

Census Data Use in Illinois by Research and Academic Community

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This paper is one in a series of four that document the uses of the Census Transportation Planning Package data by the transportation community in Illinois. The focus in this paper is on the work performed by those conducting basic research or acting as a consultant to a client. Other papers in this series address the work conducted by small and large metropolitan planning organizations and by the transit community. The Census Transportation Planning Package (CTPP) has been used extensively by the research and academic community over the last two decades. The 1970 Urban Transportation Planning Package was used in numerous studies, but the focus of this paper is on the use of the 1990 CTPP. At least one major study is ongoing that examines the changes inherent from the 1970 to the 1990 planning packages, and several studies are discussed that examined the changes from 1980 to 1990. Nine different applications of the CTPP at five different institutions are documented. The applications are quite varied and include studies of Chicago as well as of smaller metropolitan areas throughout Illinois. Most are transportation studies, but there are also numerous uses of the package because of its readily available information on employment by small area. The researchers uniformly indicated that their work could not have been performed in its present form, and in most cases could not have been performed at all, without the CTPP. The CTPP is indeed a very useful source of data for a variety of studies using small-area zones.

Planners and scholars have now used the census transportation planning packages in the Chicago area for well over 20 years. The 1970 Urban Trans-

portation Planning Package (UTPP) was utilized extensively by the staff of Northeastern Illinois Planning Commission (NIPC) and particularly by the Chicago Area Transportation Study (CATS). It was also intensively used by Sen and Sööt at the University of Illinois at Chicago in nearly a dozen studies funded by the U.S. Department of Transportation (DOT) as well as by numerous local agencies. They also spent over half a year in enhancing and modifying the 1970 UTPP to make it more readily usable. Based on the work in the 1970s, the 1980 UTPP was used widely for modeling and descriptive purposes. Most of these efforts were centered on modeling trip distribution and modal split. Several hundred laborsheds were also mapped as a first step in the development of a laborshed model.

In this paper, the focus is on use of the 1990 Census Transportation Planning Package (CTPP). Nine applications for research and planning purposes at five different institutions are discussed. The studies not only addressed transportation questions but also examined employment distributions and concentrations. Several of these studies used both the 1980 and the 1990 packages.

APPLICATIONS

The CTPP has been utilized by numerous individuals at several universities and research institutes in the Chicago area: the University of Illinois at Chicago,

Northern Illinois University, Loyola University of Chicago, Illinois State University, and the Woodstock Institute. The staff of the Urban Transportation Center at the University of Illinois at Chicago has used the CTPP for three substantial studies. The first was to determine the potential users of the proposed Downtown Circulator System (light rail). The second was to compute the average vehicle occupancy level for the Chicago area. The third was to produce the weights for the CATS Household Travel Survey and to develop a model estimating nonresponse rates. Each of these studies was highly dependent upon the CTPP data.

Use of Downtown Circulator System

The city of Chicago proposed a network of light rail lines connecting major traffic-generating points and sub-areas in the greater downtown. The study of the potential users of the proposed circulator system made extensive use of the 1990 CTPP (1-3).

A critical factor in garnering political support for the circulator was the demonstration that the Chicago downtown was not just the work destination for wealthy suburbanites and the elite of the city but that it serves nearly all of the Chicago neighborhoods. Figure 1 shows that a high proportion of the workers residing in the upscale neighborhoods along Lake Michigan to the north work in the downtown area, but it also clearly illustrates that the downtown is an important work destination for many of the workers residing in the minority neighborhoods south of the downtown. Figure 1 and the accompanying report (1) were important in understanding the significance of downtown jobs for many minority neighborhoods throughout the city. Conversely, it is evident that the northwestern portion of the city, with a preponderance of single-family homes and upper-middle-income households, is not as dependent upon downtown jobs as most minority areas are.

This application also illustrates the use of the geographic information system (GIS) in working with the CTPP. It was necessary to gather the information by political wards, which are rather irregularly shaped districts and therefore do not conform to the traffic analysis zone (TAZ) geography available in the CTPP. A PC-based GIS was used to aggregate the TAZ data to approximate the city's political wards, as shown in Figure 1.

