Telephone Versus Personal Interviews for Travel Surveys

1. The Problem

To determine the differences in trip production per household obtained through the use of personal or telephone interviewing methods.

2. The Problem Area - Travel Survey Techniques

3. Objective

To carefully determine the amount and characteristics of trips lost when telephone interviewing is utilized.

4. State of Knowledge

Several organizations have utilized telephone techniques in travel survey interviewing during the past few years. This had led to a fair amount of controversy as to the completeness of interviews obtained by telephone. No really thorough comparison of the two techniques has been done to date.

## RESEARCH PROBLEM STATEMENT

### A-4 Coordination of Travel Surveys With The Bureau of Census

1. The Problem

Every large metropolitan area in the nation has or soon will have underway a continuing transportation planning program. As the initial planning efforts will be updated at intervals of probably five years or less, collection and analysis of updating data must be efficient so that plan changes can be made as soon as changing conditions are identified. The Bureau of Census of the Federal Department of Commerce systematically and regularly collects much basic data on a sample of dwelling units in urban areas in much the same manner as travel information is presently being collected. A duplication of effort and cost could be reduced by a cooperative effort between the Bureau of the Census and the Bureau of Public Roads wherein certain data pertaining to travel will be obtained by the Bureau of the Census in its periodic census.

2. The Problem - Home Interview Surveys

3. Objectives

The objective of this research would be to determine: (a) the degree of interrelation that currently exists between items of data normally collected by the Bureau of Census and by home origin-destination studies; (b) the determination of the items of census data that are most closely related to trip generation at the home; (c) the development of a procedure that would provide factors to be applied to appropriate census data to produce trip generation data that could be used to update existing home origin-destination studies; and (d) the development of the most meaningful and significant additional statistics by enumeration districts (insofar as transportation planning is concerned) which the Bureau of the Census could obtain during its periodic census, to materially reduce or eliminate the home interviews now employed in transportation studies.

4. State of Knowledge

A census of dwelling units prepared by the Bureau of Census for 1960 is available for all metropolitan areas in the nation and home origin-destination data is or will soon be available for all metropolitan areas in excess of 50,000 population. Many independent investigations of aspects of this problem have been conducted in the recent past by or through the Bureau of Public Roads.

## RESEARCH PROBLEM STATEMENT

### B-1 CBD Work Trip Characteristics

1. The Problem

During journey-to-work hours, concentrations of autos on many urban expressways and arterials absorb most of the available vehicular capacity. At the same time, these same highway facilities have abundant passenger capacity, if only express bus routes were available and utilized more intensively. Under our system of freedom of sonsumer choice, what inducements will cause workers who journey to work by auto to shift voluntarily to bus or other available common carrier travel? The answers may be predicated on their current behavior, as reflected in journey-to-work data that has been assembled.

2. The Problem Area - Characteristics of Travel to Central Areas.

3. Objectives

It is proposed to examine, microscopically, only journeys-to-work to the CBD's and other concentrated areas of employment to identify (a) the characteristics of workers who choose mass transit; (b) the characteristics of employment areas served by mass transit; and (c) the characteristics of mass transit that successfully attract workers who own and could use their autos.

4. State of Knowledge

Many urban areas have assembled data, from household interviews, on the modes and other characteristics of work trips. Data on distances, travel times, costs, and other correlative aspects have also been compiled by urban studies.

The U. S. Bureau of the Census has assembled, for most urban areas in the United States, the aggregate journeys to work from homes to areas of employment, via auto and mass transit.

## RESEARCH PROBLEM STATEMENT

### B-2 Weekend and Recreational Travel Data Collection.

1. The Problem

While urban week day travel habits have been the subject of comprehensive study for two decades, comparatively little is known about weekend and recreational travel. This component of travel has already surpassed weekday travel in some areas, and is growing at a rate exceeding home-to-work travel growths. Little data and even fewer analyses are available. The problem is to recognize the need for data on weekend and recreational travel, to determine the scope and methods of such data collection, and to compare weekend trip characteristics with those of weekday trips.

2. The Problem Area - Travel Characteristics - Travel Surveys

3. Objectives

It is proposed to extend the collection of home interview travel data to include travel on Saturdays and Sundays. Such a study should cover an entire year's travel, since large seasonal fluctuations exist. Travel out of the study area should also be obtained. In addition, it may be desirable to interview households in depth to determine overall recreational travel habits and patterns related to family characteristics.

