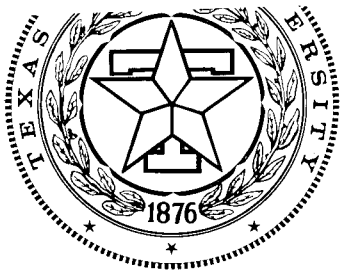

TEXAS TRANSPORTATION INSTITUTE

TEXAS HIGHWAY DEPARTMENT

COOPERATIVE RESEARCH

TRIP GENERATION
2-8-54-1

in cooperation with the
Department of Commerce
Bureau of Public Roads

BIBLIOGRAPHY (64-17)
SURVEY OF LIBRARY FACILITIES PROJECT

TRIP GENERATION

Compiled by
Texas Transportation Institute
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1. "Calibrating and testing a gravity model with a small computer." U.S. Bureau of Public Roads, Office of Planning, Washington 1963, 1v(various pagongs) Processed.

   System designed to edit, sort and link a set of detailed trip records that can be produced from basic travel inventories.

2. Carroll, J. Douglas, Jr.," Future traffic predictions for the Detroit area. Nat'l Research Council--Highway Research Board Prcc 36: 1957, p 680-685.

   Methods and assumptions used in the Detroit Metropolitan Area Traffic Study to forecast future traffic patterns are described. This includes the relation of traffic to population, economic growth, and changes in distribution of carownership and population. Also presented is a forecast of land usage and the expected traffic generation. The method of developing future origin-destination patterns is touched on and the estimated effects on expressway loading and planning are summarized. Some of the short comings of these methods and possible improvements are pointed out.

3. Davidson, Robert G.,"Developing a traffic model with a small sample." Nat'l Reaearch Council--Highway Research Board Bulletin 297, 1961, p 106-108.

   For years the Boston Metropolitan Area has accomplished too little in its efforts to create and keep up=to-date reasonably good data dealing with the pattern of daily travel and origins and destinations of its residents and visitors. The first and last comprehensive O-D study was undertaken in 1945 at a time when travel patterns were abnormalbecause of World War 11. The study must now be considered useless. In more recent years partial O-D surveys have been made, but these have consisted of Cordon Count O-D surveys and studies of industrial plan commutation patterns(such as along Route 128) These surveys cannot be classified as the type necessary to properly guide a comprehensive public transportation policy.

   Nevertheless, the construction of highway and expressway facilities has progressed with moderate speed. The process has been somewhat confusing, sometimes mixed with politics, and not always in the best interests of economic development of the region. More seriously, the highway program has progressed (with Federal financial help) unilaterally-and not with the

parallel development of related transportation facilities such as parking lots, transit, local streets, and frequently other highway under other governmental juriddictions.

For those reasons, and the simple fact that those highways already built exceed estimated 1970 traffic volumes, the great need for good and up-to-date O-D data and estimates of future traffic flows is intensified. And of course it was obvious that the traffic engineering profession should have a bigger role in the decision-making process.

At this time Boston College, with Ford Foundation help, had formulated a :Seminar Research Bureau" to carry out programs The first problem identified and investigated was urban transportation. It quickly followed that the Boston College research program would consist of investigation and use of the Gravity Model as a means, first of making(hopefully) a small contribution to the process of data collection and analysis in Boston. It was intended, and still is, that the Boston College Study could create a good, reliable and inexpensive traffic analysis and estimation process that would be adopted by appropriate official agencies.

4. Gorman, A.D. S.T. Hitchcock,"Characteristics of traffic entering and leaving central business district." Pub Roads 30: n 9, Aug 1959, p 213-20.

Results of study by Div of Highway Planning Bur Pub Roads, conducting parking surveys in 91 cities between 1945-1955; traffic volumes compared on per capita and on square mile basis; variations among cities of same population group; changes in supply of parking spaces; outbound-and through traffic volumes; truck and bus travel trip purposes; traffic pattern at periphery of CBD; appication of data to emergency evaculation.