The CTPP was also used to determine the importance of other employment centers to city residents. In each of these cases the geographic extent of the employment center needed to be delimited. The CTPP was an exceptionally good source of data to accomplish this task. Figure 2 shows how the CTPP was to be used to define employment hubs in a direct cartographic manner. Although the limits of the hubs are not shown,

it is evident that with spatial data such as these, the hub can be defined using a minimum employment density criterion as well as a contiguity requirement. This task can be accomplished more readily by visual inspection than by the development of an extensive computer code.

Other techniques could clearly be used, but the visual statement of what constitutes the employment hub is important in establishing the credibility of the method. Seven major employment hubs, including the central business district (CBD) were defined using this method (Table 1). The commuting patterns to each of these seven hubs and other destinations were then determined. Using the geographic detail provided in the CTPP (TAZ-to-TAZ work trips), the number of individuals commuting from each of the city's 50 political wards was tabulated.

The amount of traditional and reverse commuting could also be seen. The first four destinations in Table 1 are within the city (O'Hare International Airport is partially in the city). It also showed that in some employment hubs, such as the University of Chicago/Hyde Park, residents find more jobs in the Chicago downtown than they do in their own local employment hub. In general the importance of downtown jobs is very evident.

Without question, this study could not have been conducted at this level of detail without the CTPP, nor could it have been conducted at a much more aggregated level with the ease made possible by the CTPP. The study clearly demonstrated that the Chicago CBD was critical to many inner-city minority neighborhoods as a job destination, and it was used to refute conventional wisdom about the significance of the downtown for many low-income neighborhoods.

Average Vehicle Occupancy

The Statewide Element of the CTPP was utilized to determine the average vehicle occupancy (AVO) rates for the city of Chicago and suburban Chicago (4). By examining the CTPP work-trip data by time of day it was possible to determine the number of workers commuting during the critical morning peak period. Drivers could be distinguished from automobile passengers.

Table 2 shows some of the results of this work. With the CTPP files it was possible to compute the target for the Employee Commute Option (ECO) program. The city AVO was 1.07 and the corresponding AVO for suburban work places was 1.12. The highest levels were achieved by Chicago workers working in Chicago (city-city trips). Some county-to-county levels were as low as 1.05. The CTPP data allowed an examination of AVO data by both place of residence and place of work.

