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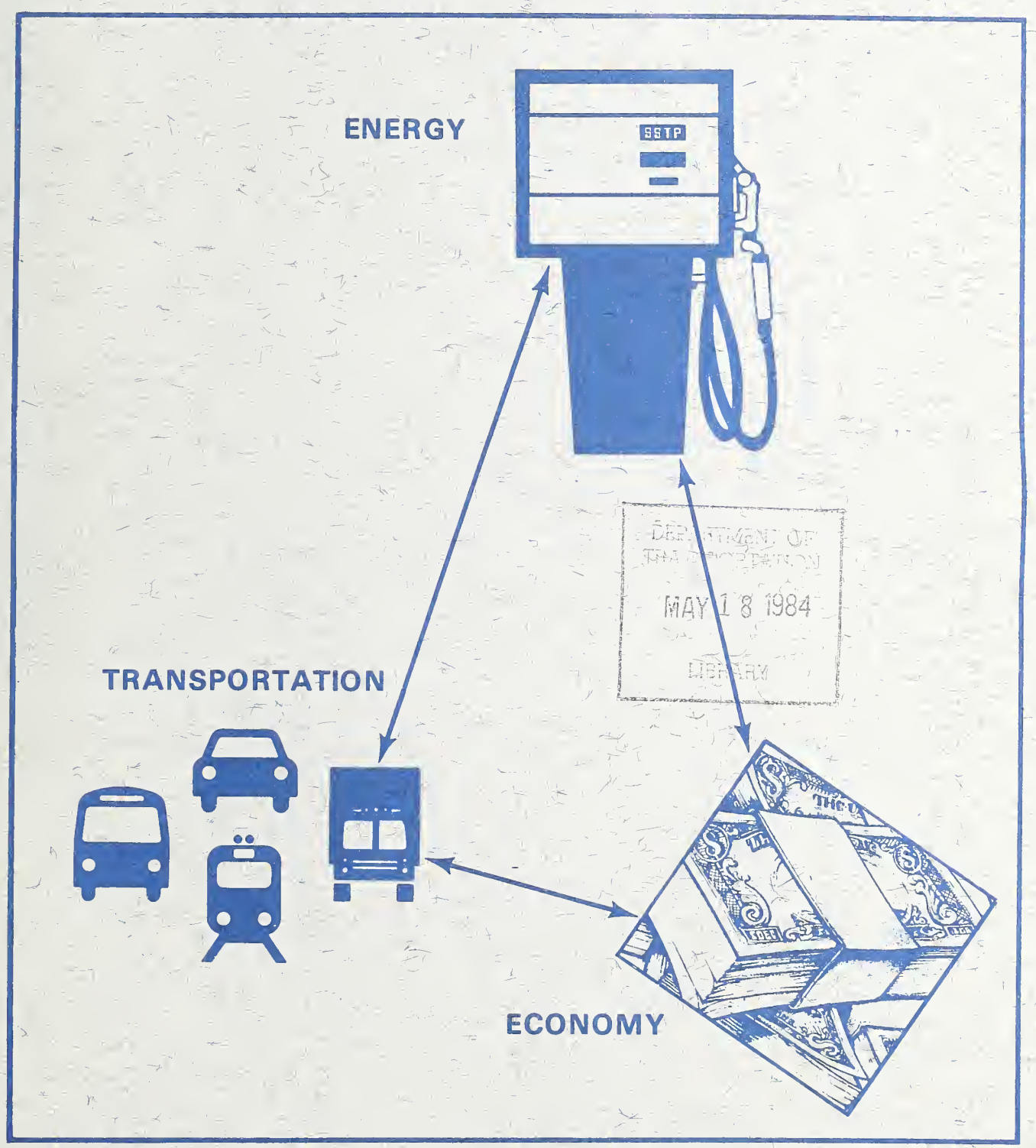
Estimating Transportation Energy Consumption of Residential Land Types

February 1983



Estimating Transportation Energy Consumption Of Residential Land Types

Final Report
February 1983

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210 Monona Avenue
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Prepared for
Federal Highway Administration
U.S. Department of Transportation
Washington, D.C. 20590

In Cooperation with
the Urban Mass Transportation
Administration and the
U.S. Department of Energy

DOT-I-83-26

FOREWORD

Like many mid-size urbanized areas in the Nation, Dane County, Wisconsin is experiencing moderate to rapid growth. Over the next 25 years, as many as 36,000 dwelling units are expected to be built. In light of their expected growth, the County is facing a dilemma between the need to encourage development in order to improve the local tax base and the need to maintain efficiency of travel in order to avoid overloading limited community resources.

In response to this issue, a methodology was developed which provides decision makers with information about the travel, fuel consumption and cost implications of residential land use development in various locations in the region. Funded jointly by the Department of Energy and the Federal Highway Administration and the Urban Mass Transportation Administration of the Department of Transportation, this study was designed to develop such methodology and to demonstrate its application in the land use and transportation decision making process.

Related reports are available on Scenario Planning, Transportation Energy Contingency Planning and Transportation Energy Management. Information on these reports is available from our offices. Additional copies of this report are available from the National Technical Information Service, Springfield, Virginia 22161. Please refer to DOT-I-83-26 on your request.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY

The Dane County Regional Planning Commission has undertaken a demonstration project to examine the relationships of residential land use development and transportation related energy consumption. The project was conducted for the Federal Highway Administration in cooperation with the Urban Mass Transportation Administration and the U.S. Department of Energy. In general, the project has been directed toward developing simple factors on transportation energy consumption per dwelling unit for differing residential land use densities and locations in Dane County, Wisconsin (Figure S-1). The process used to develop these factors is well documented so that other regions can replicate the process to produce factors specific to their area.

Another important objective of the project has been to develop a process to report these energy consumption factors and impacts to the public, local officials and implementing agency officials. The potential energy consumption resulting from new development is one factor which officials may wish to consider when reviewing proposals for new development. While there are a number of ways to report information and integrate that information into the decision-making process, the process used in the Dane County region for this demonstration project will be useful for those regions of the country whose situations are similar.

The Problem

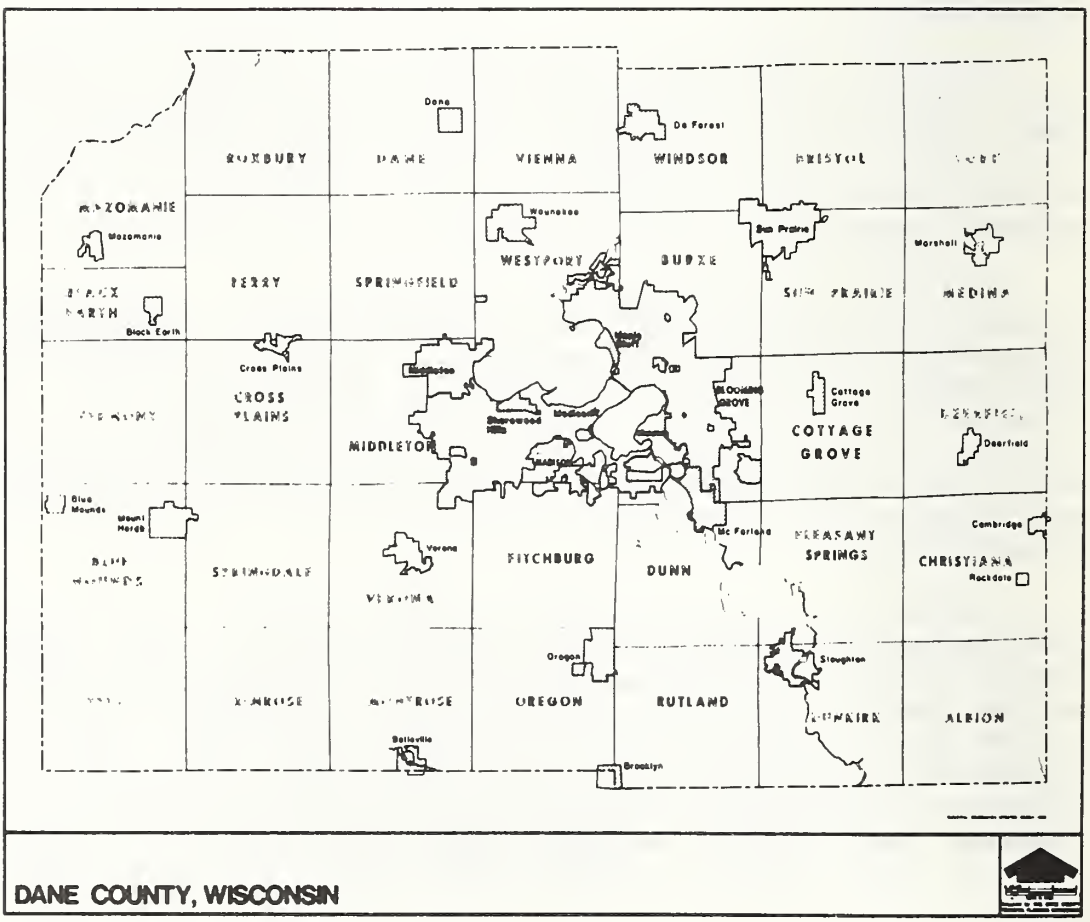
Efficient land use, characterized by compact development, conserves energy. The energy conserved as a result of such development, particularly that saved through fewer and shorter commuter trips, is a recurring benefit. Where land use is efficient, the energy consumption linked to transportation can be significantly reduced, especially in areas experiencing moderate to rapid growth.