4. State of Knowledge

The Penn-Jersey Transportation Study conducted depth interviews of recreational travel for approximately 2,000 families. In addition, external roadside surveys of summer weekend trips on recreational routes are available.

## RESEARCH PROBLEM STATEMENT

### C-1 Sensitivity of Assigned Traffic Volumes to Changes in Trip Distribution as Calculated by Mathematical Models.

1. The Problem

Owing to the complexity of traffic forecasting and assignment techniques now in use, it is difficult to evaluate the effects on model reliability of various limitations in data and techniques. In recent years a number of different methods have been developed and used to calculate interzonal trip volumes. There is need for a systematic study of the effects on assigned traffic volumes of the differing trip distribution assumptions and techniques now available.

The proposed research project would help to reduce a number of existing uncertainties concerning the reliability of presently used trip distribution techniques and their effects on assigned traffic volumes.

2. The Problem Area - Traffic Assignments - Sensitivity Tests.

3. Objectives

Research objectives would be to carry out a series of sensitivity tests, under controlled conditions, involving perturbation of inputs to at least two trip distribution models: the gravity model and the opportunity model. The two models would be calibrated and applied for a selected study area, using identical trip end data and identical traffic assignment techniques. Then controlled changes would be made in the parameters and/or iterative techniques involved in both models, and a series of traffic assignments carried out to measure the results of each. Careful comparisons of assigned volumes would be made to determine the effects on this basic output of changes in the trip distribution procedure.

4. State of Knowledge

A number of studies have been carried out to compare the trip interchange output of various trip distribution models under controlled conditions. However, little or no attempt has been made to extend this work to a systematic study of the effects on assigned traffic volumes. Since forecast traffic flows are the basic output on which transportation planning recommendations are based, this research would provide valuable insight concerning the application of traffic models. The work might later be expanded to include sensitivity studies of other traffic model components including trip production, travel mode choice, and assignment techniques.

## RESEARCH PROBLEM STATEMENT

### C-2 Small Area Traffic Assignment Development.

1. The Problem

Present travel simulation techniques operate at a scale which makes production of detailed design volumes nearly impossible. Generalized movements at interchanges fail to provide the specific information needed for design. Additionally, the effects of minor improvements in capacity or of changes in arterials (as opposed to expressways) are difficult to identify with the coarse grain of present distribution/assignment techniques.

As plans produced by long-range transportation planning groups are translated to construction or improvement projects, more specific assignment data are required than are often available.

2. The Problem Area - Design Volume Data From Computer Assignments.

3. Objectives

The objective is to develop a technique for estimating the movement of traffic in a small area at high detail. This might be termed a small-scale assignment, but should not be limited by association with present technique implied by the phrase. Evaluation of both detailed expressway plans and traffic engineering improvements should be feasible.

4. State of Knowledge

Some research has been conducted by the Chicago Area Transportation Study. However, it is believed that no full-scale direct work has been directed to this sort of project.

## RESEARCH PROBLEM STATEMENT

### C-3 Assignment of Daily and Peak Hour Traffic to Transportation Networks.

1. The Problem

Using average daily traffic volumes assigned to a transportation system to obtain design period volumes may not be an adequate procedure since the characteristics of transportation systems in many urban areas differ in peak and off-peak periods. Research should be undertaken to determine the most accurate method by which both average daily traffic volumes and design period volumes can be obtained from assignment procedures.

2. The Problem Area

The suggested research problem is within the overall problem area of traffic assignment and involves investigations of network coding and assignment procedures.

3. Objectives

The suggested field of research is an investigation of methods of obtaining both average weekday or average daily traffic volumes to permit system evaluations together with peak period volumes to permit design. Among the alternatives to be studied would be (1) assignment of average daily (or average weekday) traffic and the use of factors to obtain design hour volumes; (2) assignment of peak period traffic and the use of factors to obtain design hour and average daily volumes; and (3) separate assignment of peak and off-peak volumes with design hour volumes obtained from the peak assignment and average daily volumes obtained as the sum of peak and off-peak assignments.

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