5. Hall, Edward M."Travel characteristics of two San Diego subdivision developments." Nat'l Research Council--Highway Ressarch Board Bulletin 203, 1958, p 1-19.

An origin-destination study of two San Diego subdivision developments was made in an effort to develop relationships between land use and traffic ganeration, and to study the orientation of the generated traffic.

The smaller of these study subdivision developments contained 1,822 single family dwelling units at the time of the survey, and the larger contained 7,158 occupied dwelling units, of which 4,296 were single family, 1,838 were duplexes,and 1,024 were apartments. Both subdivisions had planned shopping areas which were partially developed at the time of the survey.

In addition to a home interview survey, a cordon line was established around each study area and 100 percent of the outbound non-residents were interviewed as were all of the

outbound transit riders. A screen line check of 95.8 percent was obtained in the smaller subdivision, while an accuracy of 98.8 percent was obtained in the larger.

Vehicle ownership in both study areas was found to be 1.22 vehicles per dwelling unit. Trip generation data was developed per dwelling unit for 5-day, 7-day and weekend trip types by type dwelling unit. Intrazonal trips were related to area. Weekday and weekend auto-truck trip purposes were studied and trip purpose time profiles developed.

The possibility of forecasting future trips using the a.m. peak period work trip and projecting by the relation of the work trip to all trips was investigated. The a.m. peak period work trips and the total of work and related business trips of the two study subdivisions appeared to be stable, although the problem of sample size was noted.

Freeway usage was studied, as a further experiment in the accuracy of projecting the a.m. peak perios volumes. It appears that the a.m. peak hour volume could be used to expand freeway type trips in areas similar in size to those studied when the trip length is under five or six miles.

The orientation of the generated trips, both auto-truck and transit, is shown by desire line charts and trip length distribution curves. The work trip was also studied in terms of its trip length distribution. Close relationships were observed between the two study subdivisions in the trip purpose analyses of trip length.

These studies developed useful trip generation data by type dwelling unit. The relation of trip generation and orientation to land use appeared in several of the analyses, thus suggesting that consistent relationships bewteen land use and travel characteristics do exist.

6. Hansen, Walter G., Alan M. Voorhees and Associates, "Evaluation of gravity model trip distribution procedures." Nat'l Research Council--Highway Research Board Bulletin 347, 1962, p 67-76.

During the past decade there has been increasing realization that to plan transportation systems for dynamic urban areas properly it is necessary to be able to forecast changes in travel demands resulting from anticipated or proposed changes in the land use patterns and transportation systems of these areas. This realization has resulted in a concerted effort to develop an urban transportation planning process capable of providing quantitative information on future traffic movements of sufficient precision to enable cities to make an informed choice between the many alternate land use and transportation programs open to them. The heart of such a process is a procedure capable of synthesizing zone-to-zone movements for alternate configurations of land use and transportation facilities.

Several such procedures, generally referred to as "traffic models" have been developed by various organizations through the country. A trip-opportunity model developed by the Chicago Area Transportation Study has been utilized in both Chicago and Pittsburg (1). Another procedure is currently being developed by the Penn-Jersey Study for use in that area (2). Yet another procedure, and the one which has been most widely applied, is the so-called gravity model (3,4). Studies based on this procedure have been conducted in Hartford, Conn. Baltimore, Md; seven cities in Iowa; and is presently being used in a transportation study of the Los Angeles region.

For the most part, comprehensive origin-destination studies were not conducted in conjunction with these applications of the gravity model. Rather, selected travel data such as screenline crossings, volume counts, employee data, and a limited number of home interviews) were utilized to calibrate the model to local conditions and check the resulting estimated travel demands. A comparison and evaluation of gravity model procedures using a complete home interview survey was carried out by the Iowa State Department in Cedar Rapids. The findings are reported in an unpublished paper (5).