Striving for more compact development is a desirable goal, but it has inherent political difficulties when it confronts the special interests of individuals, groups, or units of government who want development to occur in dispersed or sprawl locations. The problem faced by the Dane County Regional Planning Commission and other regions of the country is to be able to provide local decision-makers with the necessary information to make informed land use decisions about development, especially the impacts of dispersed development.

In arguing a case concerning the density and/or location of a controversial residential development project, the question is always asked about the impact of that development on the transportation system and energy consumption. The same question is also raised about smaller non-controversial projects. The impacts of dispersed development for regions like Dane County can be significant. Forecasts prepared by the Dane County Regional Planning Commission indicate that 36,000 dwelling units will be built in the next 25 years in Dane County. In the last nine years, the number of

Figure S-1

Location Map



DANE COUNTY, WISCONSIN

dwelling units built in dispersed or sprawl locations has ranged from a low of 9 percent to a high of 25 percent of the total such units built. Given this fairly large amount of projected development and the wide variation in density and distribution, it is clear that considerable energy could be saved or lost as the result of future land use decisions.

Given this local problem which is national in scope, there is a need to formulate a process for developing simple factors in estimating transportation energy consumption by dwelling unit type and location in a region. Also, since scattered development tends to occur incrementally over a wide area and through a diffused decision-making process, there is also a need to provide properly organized and accessible information on the energy implications of scattered development in order to generate support for energy efficient land use choices in the decision-making process.

Project Approach and Methodology

To estimate the transportation energy implications of residential development, the vehicle miles traveled (VMT) from that development was calculated for each individual unit of government in Dane County. The VMT incorporates the trip frequency and the associated trip length for vehicular trips made by occupants of single and multi-family dwelling units for any given location in the county.

The results have been applied to actual residential land use development using building permit and land subdivision data for Dane County. Communities and individuals within the region can use this information to predict vehicle miles traveled, gallons of fuel consumed and the cost of that fuel to the consumer for single family and multi-family development in their specific area.

The methodology involved ten basic steps which included: defining the overall study area, defining subareas, determining the average number of household trips by dwelling unit type in each subarea, determining the average trip length for each household type, calculating the resulting VMT, applying the VMT factors to the existing fleet of vehicles and the estimated miles per gallon (MPG) rating, estimating the gallons of fuel consumed, converting gallons to BTU's, determining density and transportation energy relationships, and developing a system for tracking transportation energy consumption trends from residential development (See Figure S-2).

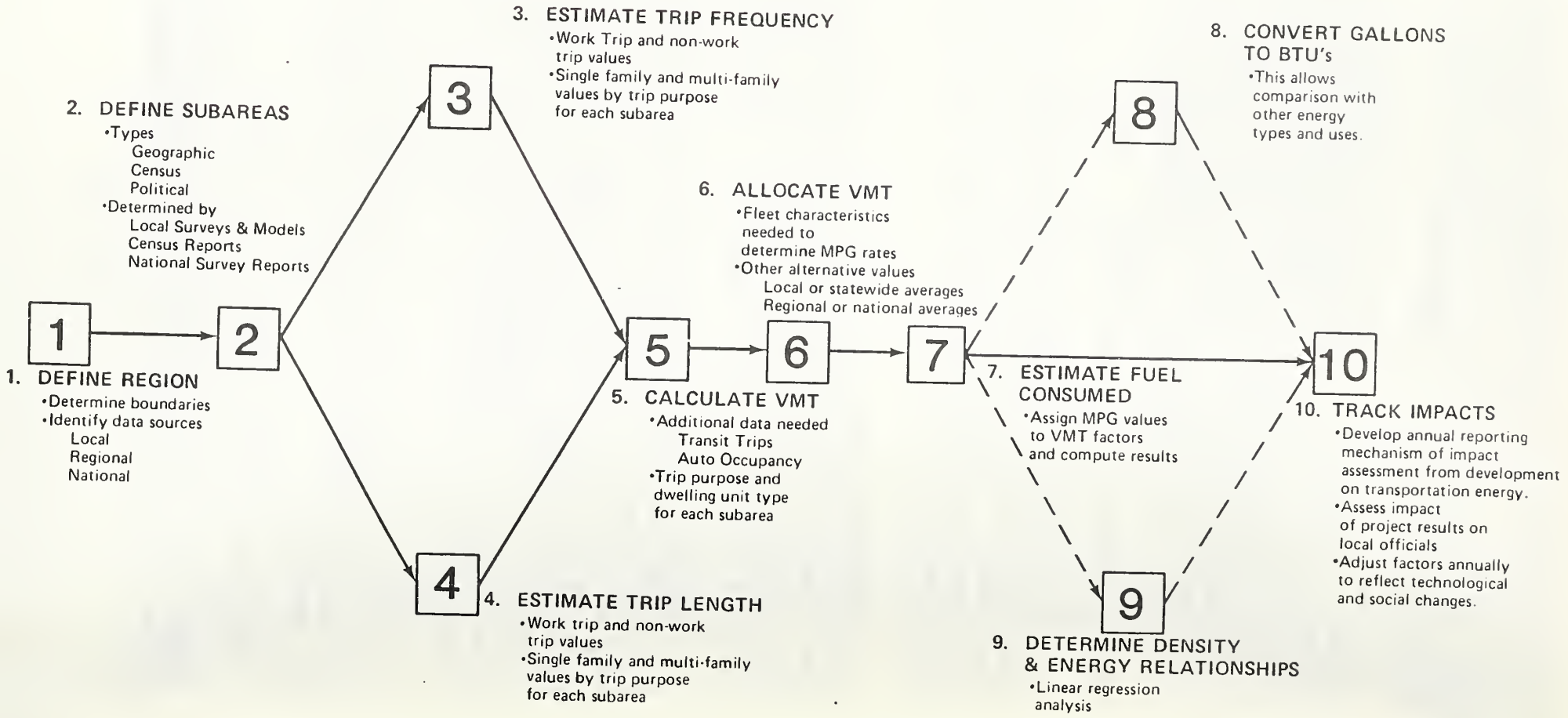
This tracking system will regularly report vehicle miles traveled, gallons of fuel consumed and cost information to the public and local officials. This will help increase the awareness and comprehension of the transportation energy implications of land use decisions.

Findings and Observations

The results available include trip frequency rates, average trip length, annual vehicle miles traveled, the resulting gallons of fuel consumed and costs of that fuel. These factors are provided

Figure S—2

Flow Chart of Methodology



for single family and multi-family dwelling units. The data is presented in two different categories: community class (towns, villages, 4th class cities, and the City of Madison), and geographic area (rural, satellite communities, central urban area).

Trip Frequency. In comparing trip frequency rates by geographic area, the following relationships have been found:

1. For all housing types there are approximately three times as many non-work as work trips made per household each year.

2. Rural residents of the county make more work trips per year than their urban counterparts. However, they make significantly fewer non-work trips than urban residents, resulting in fewer total trips made.

3. Residents of satellite communities fall in between the range of trips made by residents of households in rural and urban areas.

Trip Length: For the same geographic areas, the following observations were found:

1. For either commuter or non-work related trips, the trip length is longer when made by residents of rural areas than for residents of satellite communities and urban areas.

2. People living in single family homes in urban areas make longer work trips than those living in multi-family homes in urban areas.

3. People living in single family homes in urban areas drive shorter distances when traveling for non-work purposes. The same situation occurs for residents of single family homes in the rural area.

Vehicle Miles Traveled, Energy Consumed, Energy Costs. Tables S-1 through S-4 present the VMT and resulting energy factors which have been calculated from the above data. Countywide, residents of each dwelling unit travel an average 10,448 miles per year and their vehicles consume 646 gallons of gasoline at an annual cost of $788.

Tables S-1 and S-2 show annual VMT and energy factors for each class of community per dwelling unit (Table S-1) and the total for each community class (Table S-2). Table S-1 indicates that compared to households located in the City of Madison, the average household in the cities of the fourth class (generally populations of 10,000 and under), travels 36 percent more, and consumes and spends 17 percent more than Madison households. Village residents travel two and one half times further, and consume and spend twice as much as households in the City of Madison. Residents in towns travel three times further than residents in the City of Madison and consume a little

over two times the amount of gasoline. The households in towns and villages are close to being the same in the amount of gasoline consumed on a per dwelling unit basis even though households in towns travel slightly further. This is due to slightly higher miles per gallon (MPG) efficiencies for those living in towns.

Table S-2 shows the figures for total annual VMT for each category. The results show that town residents are responsible for 31 percent of the region's total travel and consumption of fuel. Madison residents hold the highest share at 43 percent. Residents of villages and cities of the fourth class are nearly equivalent in their respective shares of VMT/gallons of fuel consumed (14 and 12 percent respectively).

Comparisons of travel and transportation energy consumption by geographic area are presented in Tables S-3 and S-4. Table S-3 indicates that the average satellite community household travels two times further and consumes one and one half times more fuel than households of the central urban area. Households located in rural areas travel three and one half times further and consume two and one half times more fuel than households in the Madison area.

