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Data Requirements for Metropolitan Transportation Planning

An NCHRP staff digest of the essential findings from the final report on NCHRP Project 8-7, "Evaluation of Data Requirements and Collection Techniques for Transportation Planning," by Roger L. Creighton of Creighton, Hamburg, consultants, Delmar, N. Y.

THE PROBLEM AND ITS SOLUTION

Urban transportation planning studies require extensive amounts of data on population, travel, transportation facilities, land use and the various socioeconomic characteristics. Techniques for obtaining these data are costly and time-consuming. In view of the evolving nature of the transportation planning process, a reexamination of data requirements and collection techniques has been needed.

The research was intended to answer such questions as: What data should be gathered in the future? What should be the policy on data collection? How can techniques for obtaining data be improved? What potential is there for multipurpose uses of the data?

In light of the findings referred to below, the research agency makes the following data collection policy recommendations for transportation planning studies:

1. The collection of data should be regarded as a means to an end, not as an end in itself. The planning process defines what data are needed. Data collection for research should generally be dept separate from data collection for planning purposes.
2. The collection of data for strategic planning should be kept separate from data collection for the various types of implementation planning.
3. Land-use data should be maintained in current state for each metropolitan area so that at any given time major uses and density of use will be known for each traffic analysis zone.
4. The major street and mass transportation network data files should be kept current.

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5. Vehicle miles of travel (VMT) and person miles of travel (PMT) should be measured biennially and converted to daily travel costs by street type within district. Travel cost data should be used to determine whether the strategic transportation planning process needs revision and/or whether land-use controls need to be instituted to protect performance of the existing plan.

6. If the transportation plan needs review, only enough origin-destination data should be obtained to measure current levels of certain critical variables such as trip length and household trip production. For trip length, approximately 150 households should be sampled for any area (e.g., district) for which trip length is desired to be known within $\pm$ 10% at 95% confidence limits level.

FINDINGS

A. Data Needs for the Strategic Transportation Planning Process (STPP)

Examination of five representative transportation studies produced the following findings regarding the STPP and related research work:

1. Transportation studies do, in fact, need extensive sets of primary and secondary data. Typically, eight major primary surveys are taken, they are:
   - Home interview origin-destination survey.
   - Truck-taxi origin-destination survey.
   - Roadside (cordon line) origin-destination survey.
   - Arterial link inventory.
   - Transit link inventory.
   - Speed runs.
   - Traffic counts.
   - Land area measurements.

   As many as 25 different kinds of secondary data were found to have been used.

2. Primary data files have been, in general, well used by each of the studies. Only a few "data items" are superfluous. A few entire data files -- mainly collected experimentally -- were not used at all.

3. Research work conducted by the five studies was found to have used only data obtained for STPP purposes.

4. The costs of data collection of the five studies averaged $0.52 per capita and 31 percent of total study costs. Total study costs averaged less than 1 percent of the capital costs of the recommended plans.

5. The times required to collect and process data are excessive, averaging at least two years. Methods to speed up data collection, especially data processing, are badly needed.

B. Data Needs of Related Planning Process

1. TOPICS

TOPICS planning is separated from the strategic transportation planning process by the spectrum of scale.

The following findings were made:

(a) The STPP should not attempt to provide all of the detailed street inventory data required for TOPICS.

(b) Where possible, the STPP should collect additional street intersection data to make the calculation of "link" capacities more realistic than they have been in some transportation studies.

(c) Further research should be undertaken to interrelate the capital improvement programming process, and its data needs for planning local and arterial streets, with both the STPP and TOPICS.

2. Transit Planning

Strategic transit planning as practiced by transit operating agencies. Planning routes, schedules, or fare changes for transit falls outside the STPP as more of an operations than a planning problem; STPP data are clearly not sufficiently detailed for this purpose.

The following findings were made:

(a) The STPP should not attempt to provide all of the detailed data required for implementation transit planning.

(b) The basic STPP should, however, incorporate a PMT (passenger miles of travel) survey as standard practice, particularly where existing transit service is nimimal for the dual purposes of (1) augmenting sparse home interview transit travel data, and (2) providing evidence on the advisability of maintaining marginal transit service.

(c) Further research should be undertaken to design more rigorous STPP transit planning goals and objectives, and to develop the necessary evaluative tests to demonstrate how well the goals are met by alternative plans.

3. Highway Route Location (or Project) Planning

The route location process is a process distinct and separate from that of the strategic transportation planning process. It employs different methods at a different level of detail.

Although the key factors of corridor terminals and 20-year traffic forecasts used in route location planning are products of the systems planning process, most other data and estimates required for the route location planning process are prepared by route location planners. Basic decisions as to number of lanes and interchange types ought to be made jointly by systems planners and route location planners.

To compensate for the fact that traffic estimates will be in error, and to help close the gap between systems planning and route location planning, the following steps should be taken:

(a) Research should be undertaken into methods for estimating the range of errors of traffic estimates.