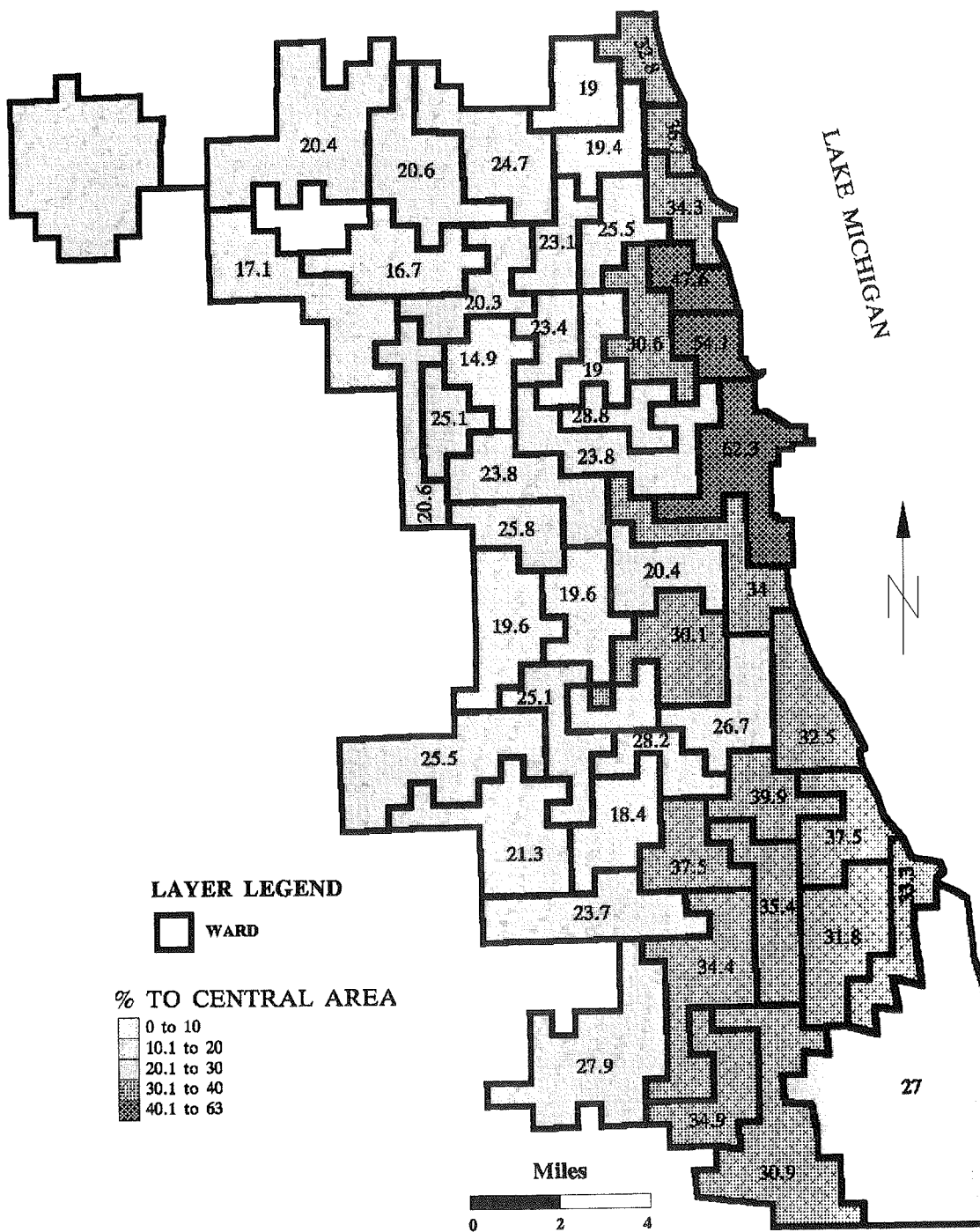


FIGURE 1 Percent of work trips from Chicago wards to the central area (city of Chicago wards generalized to quarter sections). Source: 1990 CTPP.

Household Travel Survey

The 1990 CTPP was used in two different studies relating to the CATS 1990 Household Travel Survey: to help establish the weights for each survey instrument (5) and to establish a model to estimate the nonresponse rates in a mail-out, mail-back surveying procedure (6).

The 1990 CATS Household Travel Survey was weighted for the purposes of tabulating the raw data into summary tables and other descriptive reports. The survey responses were weighted to the data on number of workers and household size available by TAZ geography used in the CTPP aggregated to factoring zones (5). Figure 3 illustrates a basic step in the weighting process. The re-