Table S-3 indicates, however, that due to the total number of dwelling units located in each area, the central urban area is responsible for 59 percent of the total VMT and gallons consumed, followed by 25 percent for the towns and 16 percent for satellite communities. Overall, households in multi-family dwelling units travel 48 percent less than households in single family homes, depending on their location in the county.

On a per person basis, Table S-5 shows that households in villages and towns are about the same in the number of miles traveled which is a little over two times the number of miles traveled by each person in the City of Madison. Each person in the 4th class cities travels about 30 percent more than someone residing in Madison.

The factors provided in these results have been aggregated by community type. Individual factors for each unit of local government in the county are provided in the full report. A separate summary was also prepared for distribution in the region which not only lists all the factors for easy reference by local officials, but also provides examples on how to use the factors.

Awareness Levels. In order to evaluate the success of the efforts to inform local decision-makers on the results of this demonstration project, a "before and after" survey of 337 key officials was performed. The "before" survey was designed to assess the officials' perceptions of transportation/land use energy consumption relationships prior to receiving information from the study. The "after" survey was conducted on the same group of officials following the release of the study results to assess the success of the reporting methods to disseminate the information and influence prior perceptions. The survey shows that the overall level of awareness increased by 20%. This is a significant increase given the short amount of time that the decision-makers were exposed to the project's results. Being

aware of the effects of the type and location of development on transportation energy consumption is one of the first important steps in moving toward informed land use decisions. It is also important to stress that land use decisions will not be made solely on transportation energy costs, but rather on a whole range of factors of which transportation energy costs is one important part.

Goal Accomplishment. The project achieved the goals that it set out to accomplish. A process for estimating detailed and generalized transportation energy factors by dwelling unit type and location in the region was developed. That process is directly transferrable to other regions. In addition, the reporting methods used by the DCRPC to convey the factors and track the impacts is showing a positive result on local officials involved in land use decisions. Finally, as a demonstration project, there were no serious setbacks or major difficulties in accomplishing the stated objectives. Minor problems on data availability were encountered, but procedures to overcome them were found and are documented in the main report and in the technical appendices.

Table S-1

VEHICLE MILES TRAVELED, GALLONS, AND COST PER DWELLING UNIT PER YEAR
BY COMMUNITY CLASS

CATEGORY	VMT/D.U./YR.			GALLONS/D.U./YR.			COST/D.U./YR.		
	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.
Towns	21,429	12,175	19,285	1,134	644	1,020	1,383	786	1,244
Villages	18,107	12,619	16,790	1,016	700	944	1,240	854	1,152
4th Class Cities	10,388	7,156	8,991	642	464	567	783	566	692
City of Madison	7,876	5,591	6,622	575	408	483	702	498	589
DANE COUNTY	13,216	6,917	10,448	793	458	646	967	559	788

Table S-2

TOTAL VEHICLE MILES TRAVELED, GALLONS, AND COST PER YEAR
BY COMMUNITY CLASS

CATEGORY	TOTAL VMT/YR.x10^6			TOTAL GALS./YR.x10^6			COST/YR.x10^6			
	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	PERCENT
Towns	405.2	79.7	484.9	21.4	4.2	25.6	26.1	5.1	31.2	31
Villages	170.0	37.6	207.6	9.5	2.1	11.6	11.6	2.5	14.1	14
4th Class Cities	105.6	52.6	158.2	6.5	3.4	9.9	8.0	4.2	12.2	12
City of Madison	254.4	224.1	478.5	18.6	16.4	35.0	22.7	20.0	42.7	43
DANE COUNTY	935.2	394.0	1,329.2	56.0	26.1	82.1	68.4	31.8	100.2	100
% of Total	70%	30%	100%							

Table S-3

VEHICLE MILES TRAVELED, GALLONS, AND COST PER DWELLING UNIT PER YEAR
BY GEOGRAPHIC AREA

CATEGORY	VMT/D.U./YR.			GALLONS/D.U./YR.			COST/D.U./YR.		
	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.
Rural	26,669	19,228	25,142	1,411	1,017	1,330	1,721	1,241	1,623
Satellite	15,915	10,048	14,097	842	532	746	1,027	649	910
Central Urban	9,076	5,502	7,267	662	402	530	808	490	647
DANE COUNTY	13,216	6,917	10,448	793	458	646	967	559	788

Table S-4

TOTAL VEHICLE MILES TRAVELED, GALLONS, AND COST PER YEAR
BY GEOGRAPHIC AREA

CATEGORY	TOTAL VMT/YR.x10^6			TOTAL GALS./YR.x10^6			COST/YR.x10^6			
	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	PERCENT
Rural	313.1	76.9	390.0	16.0	4.1	20.1	19.6	5.0	24.6	25
Satellite	201.1	56.9	258.0	10.0	3.0	13.0	12.2	3.6	15.8	16
Central Urban	421.0	260.2	681.2	30.0	19.0	49.0	36.6	23.2	59.8	59
DANE COUNTY	935.2	394.0	1,329.2	56.0	26.1	82.1	68.4	31.8	100.2	100
% of Total	70%	30%	100%							

Table S-5

VEHICLE MILES TRAVELED, GALLONS, AND COST PER CAPITA PER YEAR
BY COMMUNITY CLASS

CATEGORY	1980 Population	VMT/YR./PERSON	GALLONS/YR./PERSON	COST/YR./PERSON
Towns	74,545	6,505	343	419
Villages	33,940	6,117	342	415
4th Class Cities	44,444	3,560	223	275
City of Madison	170,616	2,805	205	250
DANE COUNTY	323,545	4,108	254	310

Note:

(35) Towns: 1980 Population Range -- 406 - 11,973; Average Population = 2,130
(19) Villages: 1980 Population Range -- 250 - 3,876; Average Population = 1,786
(5) 4th Class Cities: 1980 Population Range -- 3,336 - 12,931; Ave. Pop. = 8,889
City of Madison: 1980 Population = 170,616
Dane County: 1980 Population - 323,545

Prepared by Dane County Regional Planning Commission
February 1983

CHAPTER 1

INTRODUCTION

The Dane County Regional Planning Commission, in cooperation with the U.S. Department of Transportation (USDOT), and the U.S. Department of Energy (USDOE), has undertaken a special demonstration study to examine the relationship of residential land use and resulting transportation related energy consumption. This project was funded by USDOT and USDOE along with several other demonstration projects around the country under the title of "Development and Application of Demonstration Projects to Incorporate Energy Conservation in Urban Transportation Planning and Decision-Making."

The focus of this study is to demonstrate a methodology to better integrate transportation energy conservation into the land use implementation decision-making process. The study is designed to address the need for readily usable information which would permit local officials to assess the transportation energy implications of past, current and future land use decisions. The approach is to develop factors for simple calculation of transportation energy consumption for residential land use types of differing densities and locations in the region. These factors will then be applied to actual residential land use development in the region using building permit and land subdivision development data. The project is designed to develop a method for regularly reporting this energy consumption information to the public and to local officials to help increase their awareness and understanding of the transportation energy implications of their land use decisions.

Study Area

The project demonstration area is Dane County, a single county SMSA of 320,000 population. The County is located in south central Wisconsin and has a land area of 1,200 square miles. FIGURES 1-1 and 1-2 illustrate the geography and location of Dane County. The County contains 60 local units of government, including 35 towns, 19 villages, and six cities. The cities include Madison, a city of the second class[1] and five cities of the fourth class[2]. The county is governed by a 41-member county board of supervisors and an elected county executive. Each local unit of government also has its own elected governing body and some have appointed planning committees.

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[1]Wisconsin Statutes [62.05(1)] define cities of 39,000 and less than 150,000 population shall constitute cities of the second class. Although the city of Madison qualifies as a city of the first class (population over 150,000), the city has not officially pursued a change in class status as further specified by law.

[2]Wisconsin Statutes [62.05(1)] define cities of 10,000 population and under as cities of the fourth class.