(b) The expected range of errors should be posted whenever estimates are made.

(c) When estimates are made of traffic volumes that lie in critical volume ranges for lane decisions (or interchange design), additional right-of-way should be purchased to allow for widening.

(d) Research should be undertaken to measure the limits of trip density (generated by land use) that are allowable for planned spacings of roadways, to measure the costs of exceeding these limits, and to determine means of imposing land-use density controls if resulting costs are excessive.

4. Metropolitan Planning

There is substantial joint use of the same data in metropolitan land-use planning, land-use modeling, and transportation planning. Seventeen major kinds of data are used in common by the three preceding kinds of planning. This substantial joint use of the same data is in sharp contrast with implementation planning, which largely has its own data requirements.

Because it is clear that economies can be obtained through joint collection and continuous maintenance of data, it is recommended that wherever possible transportation agencies and metropolitan planning agencies cooperate financially and administratively in the collection and maintenance of data which they can both use.

Metropolitan growth modeling and metropolitan planning operations have tended to use, and to be limited by, the data (such as data on land use, travel, and transportation facilities) traditionally gathered by transportation planners and city planners. It is recommended that new series of data, particularly on land values

and building (both construction and maintenance), be obtained on a metropolitan-wide sampling basis, so that new measured understandings of urban growth and change can be obtained.

C. Sensitivity Analyses

Studies of the basic STPP were conducted to ascertain how sensitive the STPP is to errors in data and thus to identify data that need to be gathered more accurately (mainly by higher sample rates) or more frequently. The following conclusions were reached:

1. Basically, strategic transportation plans are prepared on the basis of, estimates, not data. Errors of estimates are likely, as a general rule, to be much larger than data errors. Gathering more data than are needed to establish the values of the estimating equations is apt to be unproductive.
2. The critical estimates used in the transportation planning process are the following:
   (a) Trip destination density.
   (b) Trip length.
   (c) Comparative travel costs (expressway versus arterial).
   (d) Network data (chiefly speeds and capacities).
   (e) Variables affecting choice of mode, such as automobile ownership.
   (f) Comparative transit-highway network speeds.
   (g) The capital recovery factor.
   (h) Capital costs of highways.
   (i) Capital costs of transit.
3. Forecast errors can have substantial impact upon the plan.

There are at least two defenses that should be set up against expected errors. The first of these defenses is a regular monitoring activity to be undertaken by the transportation study. This monitoring activity should consist of a systematic check on the changing travel characteristics as they occur. The second defense should consist of stressing studies in which errors of trip generation, trip length, mode, or other critical variables are deliberately inflicted upon the plan.

D. Alternative Data Collection Techniques

There are many different kinds of measurements that must be made to provide the primary data required by the strategic transportation plan. A number of new data collection techniques have been advanced in the past ten years. Although many of these techniques hold considerable potential, few of them -- as yet -- offer any marked improvement over established techniques of collecting the basic data needed for strategic transportation planning.

The following findings were made:

1. The computer is becoming more and more of a factor in opening up, for planning and research uses, the capabilities of data files collected by government for taxation and administrative purposes. This trend will continue for many years.
2. Governmental administrative and tax programs create records that uniquely identify persons, businesses, and parcels of land. These include:
   (a) Social security numbers.
   (b) Employer identification numbers.
   (c) Assessors' records.
   (d) The DIME (Dual Independent Map Encoding) file.
3. Transportation planners should work to secure improvement and extension of the systems identified in (2) above. From such records, data on population, employment, work trips, and land use can be extracted.

4. Research and experimentation should be encouraged in the use of aerial photography, on a sampling basis, for counting vehicle traffic on urban street systems.
5. Further research work should be undertaken in the area of special transit surveys, including on-board transit origin-destination surveys and electronic counting of transit passengers.

APPLICATION

The findings of this study will be of interest to transportation planners. It is their responsibility to review present strategic transportation plans periodically to determine whether investment levels, mode-split of investment, and corridor locations are still valid in light of the changing city. It is a safe assumption that this will require repetition of the basic STPP, featuring long-range estimates of trip production, by mode, and traffic assignments.

The findings and recommendations of this study will help the transportation engineer and planner to develop data collection policies for new and continuing urban transportation studies. The research stands alone, recommendations need not be combined with results from other research in order to be useful. The results are presented in a form considered to be defined explicitly enough to permit direct application to practice. The research conclusions can be directly applied where appropriate within the limitation specified in the report and need not be translated into other working tools with which the practicing engineer is familiar. The sensitivity studies conducted as part of this research indicate the degree to which data errors can have an effect on the evaluation of alternative transportation systems. The research studies were limited to large metropolitan areas. Cities in the below-one-quarter-million population rank were not included in the analysis of this project. Adjustments need to be made to the general recommendations to adopt the findings to the varied city forms, sizes, and structures.