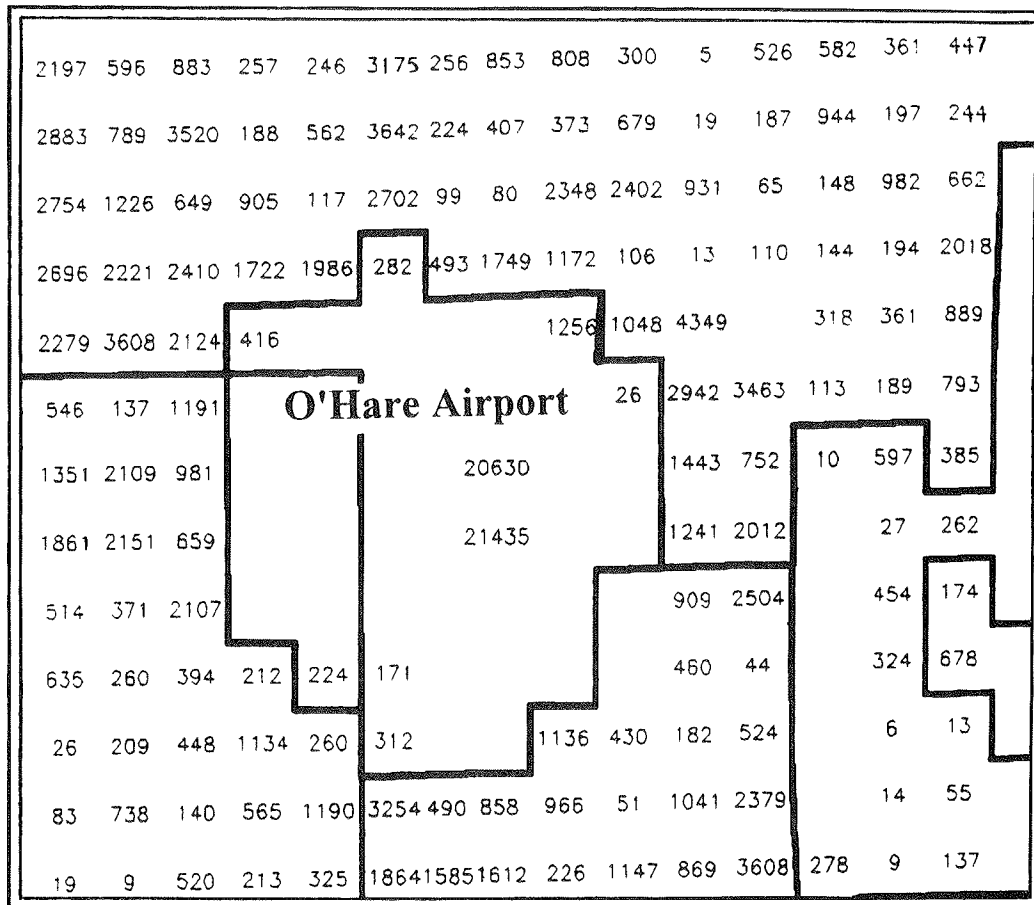


FIGURE 2 Employment in the O'Hare area by TAZ.

TABLE 1 Major Employment Hubs and Workers Living in Chicago

Employment Hub	Area sq.mi.	Employment	From Chicago	% From Chicago
Central Area	4.75	542,387	333,431	61
O'Hare East	7.00	81,030	29,627	37
Near North	6.50	79,469	57,067	72
Med Complex	6.25	69,266	45,044	65
UC Hyde Park	4.50	29,489	21,613	73
Schaum/Wdflid	6.00	49,971	4,062	8
I-88 East	13.00	70,512	6,212	9

Source: Census Transportation Planning Package, 1990.

TABLE 2 Number of Work Trips by Automobile

Residential Location	Automobile Work Trips 6:00-10:00 (1000's)	Percent of These Trips to Chicago	Percent of * of all Work Trips
Suburban Cook	793	20.9	68
DuPage County	302	9.1	73
Lake County	188	5.5	72
Will County	116	6.0	69
McHenry County	67	2.5	74
Kane County	111	1.9	72
Kendall County	15	1.6	75
Subtotal: Suburban Chicago	1,592	13.5	70
City of Chicago	524	68.2	45
Seven County total	2,116	27.0	62

*Automobile work trips (drivers plus passengers) between 6:00 and 10:00 AM as a percentage of all work trips.

Source: Household Travel Survey and CTPP (which uses 5:30 AM - 9:30 AM, here assumed to be 6:00 - 10:00 AM).

turn rates shown indicate where the standard large zones need to be disaggregated to compensate for especially low returns from some square-mile-sized neighborhoods. It should be noted that near Waukegan there are a large number of zones with low return rates. On the basis of these rates, this area was designated a separate factoring zone. Other factoring zones are much larger.