FIGURE 1-1
STATE OF WISCONSIN

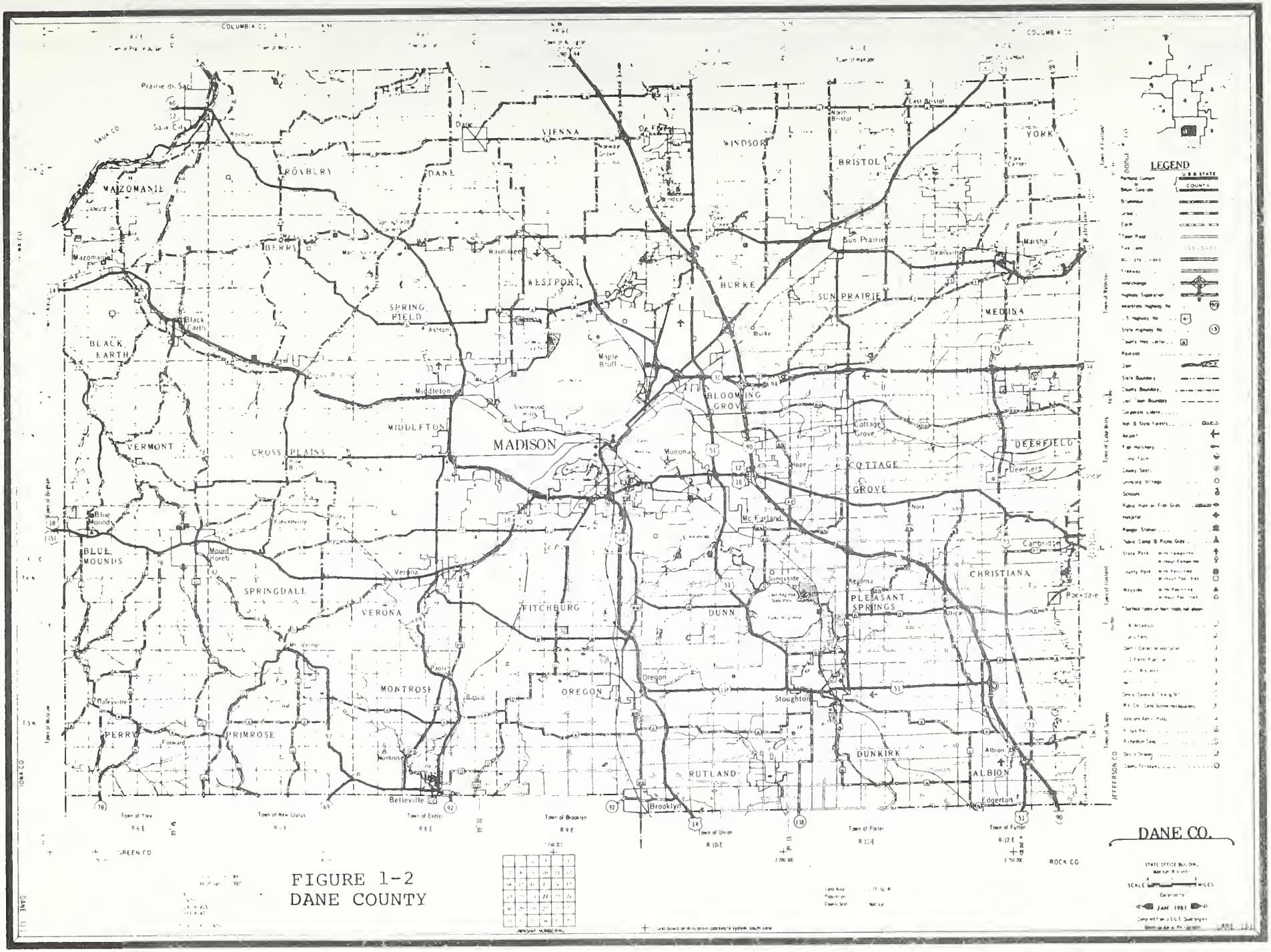

FIGURE 1-2
DANE COUNTY

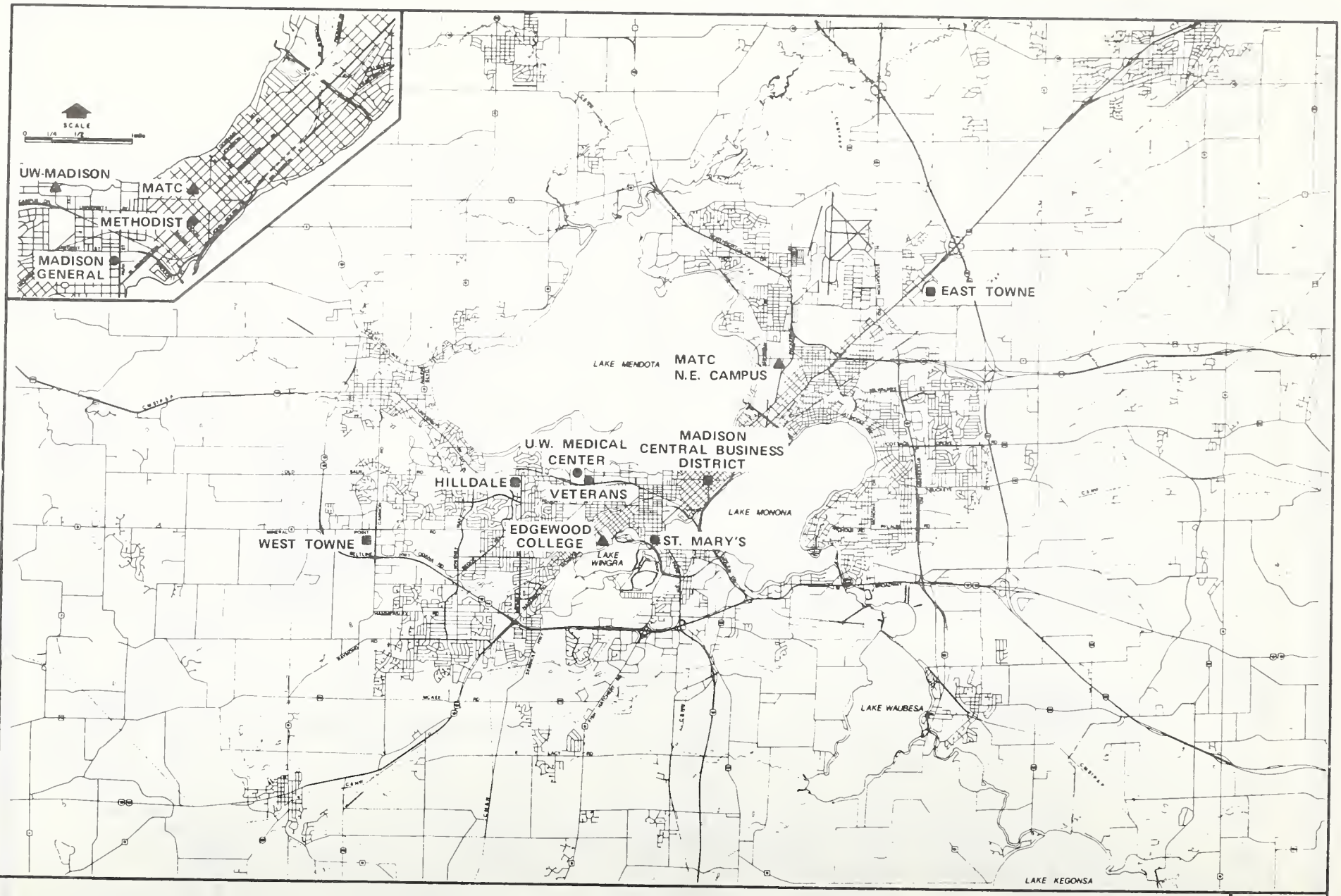

FIGURE 1-3
MAJOR ACTIVITY CENTERS

In addition to the central city, the region contains a diversity of settlement types including both newer and older suburban, urban fringe, satellite centers and rural farm areas. FIGURE 1-3 illustrates the activity centers in the Madison urban area. The central city is the most concentrated activity center containing the central business district, state capitol and University of Wisconsin. Other important activity centers in the urban area include the two regional shopping centers of East Towne and West Towne.

The transportation system in the County involves all modes: streets and highways, transit and paratransit, rail, bicycle, pedestrian and air. The two modes involved in this study are automobiles and public transit. The Madison urban area has public transit service provided by Madison Metro. Approximately 90 percent of Madison's urban area lives within one-quarter mile of one or more Metro routes.[3]

In addition to serving the City of Madison, Madison Metro serves the other urban area communities of Middleton, Monona, Shorewood Hills, and the Towns of Madison and Fitchburg. Metro also operates shuttle routes on the University of Wisconsin campus. Madison students in grades 6-12 who are not served by regular Metro routes are served by Metro's supplemental school routes. Demand responsive service is provided for the elderly and handicapped by E/H Buses, which is owned by the City of Madison and operated for the City by E/H Bus Team, Inc.

Scheduled service from communities outside the urban area is provided for commuters by private transit operators. Commuters Service, Inc. provides peak hour service between Madison and Evansville, Brooklyn, Stoughton, Oregon, McFarland, Verona and Belleville. Lodi, Dane and Waunakee are served by Blackhawk Coaches, Inc., providing peak hour service between these communities and Madison. Recent reports have indicated the per capita transit ridership in the Madison urban area is much higher than would normally be expected for an area its size.[4] The heaviest use of transit is for peak hour work trips.

Although transit ridership is relatively high, the majority of all trips in the County are taken by automobile. Auto availability to residents of the County has steadily increased over the years. From 1970 to 1981, per capita auto registration rose from .397 to .520 for all of Dane County; and from .400 to .556 for the City of Madison.[5] Because the majority of the County's population resides within the urban area it is not surprising that much of the County's

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[3]Dane County Regional Planning Commission, 1982-1986 Transit Development Program for Madison Urban Area, 1982, p. G-11.

[4]Ibid, p. A-1.

[5]Dane County Regional Planning Commission, 1981 Regional Trends, April, 1982, p. 42.

daily travel is focused on the urban area. Travel in the outlying areas of the County is concentrated on a relatively small number of major corridors which generally radiate outward from the Madison urban area. A regular traffic count program over the past several years has indicated that Madison volumes have generally increased on the outlying arterial streets and roadways while volumes have decreased through central Madison.[6] This trend is in keeping with the policy to stabilize traffic through the central isthmus area and to redirect long distance through traffic around the periphery of the urban area as expressed in the Regional Transportation Plan for Dane County.