7. Harper, B.C.S., H.M. Edwards,"Study of generation of person trips by areas in central business district. " Queen;s Univ--Dept of Civ Eng Report 9, May 1960 57p.

Investigation to determine if traffic flowing in and out of city's center is directly related to buildings and floor space in area, to develope relationship to be used inconjunction with economic forecasts of CBD space usage to predict future travel to center mor e accuratley; results indicate well developed relationship between variables and that fairly accurate predictions can be made.

8. Horn, John W.,"Impact of industrial development on traffic generation in rural areas of North Carolina." Nat'l Research Council Highway Research Board Bulletin 347, 1962, p 133-142.

The changing character of rural North Carolina in recent years has produced new problems for rural traffic planners. Increasing industrial employment of rural dwellers and a general rise in vehicle ownership by such persons have brought new functions and added new traffic to rural secondary roads. Routes that once carried promarily farm-to-market traffic now have a large percentage of industrial work trips. It is the task of the traffic planner of today to evaluate and predict traffic trends in order to plan adequately for future road needs.

To understand the importance of the home-to-work in North Carollna and how these people get to work. The State Highway Commission in North Carolina has complete responsibility for the maintenance and improvement of 13,000 miles of promary highway and 57,000 miles of secondary road that provide service to nearly 3 million rural inhabitants. Travel on North Carolina highways has nearly tripled during the past 15 years and now totals approximately 17 billion vehicle-miles per year. The home-to-work or work-to-home trip amounts to approximately 27 percent of the trips made and 38 percent of themileage traveled by the rural inhabitants of North Carolina.

9. McGrath, William R.," Land uss in traffic genration." Nat;l Research Council--Highway Research Board Bulletin 224, 1959, p 132-135.

The quickened pace of urban highway construction culminating in the Highway Act of 1956, has intensified the demand for adequate urban land use and traffic forecasting. Large scale research has been initiated and various hypotheses and statistics have poured forth. Nevertheless, no final answers as to how land use and traffic generation are or will be related has come forth, and it is very unlikely in the tabulated, handbook sense--that they will be forthcoming in the near future.

It has become evident that no community can sit back and ignore the problem. The city traffic engineer and the city planner must work together and establish the best traffic facility location and design and relate it to local land use plans. The City of New Haven is attempting to accomplish this objective. The Departments of City Planning, Traffic and Parking, and Redevelopemnt, and the Planning Consultant all function under one Developemnt Administrator to the end that they coordinate their plans and are advisors one to the other in all related activities.

10. Quinby, H.D.,"Traffic distribution forecasts--highway and transit." Traffic Eng 31: n 5, Feb 1961, p 22-9, 54, 56.

Detailed study of highway and transit diversion of traffic in San Francisco Bay area: transit and highway diversion curves for presicting traffic distribution.

11. Sharpe, Gordon B., Walter G. Hansen, and Lamelle B. Hammer, "Factors affecting trip generation of residential land-use areas." Nat'l Research Council--Highway Research Board Bulletin 203, 1958, p 20-36.

The present and potential trip-generating power of urban residential areas can be estimated with a reasonable degree of accuracy, dependent upon the availability and reliability of certain related information.

The major factors affecting trips by residents of an area are population and automobile ownership. With data normally developed froma home-interview-type origin and destination survey it is possible either to up date the resident trip information or, with slightly less reliability to forecast the trips for some future date.

It was found the the total number of trip ends in a residential area is approximately equal to the number of trips made by residents of that area between all origins and destinations. Therefore, any methods for estimating residents trips are equally applicable to estimates of total trip ends on residential land. As a corollary, the number of trips to non-residential land in an urban area can be estimated if the number of trips made by residents of the entire urban area is known.

Generally, abour 80 percent of all trips made by residents of a residential area begin or end at home. Also approximately 8- percent of the total trip ends on residential land, by residents and non-residents, are "home" oriented. These proportions are greater in areas where car ownership and economic status are lower, and where population density is higher. They do not vary appreciably with distance from the central business district.

