

AN APPROACH USING WORK-TRIP DATA

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There was some thought that this paper would present a technique for using census work-trip data for transportation planning. I wish that were so. Unfortunately, except for some research we did 3 or 4 years ago (1), little concrete effort has been expended to date to advance this approach to a technique. I have heard some rumors from time to time that it might soon be utilized functionally but have not heard of any actual situations. I think that the approach is probably as well suited for use with census data as with major generator data, as was originally intended. So perhaps with the availability of 1970 census information, some testing will be carried out.

I would like to review this approach because I am confident that it can be used in smaller urban areas where travel patterns are not too complex and that it also has considerable merit for use in larger urban areas, although for such cases much care and special handling must be exercised in order to consider significant travel patterns that might otherwise be neglected. I will start with a review of the information that will be available from the census, then discuss the uses for which I feel it is appropriate, and conclude with how it can be implemented.

The principal census data of interest here are the journey-to-work data. These data will be assembled by asking the location of the principal employment of all workers in 15 percent of the households in the country. This year, by virtue of a special appropriation, the employment place data are available to the street address location rather than to the political jurisdiction as was the case in 1960. This detail of location will permit coding of employment location according to the census block, effectively providing tract-to-tract work-trip interchange data for the 15 percent sample. This is a considerably greater sample than would be available in most urban studies, except Cleveland for instance.

The impact of this is obvious; the census is providing a large-sample, work-trip table that can be used for urban transportation planning. The question may be asked, What good is a single-purpose trip table? That is the key question for this technique, and I will go into it shortly. Suffice it to say for now that there is considerable feeling that these data can be exceedingly useful for numerous reasons. This is why the great effort was put forth to obtain work-place location information to this level of detail.

The same 15 percent sample of households will be asked their occupation and the industry in which they are employed. These 2 classifications will each be coded to numerous major levels. The respondents will also be asked to indicate their principal means of travel to work according to 9 classes. Twenty percent of the households will be asked to indicate their income level. Thus, significant, critical data on the journey to work, the most important trip group in most urban areas, will be available from the census for all SMSA's of the country. The data will be procured at least every 10 years and perhaps every 5 years. In addition to this special data obtained from 15 percent of the households, data on the characteristics of all households will be obtained. This will include significant production-zone information such as family size, sex, and age stratifications. Other characteristics of households will be obtained as well and may be more particularly useful in some urban areas than in others.

How can these data be used for transportation planning? I have already mentioned that the census will provide data that can be used to generate a work-trip table for several modes. Processing of the census data by programs being sponsored by the Federal Highway Administration will yield trip tables that are compatible with zone systems developed for previous urban work. The result of this processing will be a conventional interchange matrix of zonal work trips.

Earlier I raised a question regarding the holes in the universe of travel. Some time ago we looked at some actual data from the 1964 study in Indianapolis. We compared the travel patterns manifest in assigned traffic for work trips to those for all trip purposes. For individual link volumes on freeways and arterials, the correlations between work-trip and total-trip volumes were very high and quite significant. This test was made to examine a theory that, if a good basic major street system is provided, it will provide travel service for trips of all purposes. The test was not the most rigorous that might be performed, but within the constraints that existed, it provided a good indication that the theory was plausible. What the test did say explicitly was that, by using conventional transportation planning procedures, essentially the same results could be obtained (that is, defining major facilities) by using only work trips as by using a complete trip purpose spectrum.

There may be specific loopholes in this theory but, in general, it is quite well founded and reasonable. Consider the correlations between site development locations, employment concentrations, and major highway locations. Major traffic generating facilities tend to locate in high accessibility corridors in order to maximize their proximity to their particular markets. From an efficiency standpoint, major facilities that carry work traffic in peak hours should be utilized to carry other purpose travel when work traffic is not heavy. In some specific cases, such as large shopping centers, recreation areas, universities, or airports, these major generators are usually easily located and should be amenable to special handling that would provide for sufficient facilities to serve such generators from the otherwise designated highway system.

Another way to handle large traffic generators is to do some type of special generator survey, perhaps using license plate procedures. Indeed, this technique was originally intended to be oriented to special generator surveys that would gather work-trip data at the place of employment and other generator data at the attraction zone. Production zone data would, of course, be available from the census. The approach is equally appropriate for use with census work-trip data because the essence of the theory is the representiveness of work trips and because census work-trip destinations are now available to the tract level of detail in all SMSA's.

It should be obvious that many of the instances that come to mind to disprove this theory are those in larger urban areas. Thus, as the city size becomes larger, the individual, diverse, nonwork travel demands of residents that must be handled become more significant in comparison to the miniscule volumes observed in smaller cities. Indeed, comprehensive studies have already been completed in most of the large cities anyway.

This technique is directed at providing a very inexpensive, yet accurate, tool for use in planning street facilities for smaller urban areas, those that are not covered by the 1962 Federal-Aid Highway Act. The nonwork purposes may be relatively as important in the small cities as those in the large cities; that is, they may represent the same percentage of all travel. Because of the smaller travel universe, however, their actual trip volumes are less important. A lane is a lane, in general, regardless of urban area size. For all intent and purposes, the transportation system in a small town is one that satisfies the travel demand for those two 15-minute peak periods when mainly work travel occurs. This is not the most accurate technique perhaps, but certainly it is very cost effective.