Construction of new roadway facilities is mainly limited to local streets providing access to new development. Recent construction projects have also included the reconstruction of several major arterial roadways to accommodate increased traffic volumes. Greater emphasis is being placed on the maintenance of the existing transportation facilities as the system begins to age. Over the past few years, roughly 35-40 percent of total community costs for transportation in the County has been for maintenance of existing facilities. Although financial and engineering assistance is available from the State and Federal governments on the majority of roadway projects, the major responsibility for construction and maintenance rests with the County and local units of government.

Status of Planning in the Region

Comprehensive planning and transportation planning have existed in the Madison urban area and Dane County for many years. The Dane County Regional Planning Commission was established in 1968 to include the geographic area of Dane County, and is recognized as the areawide planning organization for this area and serves as the A-95 metropolitan clearinghouse. The Regional Planning Commission has adopted plans in the areas of land-use, farmland preservation, transportation and environmental resources. These plans are reviewed annually and updated as needed.

In addition to the Regional Planning Commission, the City of Madison and other local units have active planning programs under way. As of early 1982, 33 of 35 towns in the County had adopted land-use plans and 25 had adopted exclusive agricultural zoning. Local governments have also approved 22 of the 25 urban service areas (USAs) proposed in the County land-use plan.[7]

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[6] Ibid, p. 42.

[7] Urban Service Areas--are those areas adjacent to existing communities determined to be most suitable for expanded urban development. The intent is to designate the most appropriate location for future development at urban densities that will ensure the efficient and economical provision of a full range of urban services. All individual development proposals are evaluated against the full policy recommendations of the Land Use Plan.

The Regional Planning Commission serves as the transportation planning policy body for the area as the designated metropolitan transportation planning organization (MPO) for Madison and Dane County. Transportation planning has been actively underway in the area since 1961. The Regional Transportation Plan for Dane County (RTP), which updates earlier plans, was adopted by the commission in 1978 and is reviewed annually. The plan addresses the total transportation system including streets and roadways, transit, paratransit, bikeways, pedestrians, rail and air transportation. Special transportation studies in each of these areas have also been conducted following adoption of the RTP.

To aid the commission on transportation planning and other matters, it has formed two advisory committees: an RPC Citizen Advisory Committee composed of representatives of major interest groups in the area; and a Transportation Technical Coordinating Committee composed of representatives of transportation and planning agencies in the area. Additional ad hoc committees are formed from time to time for specific issues or planning efforts. The organizational structure of the commission's transportation planning, entitled "Dane County Transportation Study," is shown in FIGURE 1-4.

The Transportation Energy Situation in the Region

Concern over the high consumption of energy for transportation has been expressed for many years as evidenced by the desire to improve fuel efficiency of our vehicles. That concern substantially increased with the oil embargo of 1973-74 and the Iranian crisis in 1979 resulting in gasoline shortages. When compared to other urban areas, Dane County was mildly affected by both the 1973-74 and 1979 fuel crises. The supply and cost problems existed, but with the exception of striking truck drivers, there did not seem to be many problems.

Data indicates local travel habits did change, particularly during the 1973-74 crisis. The average weekday traffic volume counts taken by the City of Madison were down significantly reversing a trend toward higher traffic volumes.[8] Although traffic volumes again increased immediately following resolution of the crises, in the past five years traffic volumes at all counting locations have generally decreased from two to five percent.[9] Transit ridership has steadily increased in the Madison urban area during the period as well. Since 1971 Metro ridership has increased at an annual average rate of 7.7 percent.[10]

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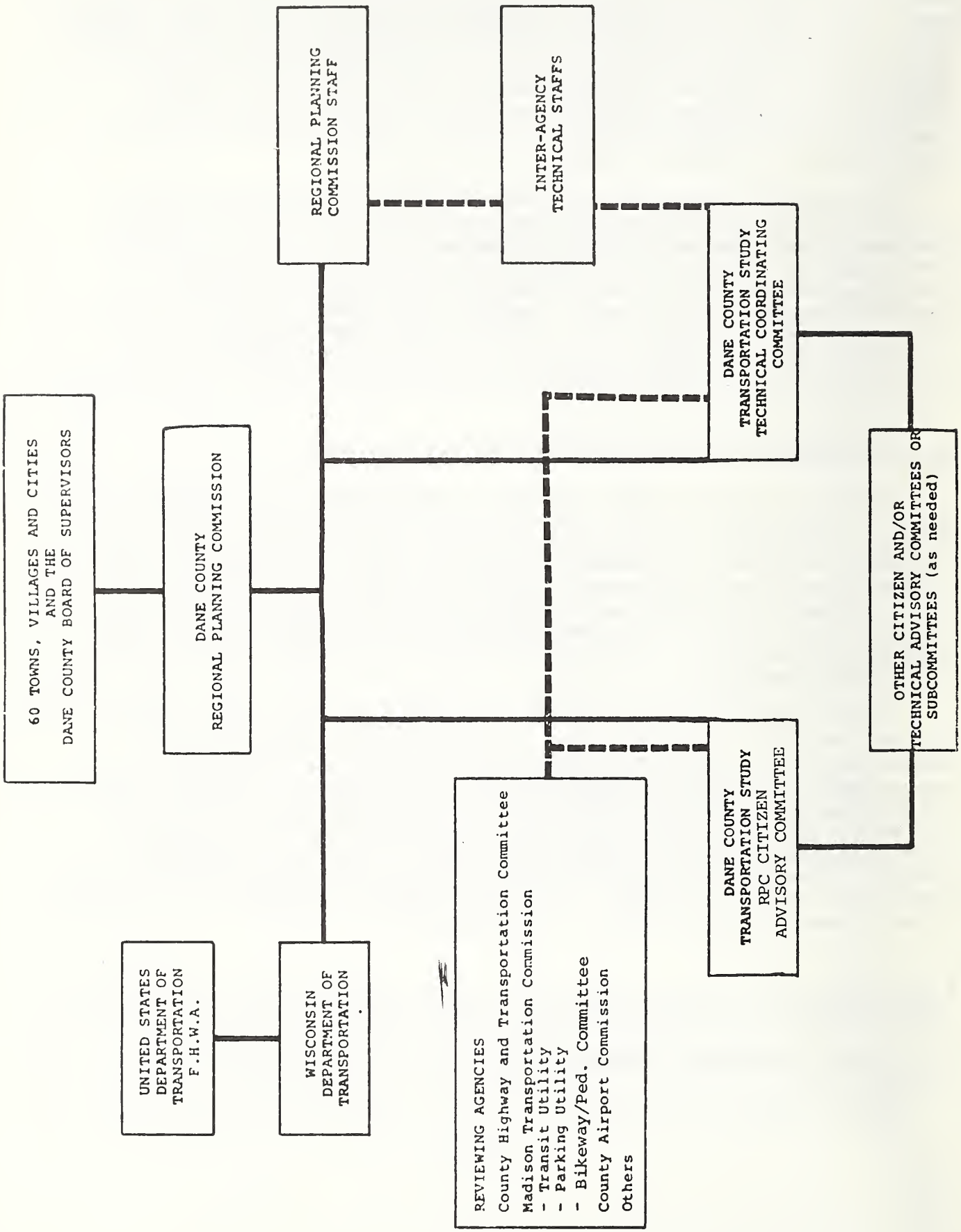
[8] City of Madison, Department of Transportation Traffic Volume Data, 1971-76.

[9] Dane County Regional Planning Commission, 1981 Regional Trends, p. 42.

[10] Ibid, p. 40.

FIGURE 1-4
DANE COUNTY TRANSPORTATION STUDY
ORGANIZATION STRUCTURE



Fuel consumption data specific to Dane County is not available for the period. All currently available fuel consumption data is on a statewide basis. The Wisconsin Department of Transportation has reported that, statewide, gasoline and diesel fuel consumption increased steadily from 1970 to 1979 with the exception of 1973-74. The trend reversed in 1979 and fuel consumption has been decreasing steadily since that time. This trend is due to improved fuel efficiency of the vehicle fleet as relative travel has not decreased as significantly.[11]

Efforts to promote energy conservation over the years in Dane County include increased support for mass transit, a multi-faceted ridesharing program, staggered work hours program for government workers, energy conservation manuals for local governments and regional planning commissions, a transportation energy conservation program for the area and a transportation energy contingency program. This Transportation Energy Conservation Project is designed to be an additional means of promoting energy conservation by increasing awareness of the effect of the type and location of residential development on transportation energy consumption.

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[11] Wisconsin Department of Transportation, Wisconsin Traffic Trends, January, 1982.

CHAPTER 2

SUMMARY OF PROBLEM AND PROJECT OVERVIEW

Population and Dwelling Unit Trends

Efficient land use, implying compactness of development, is energy efficient development. Energy conservation gained as a result of good land use development, and particularly gains obtained by minimizing the journey to work, tend to be recurring benefits which can be realized day after day, and year after year. While there are other energy implications to land use in addition to those linked to transportation (e.g., heating energy savings through multi-family construction, etc.), there can be little doubt that promoting efficient land use can significantly reduce transportation energy consumption, particularly for areas experiencing moderate to rapid growth. It is also realized that the decision on where development takes place is based on a whole range of factors of which transportation energy costs is one important factor.