The CTPP was also used in estimating the nonresponse to the CATS Household Travel Survey. It is apparent that response rates for survey instruments were much higher for some neighborhoods than for others. Since in most surveys a target number of responses is desired from each neighborhood, it is necessary to have a reasonable estimate of the response expectations. The sociodemographic information from the CTPP was used as independent variables in a regression analysis of response rates (6).

Analysis of Employment Concentrations

Richard Greene of Northern Illinois University and Richard Forstall of the Population Division of the Bureau of the Census have worked on several joint efforts between the two agencies; one was in the Chicago area. The Chicago study used both the 1980 and 1990 trans-

portation planning packages to define employment concentrations and to examine the shifts in employment (7). Greene and Forstall cooperated in a similar study for Los Angeles and noted that the size of the average census tract (the TAZ) in the Los Angeles area is 0.62 mi², whereas in the Chicago area TAZs are approximately a quarter of a square mile. In the Chicago metropolitan region the average census tract is several square miles in area; therefore the TAZ provides data for a much smaller area than the census tract.

Since the Chicago metropolitan area (the Chicago CMSA) now includes 13 counties in three states, the authors focused on the three central counties—Cook, DuPage, and Kane. Cook is the central county (Chicago) and the other two are directly west of Chicago. Other counties were excluded because each had problems associated with coding place-of-work data by TAZ.

As part of their analysis they mapped several variables, including the number of resident workers and jobs by place of work. The distribution of resident workers is largely concentrated in the city of Chicago and close-in western and northern suburbs. The distribution of jobs, however, is much more clustered, with several TAZs having more than 5,000 jobs. Although

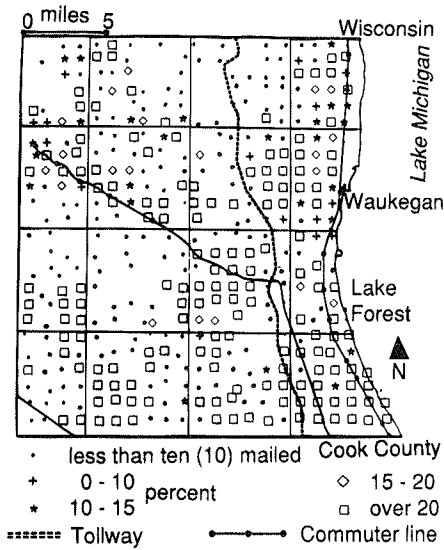


FIGURE 3 Lake County return rate by square-mile zones.

large numbers of workers reside on the south side of Chicago, the concentrations of jobs are found elsewhere. It is very evident from their maps that there is an imbalance of workers and jobs on the south side of Chicago. For many of these south-side communities, average work trip travel times are in excess of 45 min in contrast to the metropolitan average of 28.1 min. This imbalance in travel times continues to be a problem that defies a short-term solution.

The jobs are concentrated in and near the Chicago CBD and in the near north side. In the suburban area the greatest cluster is at O'Hare International Airport and in the industrial parks and mixed office and hotel land uses in the northern suburbs. There are other major employment areas such as the I-88 corridor, the Schaumburg/Woodfield area and the western suburbs.

Some of these patterns can be more readily seen in Figure 4, which covers only the three counties of special interest in their study. With the CBD area removed, some of the remaining clusters can be more readily seen,