The census obtained address of work place for all urban areas, but the location will be coded in detail only for SMSA's. For urbanized areas in most SMSA's, where address coding guides were available at coding time, the location will be coded to blocks. In other SMSA's the location will be coded to tracts, but block coding could be developed by using address coding guides prepared after the original coding operation. In

other urban areas, locations will be coded only according to uniform area code, essentially the city where the work place is located. More detailed coding could be accomplished, although at considerable expense, by recoding work place location from original forms. This obviously limits the applicability of census work-trip data for smaller urban areas. As a result, major generator surveys may still be most appropriate.

The census data do provide capabilities for updating previously obtained data and forecasts in such larger areas. They can be used to check and adjust the work-trip tables and models prepared previously. Propitious factoring can guide adjustments to the nonwork models in line with general trends in person travel behavior, such as trip length and frequency, observed in the work model updates. With the advent of quinquennial censuses, continuing study organizations may be able to fine-tune their models and forecasts quite often in order to keep abreast of the most recent trends in behavior. This will be very important because of the changes in behavior that respond to alteration in traditional institutional constraints and standards.

I have avoided comments regarding mode of work travel until now in order to emphasize mode-choice impact. Naturally, the previous comments were addressed to use of automobile-driver travel data. The availability of multiple travel-mode designations for work trips provides a data base for analysis of mode choice as well as for automobile occupancy and the rail-bus submode decisions.

For the case of automobile-transit mode choice, work-trip data are the most appropriate data that can be used. Much modal-split work in the past has been principally oriented to work-purpose trips, using factors to estimate the total travel universe. The obvious reason for this is that traditionally transit has depended on work travel so much more than on travel for other purposes. Work trips constitute an overwhelming majority of transit trips. Having tract data on trip ends and interchanges by mode will permit mode-choice modeling from census data alone. The most appropriate production zone characteristics, income and density, will be available from the census. The data on industry at work place will provide stratified employment estimates by zone from the same survey source. I do not think anything further is needed to demonstrate this because the available data readily fit the requirements of the standard procedure.

The numerous stratifications of travel mode will also permit analysis of appropriate submode decisions. The automobile occupancy and rail-bus splits fall directly from further stratification of the principal-mode travel data. In addition, the census will provide data on what has heretofore been rather elusive, the number who walk to work and work at home. The 15 percent sample will provide adequate data to estimate these correction factors to the universe of work-travel data. These home-employment and walk-travel estimates have usually not been available from traditional urban surveys.

One further thing that the census will permit with work-trip data is a means to estimate employment by type in attraction zones. This will be a useful check on employment data from other sources, particularly those that are usually conceded to be in some manner inadequate, such as employment security data. It will also provide gross data for rural areas for use in statewide planning. Such data may not previously have been prepared or even been available.

What type of program can be developed to utilize these data? The biggest problem here will be interfacing with the census. The Bureau of the Census has enough responsibilities to occupy it, so we cannot expect special treatment to satisfy the particular needs of each urban area. It would seem reasonable that these work-trip data may be some of the last prepared for external consumption. Indeed, the work-trip data will be processed with the special FHWA programs only on request. The original coding, of course, is to the work-trip destination block. Once that is available, the user can request a summary according to the traffic zones for his area merely by providing equivalence tables and money. From there on, the procedure is fairly straightforward. Work-trip tables can be built, and travel models can be calibrated. Alternatively, the models developed previously might merely be checked by comparing the work-trip distribution of census trip ends to the census trip table. The normal battery of checks would follow.

The key to the technique suggested here is to develop appropriate expansion factors that will provide total highway or transit trips from those for the work purpose only. These factors can be prepared from survey data from the urban area or from cities of similar character. In general, these factors do not differ significantly among urban areas in a region. Because the estimate desired is really an order-of-magnitude type, slight errors can be tolerated. Substantial sophistication in these derivations may be warranted, however, because of their impact. The factors would then be applied to develop either total ADT or peak-hour tables. These would be assigned to a network and analyzed in the usual manner. As mentioned before, care must be taken to ensure that major nonemployment generators are accounted for because this procedure will not necessarily provide adequately for special cases. Use of peak-hour factors will provide direct design data in many cases for urban areas.

This procedure has some significant advantages and drawbacks. The data are collected uniformly for a single base year in an identical manner for all portions of the country. Thus, consistent procedures for using it can be developed and reapplied economically. The survey will be repeated periodically, every 5 or 10 years, and will provide for periodic checking and updating without further travel surveys such as those that have been taken in the past. The data are very inexpensive for the individual planning agencies, although some burden-sharing will eventually be effected. The sample is larger than samples in most previous urban travel surveys. This is important because the data for other travel purposes will be developed from it. The census data will provide an independent source for checking previous work and independent data for periodic subsequent updating.

The fact that the data are for work trips only can be overcome with careful factoring. The work data will be very reliable because of the larger sample, and therefore errors due to factoring will be less dramatic. The census may, however, be inconsistent with other data sources in ways that can only be detected for individual instances when they are examined.

The singular use of census work-trip data for transportation planning appears from tests to date to be quite appropriate and accurate. Further tests may be desirable, but the thesis of this approach appears strong enough to warrant its practical application.

REFERENCE

1. Shunk, G. A., Grecco, W. L., and Anderson, V. L. The Journey to Work: A Singular Basis for Travel Pattern Surveys. Highway Research Record 240, 1968, pp. 32-51.