For Dane County, the major population trends of the 1970s is continuing into the 1980s. The towns (townships) and outlying communities are growing, while Madison and its adjacent cities and villages are generally remaining stable or declining (see FIGURE 2-1). The towns which contained 19.5 percent of the County's population in 1970, now contain 23.4 percent.

Another trend of the last decade continuing into the next is the decline in household size. Countywide, the average population per dwelling unit rests at 2.54, down from 3.14 in 1970 (see FIGURE 2-2). The smaller household size in the 1980s means that residential development must proceed faster than population growth.

DCRPC forecasts indicate that 36,000 new dwelling units will be built in the next 25 years in Dane County. In the last nine years, the number of new dwelling units (DUs) built in dispersed (sprawl) locations have ranged from nine percent to a high of 25 percent as a percent of total DUs built (see FIGURE 2-3). Given this fairly large amount of projected development and the wide variation in density and distribution, considerable energy could be saved or lost as a result of decisions being made now and in the future.

Scattered development, because of its nature, tends to occur incrementally, over a wide area, and through a diffused decision-making process. The information on the energy implications of scattered development if properly organized and utilized could go a long way in marshalling support for energy efficient land use implementation decision-making.

FIGURE 2-1

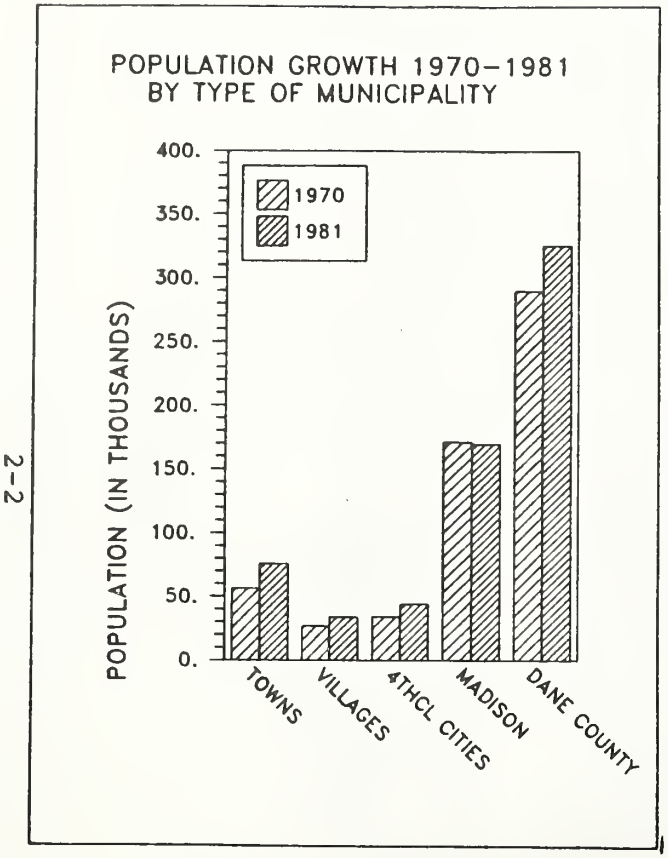


FIGURE 2-2

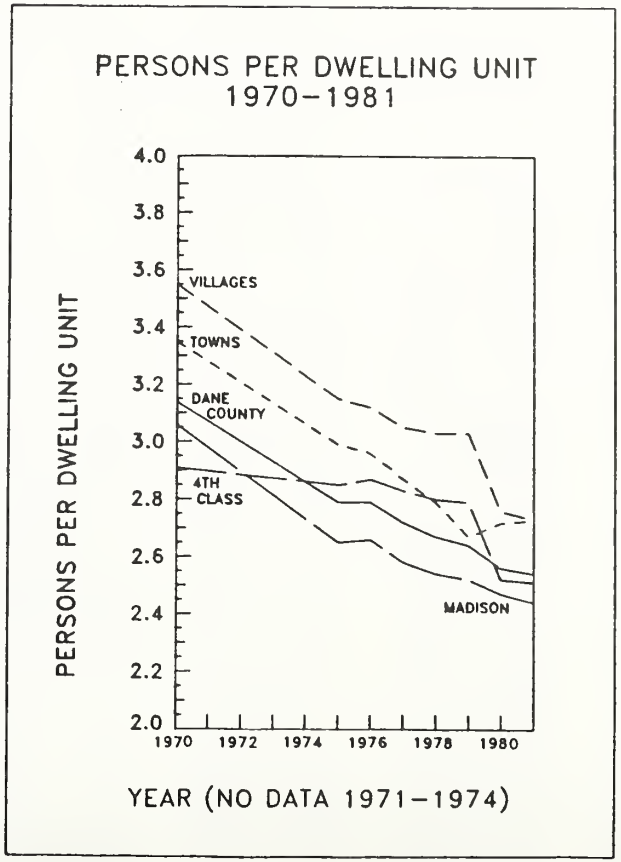
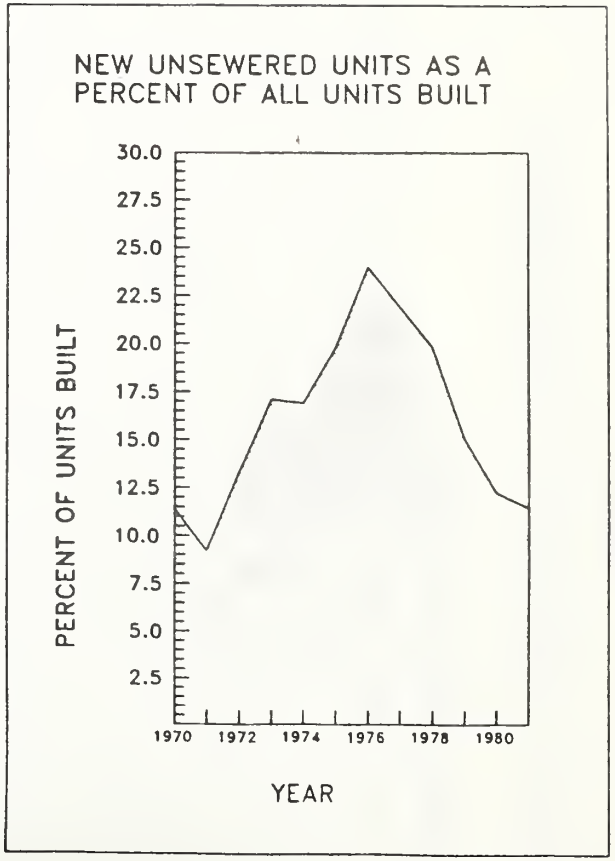


FIGURE 2-3



Prepared by Dane County Regional Planning Commissio
November, 1982

Thus, there is a specific need for readily usable information which would permit officials to assess the transportation energy implications of past, current and future land use decisions in Dane County. There is also a need to develop an easy reporting process that relates in a timely way to the public, to elected officials and to implementing agency officials the energy consequences of land use decisions. In the final analysis, it is public opinion followed by political decision-making which is likely to result in any significant change.

Experience of Other Regions

A review of the current literature indicates that the need to seek more energy efficient land use patterns through compactness is a matter of widespread interest and certainly not unique to Dane County, Wisconsin, as described in the following four examples:

1. Santa Clara County, California[12], is a region where past low density residential zoning has created a problem such that if local land use trends are allowed to continue unchecked, the average commuting distance to work is projected to increase within the range of 12.6 percent and 13.3 percent by 1990 depending upon whether the trip origin is inside or outside the county. Currently, 99 percent of all vehicle miles traveled are made by automobile.

2. In Portland, Oregon[13], 90 percent of Portland's residential land is zoned for single family use; six percent is zoned for duplexes and townhouses; three percent is zoned for medium-density apartments and one percent is zoned for high-density apartments. Residents of an average Portland single family household in 1975 traveled 12,228 miles. The typical single family household in outlying areas traveled 15,100 miles. By 1995, the annual miles traveled by the average single family household both in central Portland in outlying areas of the SMSA is expected to increase by 22 percent. It is noted that in Portland, residents of apartments travel 20 percent less than persons in single family households.

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[12] Peter G. Flachsbart, "Transportation Energy Conservation: Policy Analysis at the Community Level," Community Energy Planning, Defining Achievable Alternatives, Workshop Papers of the American Institute of Planners Energy Task Force, Annual Meeting, September 28-30, 1978, New Orleans, La., p. I-15.

[13] Energy Conservation Choices for the City of Portland, Oregon Volume 3B, Transportation and Land Use Conservation Choices, by Policy Analysis Section, Bureau of Planning, Portland, Oregon; U.S. Government Printing Office, September, 1977, pp. 12 and 18.

3. In a study of the Washington, D.C. Metropolitan Area[14], which compared energy consumption of future development according to several development scenarios ranging from "Dense Center" to "Sprawl," found that energy consumption in the "Sprawl" alternative increases by 46 percent from the base year, while the "Dense Center" alternative increases by 34 percent. In other words, for the households added to the housing stock of the metropolitan area between now and the forecast year, about one-third of the energy consumed in the "Sprawl" alternative could be saved by building at higher densities.