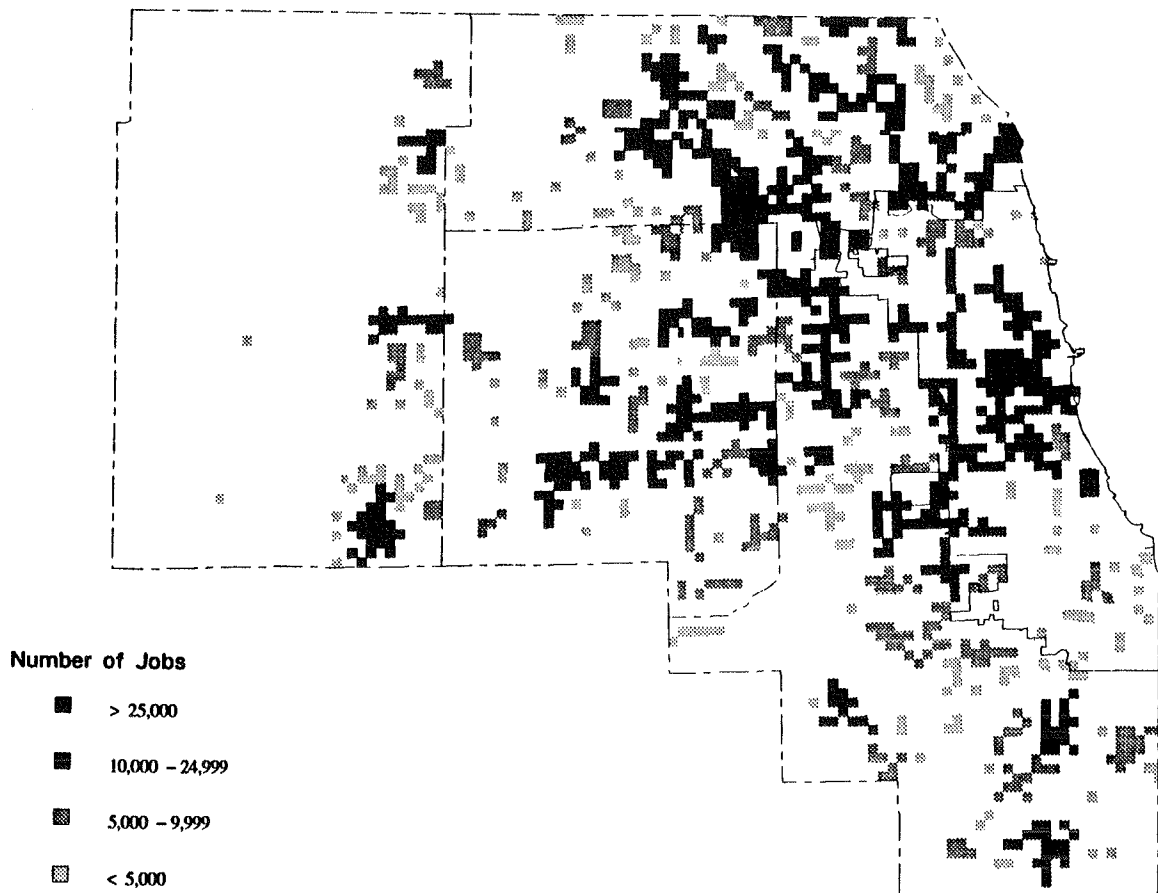


FIGURE 4 Employment concentrations outside Chicago's CBD (7).

including the North Branch (River) industrial area and the ones mentioned in the previous paragraph.

Last, Greene and Forstall examined the changes inherent from 1980 to 1990. These maps clearly indicated that employment growth is in the suburban areas, principally in the western and northwestern suburbs.

Examination of Congestion and Air-Quality Relationships

Currently Audrey Clark and Andrew Kremenc at Northern Illinois University are participating in a promising study of changes in travel behavior and how these are contributing to congestion in the Chicago area. The study is the first step in congestion mitigation analysis. The goal is to achieve air-quality improvements by first better understanding current travel behavior and the changes since 1970. Because 1980 was a period of unusually high energy costs, the 20-year time horizon is particularly useful. The 1970 and 1990 planning packages represent the centerpiece of this research. It is the first serious long-term effort using both the 1970 and 1990 CTPP to track changes in travel behavior in the Chicago area. The work is ongoing and the results should be available near the end of 1996.

Decentralization and Suburbanization of Employment

David Merriman, in the Department of Economics at Loyola University of Chicago, found the CTPP indispensable in completing the paper *Location, Location, Location?*, currently in draft form (8). The study examines to what degree location is important in determining employment growth. He uses the 1980 and 1990 transportation packages to examine empirical evidence for the role of location in light of the traditional urban economic theories that indicate the importance of access to amenities and other economic activities in locating new employment. Merriman's early findings suggest that location is not as important as many would suggest.