These findings are allbased upon analyses of data from the two home-interview-type origin and destination traffic survey s made in the Washington, D.C., metropolitan area in 1948 and 1955. All of the results pertain to the Washington area during the time interval studies, but it may reasonably be assumed that certain aspects of the findings and methodology will be applicable eslewhere.

12. Shuldiner, Paul W.,"Trip generation and the home." Nat'l Research Council--Highway Research Board Bulletin 347, 1962, p 40-59.

The relationship between a number of household and neighborhood characteristics and the frequency of person-trips associated with individual dwelling units is analyzed. Family size and vehicle ownership are found to have the greatest effect on trip production. Other dwelling unit variables affect trip generation only slightly when the impact of associated variations in family size and vehicle ownership ate accounted for.

A fuller understanding of observed variations in trips

generation is derived from consideration of certain social characteristics of the generatin area. Two indexes obtained from Census data--social rank and degree of urbanization--are found to be particularly useful in this regard.

The paper closes with a brief discussion of the apparent gain in precision which results from grouping data before regression analysis. Examples of the bias that such aggregation produces are considered.

13. "Trip generation and urban freeway planning." Nat;1 REsearch Council --Highway Research Board Bulletin 230, 1959, 125p.

This bulletin contains five papers on matters that influence urban freeway planning. Included are the following:"Studies of Trip Generation in the Nation's Capital, 1956-58."
"Traffic Characteristics on Massachusetts Route 128."
"The Nature of Urban Freeway Systems."
"Factors Influencing Transit and Automobile Use in Areas."
"A Method for Predicting Speeds Through Signalized Street Sections."

14. Tomazinis, Anthony,"A new method of trip distribution in an urban area." Nat'l Research Council--Highway Research Board Bulletin 347, 1962, p 77-99.

This paper introduces a new method of simulating and projecting trip intrrchanges within an urban area. The method is based on probabillty theory but it also utilizes certain aspects of the gravity models. It has been developed with 1947 O-D data of the Philadelphia metropolitan area and it is currently used in analyzing the 1960 data gathered by the Penn-Jersey Transportation Study.

15. Udy, Stanley H., Jr.,"Occupation, commuting, and limited-access highway use." Nat'l Research Council--Highway Research Board Bulletin 347, 1962, p 100-105.

This paper reports the results of an exploratory study of occupational differentials in limited access highway use by commuters in greater New Haven, Conn. The study was carried out with two main objectives in mind: (a) exploration of the feasibility of using city directory data in the analysis of work trips, and (b) exploration of the possible relationship of occupational differences to commuter use of limited-access highways.

16. Wyant, Dan,"Gravity Model" method studies traffic movement for survey of Eugene-Springfield (ore.) highway needs." Western City 39: n 5, pp42-45, May 1963.

The cooperative resources of local, State and Federal agencies are pooled in a pioneering type of highway study which charts the routes that will move the two million daily vehicle miles of traffic anticipated for the Eugene-Springfield, Oregon, metropolitan area by 1980 to 1985.

The study was carried out by the Bureau of Municipal Research and Service at the University of Oregon. Project Director Donald N. Johnson utilized a relatively new technique--the gravity model method--to estimate present and future traffic flows. He found that with proper checks and balances, the gravity model approach offers a promising improvements, in time and cost, over the ponderous method of origin destination interviews usually employed.

Instead of sending crews of interviewers into the field to determine trip desires, Johnson put his staff to work reducing key factors of trip production to a mathematical formula and then fed these statistics through an Oregon State Highway Department IBM electronic computer.

For the study the Eugene-Springfield area was divided into 32 zones. Statistics on such factors as employment, population, travel time, and trip purposes were then applied to compute the vehicular attraction of one zone to the other. Some 1,960 gravity model results were thoroughly checked for accuracy and reasonableness. Comparisons left Johnson confident that survey figures based on the gravity model method are valid for the present and for the 1980-85 forecasts.