4. In the Metropolitan Toronto Area[15], residential land occupies about 28 percent of the total developed land and consumes about 35 percent of the total energy. Changes in the distribution and density of residential land would involve about one-third of the area's total energy. If residential energy consumption could be reduced by half, it would result in about a 17 percent reduction in areawide energy consumed.

All of these examples suggest that higher density housing requires less energy than residential land under sprawl conditions. In general this is true, but there is a point at which energy benefits begin to fall off and can even be reversed as density increases. According to Duncan Erley et al[16], this threshold is the result of the added energy costs of providing elevator service and general services to high-rise buildings. These studies indicate that medium-intensity development (mid-range multiunit housing types) in individual projects and communities is more efficient.

Despite the different views in the literature, some generalizations can be made:

1. Higher residential densities tend to relate to lower energy consumption;

2. Single family detached homes tend to consume more energy than low-rise, attached, and multistory housing;

3. Increases in residential density may create opportunities to increase the efficiency of electrical and mechanical systems;

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[14] James S. Roberts, "Energy and Land Use: Analysis of Alternative Development Patterns," Environmental Comment, Urban Land Institute Research Division, September, 1975, p. 6.

[15] Herbert S. Levinson and Harry E. Strate, "Land Use and Energy Intensity," Transportation Research Record 812, 1981, p. 70.

[16] Duncan Erley, David Mosena, and Efraim Gil, "Energy-Efficient Land Use," Planning Advisory Service Report No. 341, The American Planning Association, Chicago, Il., May, 1979, p. 8.

4. Higher density housing units tend to be smaller than single family houses and thereby require less energy for heating and cooling; and

5. High density living often means greater public transport use and lower automobile use.

Project Objectives to Address Problem

Dane County not only shares in the common problem of dispersed development as found in other regions of the country, but it also lacks (a) readily usable information which would permit officials to assess the transportation energy implications of past, present and future land use decisions, and (b) an easy reporting process which conveys to the decision-maker the energy consequences of land use decisions.

To address these problems, the project has identified several objectives which it seeks to achieve:

1. To develop and demonstrate a methodology to better integrate transportation energy conservation into the land use implementation decision-making process;

2. To develop simple factors on transportation energy consumption per dwelling unit for differing residential land use densities and locations;

3. To develop these factors in a manner that other regions in the country can develop comparable factors for their area;

4. To develop an annual public information reporting system to bring this information to the attention of the public as well as local elected and agency officials;

5. To develop, in time, an improvement of local land use decision-making by increasing the awareness and understanding of local decision-makers of the transportation energy implications of their decisions; and

6. To provide information which can aid in conserving transportation energy in the Dane County region.

Role of Regional Planning Commission in Land Use Decision-Making Process

The objectives stated above point out that the Regional Planning Commission seeks to incorporate the results of this project into the land use decision-making process. To better understand how this will be done, this section will provide a brief overview of the role of the commission in this process.

It was pointed out in Chapter 1 that the Dane County Regional Planning Commission is a comprehensive areawide planning agency organized in 1968 under the regional planning enabling legislation of the Wisconsin Statutes (Section 66.945). Dane County and all 60 local units of government are represented on the DCRPC. The Commission is composed of eleven members chosen by the elected officials of the towns, villages, cities and the county governments. Six of the eleven members are County Board Officials.

The DCRPC activities are directed toward a broad range of planning and coordination efforts, and the Commission has prepared and adopted a fairly complete system of plans and programs for the physical development of the region. Current emphasis is placed on implementation seeking actions. A key plan in this system of plans is the Land Use Plan for Dane County, a general framework plan which sets forth specific objectives, policies and strategy for guiding growth and development of the region. The plan includes both long and short term policies, implementation recommendations, and some legislative proposals as to where and how growth and development should take place and where it should not take place.

Since land use plan implementation is largely in the province of local government, the DCRPC role continues in the direction of working with local units and Dane County. This provides areawide plans with detail and refinement not otherwise possible. In addition, it helps to educate local implementing authorities on areawide concerns and helps secure local commitment to the policies and thus to implementation.

It is important to stress that the Regional Planning Commission does not have implementation powers of its own. Zoning powers rest with the County and incorporated areas, the villages and cities. County zoning jurisdiction rests only in the Towns, the unincorporated areas where this power is basically shared. The County zoning decisions can be vetoed by the Towns but Towns cannot reverse a disapproval at the County level.

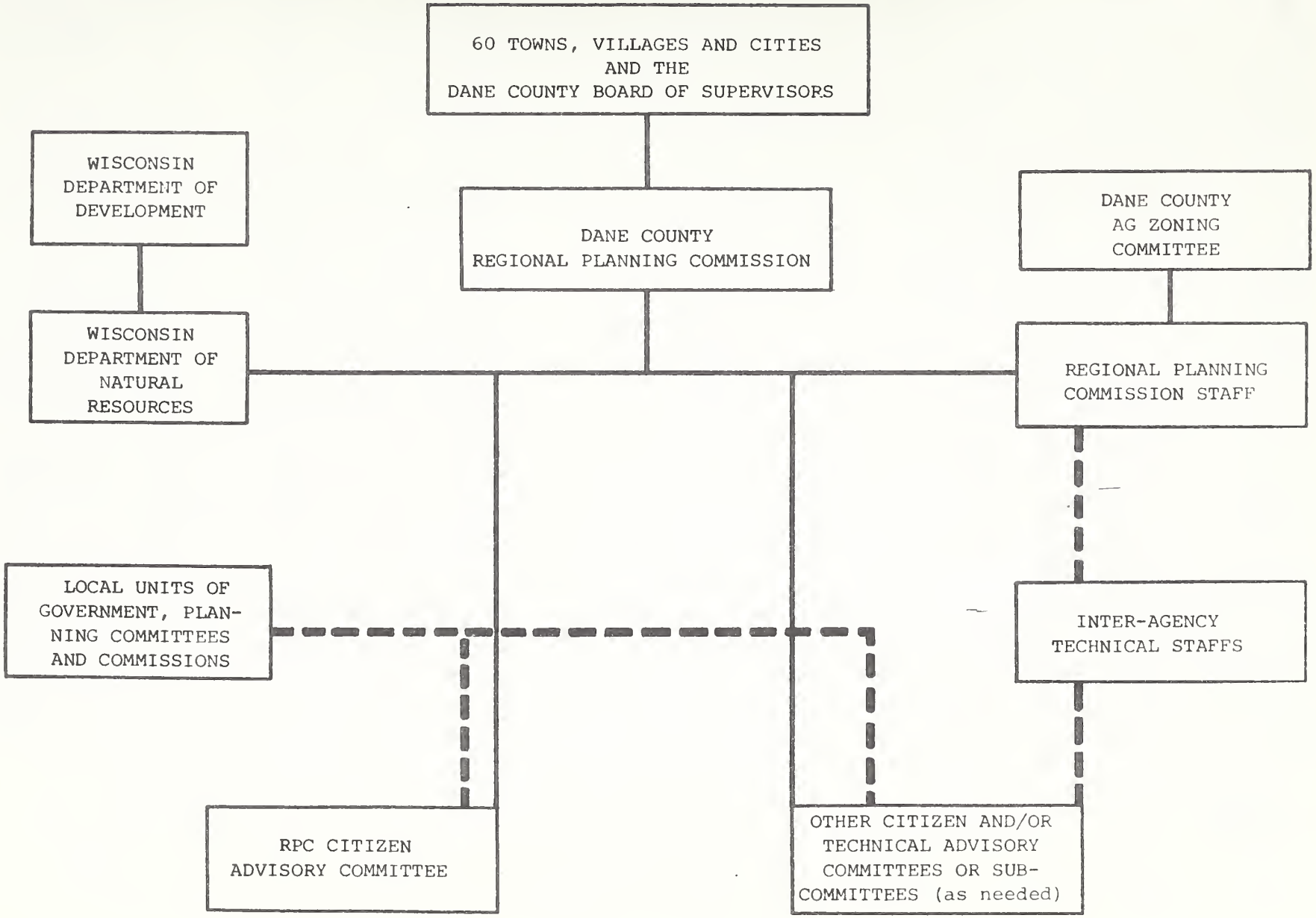
Plat review is also conducted by the County and the incorporated areas. The Towns can also adopt subdivision ordinances and conduct plat reviews in the unincorporated areas if they choose to adopt stricter regulations than the County.

FIGURE 2-4 shows the position of the DCRPC in the land use decision-making process. To aid the Commission on land use planning and other matters, it has formed a citizen advisory committee which is made up of major interest groups in the area. Additional ad hoc committees are formed from time to time for specific issues or planning efforts.

Joint review of locally prepared land use plans is made by the DCRPC and the Dane County Ag-Zoning committee. DCRPC staff also provide review of proposed zoning amendments and subdivision plats which comes before the Ag-Zoning committee to further ensure coordination in land use issues.

FIGURE 2-4

DCRPC LAND USE DECISION-MAKING PROCESS



Annual review of and periodic amendments to the urban service area component of the Land Use Plan as well as required review of sanitary sewer extensions for consistency with adopted regional plans provides the DCRPC with additional land use policy implementation.