Merriman examined the employment distribution by industry for the 4,244 TAZs that are found in both the 1980 and 1990 packages. No other census product would have given him this level of geographic detail. For the emphasis on the spatial aspect of changes in employment distribution, the small-area geography provided by the 1980 and 1990 packages is ideal. Also, the 1980 and 1990 packages readily lend themselves to longitudinal analysis. The 1970 package is more difficult to use because of the varied sizes of employment zones (TAZs, ZIP codes, municipalities, and counties as well as work place not reported). Merriman computed the center of gravity for

each of 14 employment categories by industry and found that most centers moved west and north of the Chicago CBD during the decade studied. He also used an economic model to examine the decentralization of employment from the existing employment cores, which suggests that decentralization forces are active since large clusters of employment are not growing but smaller ones are.

Redefinition of Metropolitan Areas

The 1990 CTPPs for Bloomington-Normal, Springfield, Kankakee, and Chicago in Illinois and Clarkville in Tennessee were used to explore the possibilities of providing an alternative to the current practice of designating one or more cities as the central city of a metropolitan region. The study by Treadway at Illinois State University (9) concludes that the CTPP is an ideal source for identifying small subareas used to define a "more suitable multi-nodal 'metropolitan core' than central cities" (9, p. 13). He also points to several methodological problems associated with other procedures.

Treadway's procedure is based on initially allocating default-zone employment (employment that is not assigned to a TAZ) to existing TAZs. In his five metropolitan areas this ranges from a low of 4 percent of the work trips in Chicago to a high of 33 percent in Kankakee. After the allocation of default-zone employment to TAZs, the resulting employment is divided by the number of resident workers to obtain employment-residence ratios (Figure 5). Areas with ratios less than 1.0 are interpreted as principally residential and not part of the employment core of the metropolitan area. These areas account for a high of 78 percent of the TAZs in Chicago to a low of 60 percent in Springfield (the state capital).

Treadway mapped several ratio levels and interpreted the bounds of these respective TAZs as possible limits for the central core of the metropolitan area as an alternative to the central-city concept. He mapped the distribution of the major employment concentrations with employment-residence ratios over 5.0. The other ratios over 1.0, mapped separately in the study, need to be added to obtain the final results. In summary, this procedure is analogous to procedures exercised in the New England states where metropolitan areas have definitions different from those for the rest of the country. Clearly this approach is only feasible if there are employment data by the same geography as resident worker data, which is currently only available in a single source, the CTPP.

Intercounty Work-Trip Flows

The Statewide Element was also used to study the work-trip flows in central Illinois. The eight-county area in the

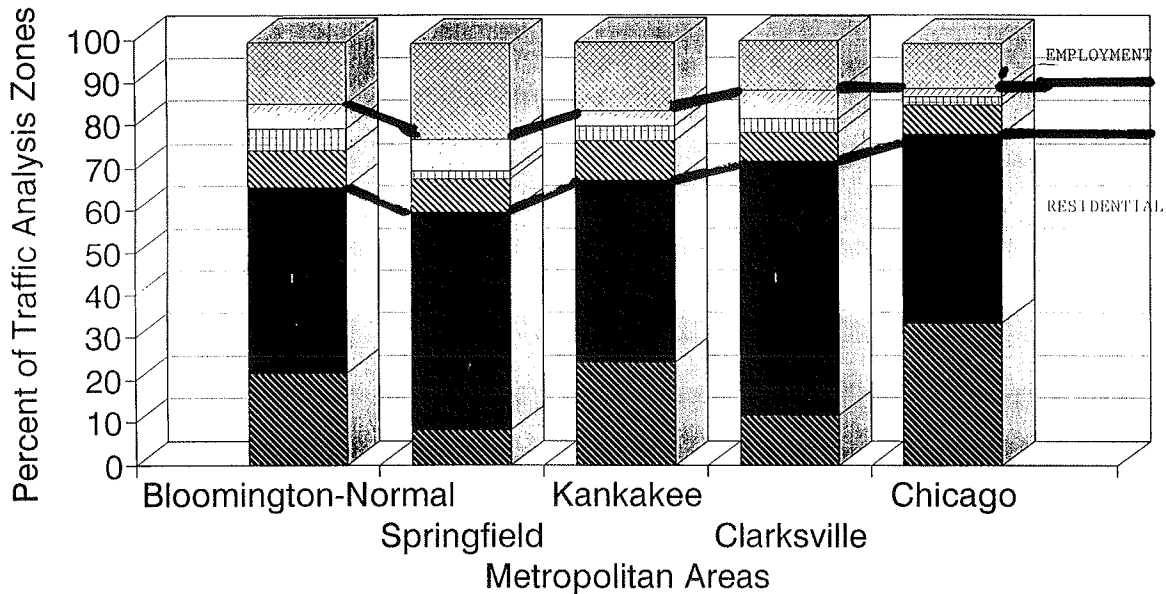


FIGURE 5 Percent of TAZs by employment-residence ratio, metropolitan areas, 1990.

vicinity of Peoria showed which counties exported workers and which counties imported them (10). Peoria County is the work destination for over 100,000 workers, only about 68 percent of whom live in the county. McLean County also imports workers.

Studies such as these are important in assessing the draw that each central county exerts on surrounding residents. This information is important for prospective employers in determining the size of the potential labor pool when siting a new facility. Data such as these are also useful in longitudinal studies of commutersheds and for transportation planning.

Inner-City Jobs Accessibility

The Woodstock Institute in Chicago is a public interest research organization that has studied a variety of problems confronting inner-city residents. Currently one of the major focus areas is the loss of jobs in manufacturing and related industrial sectors near the core of city. The CTPP has been used in several studies (11, 12) to examine how residents are adjusting to job losses in the central city and job gains in the suburbs. In one study the Institute focused on a select neighborhood (Noble) and studied both the source of workers and the work places of local residents using pie charts. The study area was found to be much more important as a source of workers than as a destination for local resident workers. In this study area traditional commuting from the suburbs to the city is still much more prevalent than is reverse commuting.

Robert Gray of Gray Data, who has used the 1970, 1980, and 1990 packages for a variety of studies, per-

formed much of the data processing for the Woodstock Institute. He is currently beginning another effort utilizing the CTPP, but it is too early to report his preliminary findings.

CONCLUDING REMARKS

In Illinois there has been a long tradition of CTPP use, starting with extensive utilization of the 1970 UTPP. The 1980 UTPP was used more extensively, and the 1990 CTPP is being used to address a wide variety of questions. There now is also the opportunity to use the census packages in longitudinal studies. Several of the studies cited here focused as much on the current patterns inherent in the 1990 data as they did on the changes since 1980. A major study is currently in progress examining the changes in travel patterns from 1970 to 1990. This study is especially promising since the 1980 UTPP data reflect a period of unusually high energy prices and therefore a mix of mode choices, particularly carpooling, which was not reflected in either the 1970 or 1990 travel behavior.

The planning packages represent the only data bases available in most metropolitan areas that use a consistent method of data collection and provide detailed travel and sociodemographic information on a small-area basis (TAZs). The next decennial census will add to the potential to conduct longitudinal studies.

Since the CTPP also includes sociodemographic information, it has been used by a large number of persons in the academic and research community. It has been used in two thorough studies of laborsheds in the

Chicago area, both of which used the 1980 and 1990 packages. It has been used to produce weights for the CATS Household Travel Survey and to produce a procedure for estimating survey response rates. In smaller metropolitan areas in Illinois, it has been used to study intercounty work trips and to assist in developing new definitions for metropolitan areas.

The CTPP has even been used by a not-for-profit organization to study target neighborhoods and the flow of workers in and out of these neighborhoods. Discussion of these efforts with the researchers indicated that their work would not have been possible without the availability of the CTPP or that their work would have had to be very different and would not have had the level of detail that allowed many of the conclusions to be drawn in these studies. The 1990 CTPP has been an exceptionally useful data source.

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