CHAPTER 3

METHODOLOGY

This section describes the methodology used to arrive at the factors for simple calculation of transportation energy consumption for residential land use types of differing densities and locations in the region. While the factors themselves provide an easy way for estimating this type of energy impact from residential development, deriving each of the factors is a much more involved process. Sufficient detail will be provided below in the discussion of each step to basically understand how it was done. The lengthy calculations needed to produce the end result have been placed in the appendices for those wishing to explore the finer details of the analysis. A flow chart of the methodology has also been provided in the summary and at the conclusion of this Chapter.

The basic approach of the project is to arrive at an estimate of vehicle miles traveled (VMT) by dwelling unit type and then convert this estimate to energy units or factors. Relationships will then be established between type of dwelling unit, location, and density of those units within the region. In addition, the transportation energy consumption factors will be applied to actual residential land use development in this region, using building permit and land subdivision development data which is now collected quarterly for urban and rural portions of the region. On an annual basis, the transportation energy consumption of the region's residential development will be reported to the public and to elected and agency officials.

Step 1: Define the Region

The region investigated in this study was Dane County, Wisconsin. As mentioned earlier, Dane County is located in the south central part of the state and covers 1,200 square miles of territory. The county contains over 320,000 people which are represented by 61 units of government. The boundaries of the county are coterminus with the Census SMSA boundaries and the Metropolitan Planning Organization (MPO) boundaries. Therefore, it was expected that the data needed for the project would conform to the data base of the region. While data was also sought from outside the region such as from State and National sources, the use of such information was for the purpose of checking and augmenting local data.

There were three principal sources of data used in this study:

1. The National Personal Transportation Study (NPTS)

   The 1977 NPTS was conducted by the Bureau of Census under sponsorship of the Department of Transportation (DOT) as part of the expanded scope of the National Travel Program. The computer tapes of this survey as well as the time of a computer programmer were made available to this project by the Wisconsin Department

of Transportation in order to extract the information from these tapes required by this project.

2. The 1975 Bureau of Census Journey to Work Supplement

A 1975-1976 Annual Housing Survey was conducted by the Bureau of Census in the region. Attached to this survey was a supplement which provided journey to work statistics by census tract.

3. Local Travel Forecast Model

In cooperation with the Wisconsin Department of Transportation, the Dane County Regional Planning Commission simulates existing and future travel patterns in the Madison area by using mathematical models. The agencies currently use the Urban Transportation Planning System (UTPS) battery of computer programs for model preparation.

In working with the travel forecasting models, the existing or forecast transportation system is simulated by a computerized network of nodes and links. The mathematical models employed to estimate demand for transportation facilities require a socioeconomic data base which contains variables relating to the area's population and development. Typical variables considered in the travel forecasting process are population, dwelling units, autos owned, employment, school enrollment and commercial or residential land use. (This model applies only to the Central Urban Area.)

Other sources and studies were also investigated such as special neighborhood studies and reports prepared by other regions, but the primary sources having an impact in this study are the three identified above. Refer to the Bibliography of this report for a detailed listing.

Step 2: Differentiate Region into Subareas

It was determined that three levels of results were needed from this study with each succeeding level becoming increasingly more detailed. For example, at the first level of detail the county was divided into three broad geographic categories designated as urban, rural and satellite (see FIGURE 3-1). The urban area consists primarily of the entire central metropolitan area which includes three cities, three villages, and one town or township. The rural area is the composite sum of all the towns in the county except for those which are included in the central urban area. Likewise, the satellite category consists of the composite sum of all the villages in the county with the exception of those located in the central urban area. Efforts were directed to research and analyze our data at this broadest level before moving on to the

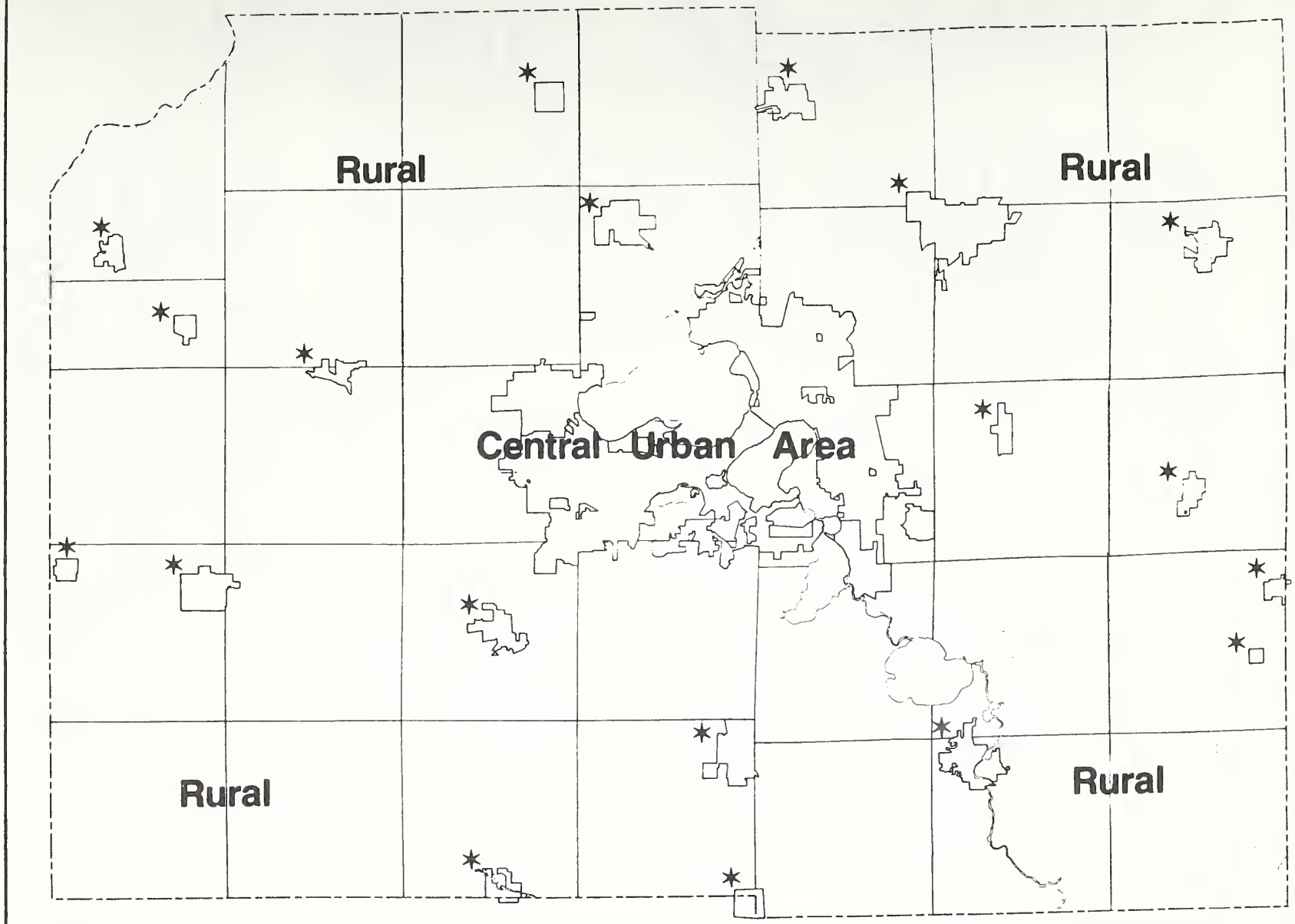


FIGURE 3-1
REGIONAL SUBAREAS
DANE COUNTY, WISCONSIN

✶ Satellites

next level of detail. The NPTS data was instrumental in providing information at this generalized level but only for the urban and rural categories.

The second level of analysis, which was more refined than the first, was to estimate and identify transportation factors at the census tract level (see FIGURE 3-2). The 1975 Bureau of Census, Journey to Work Supplement was a good source of local information for all three categories but only for work related trips. Information was not available for non-work related trips.

The final level of analysis estimated a transportation factor for each unit of the 60 units of government in Dane County (see FIGURE 3-3). In addition, a more refined analysis was done within the central urban area. FIGURE 3-4 illustrates the manner in which the central area was divided up into 34 districts called superdistricts. These superdistricts are an aggregation of smaller traffic area analysis zones. A computer model (UTPS) which is used by the Wisconsin Department of Transportation and the MPO was instrumental in providing work related trip information for each of these districts.

From the discussion above it can be seen that neither of the major sources of information was complete in itself to provide the necessary data for each category or level of detail required by the project. It was necessary to utilize all three in an integral fashion in order to meet the needs of this study.

Step 3: Determine Trip Frequency For Each Subarea

The first major piece of information needed to arrive at vehicle miles traveled (VMT) per dwelling unit is the trip-making frequency of households in that dwelling unit. Typically these trips are classified into one of two categories, work trips and non-work trips. Non-work trips can be further refined according to specific activities, but for the purposes of this project only the totals of these two categories were used. This project also analyzed the trip-making characteristics of the households in various subareas of the county according to dwelling unit type; and more specifically, according to single family and multifamily units.

By Geographic Area. TABLE 3-1A shows trip frequency (person trips per household per year) for work trips, non-work trips, and all trips from the three primary data sources. This is according to the first level of detail which is by major geographic subarea (urban, rural, and satellite). Each subarea reports trips according to single family and multifamily dwelling unit type. The general relationships expressed in TABLE 3-1A can be summarized as follows:

1. For either community or housing type, there are approximately three times as many non-work trips as work trips made per household each year;

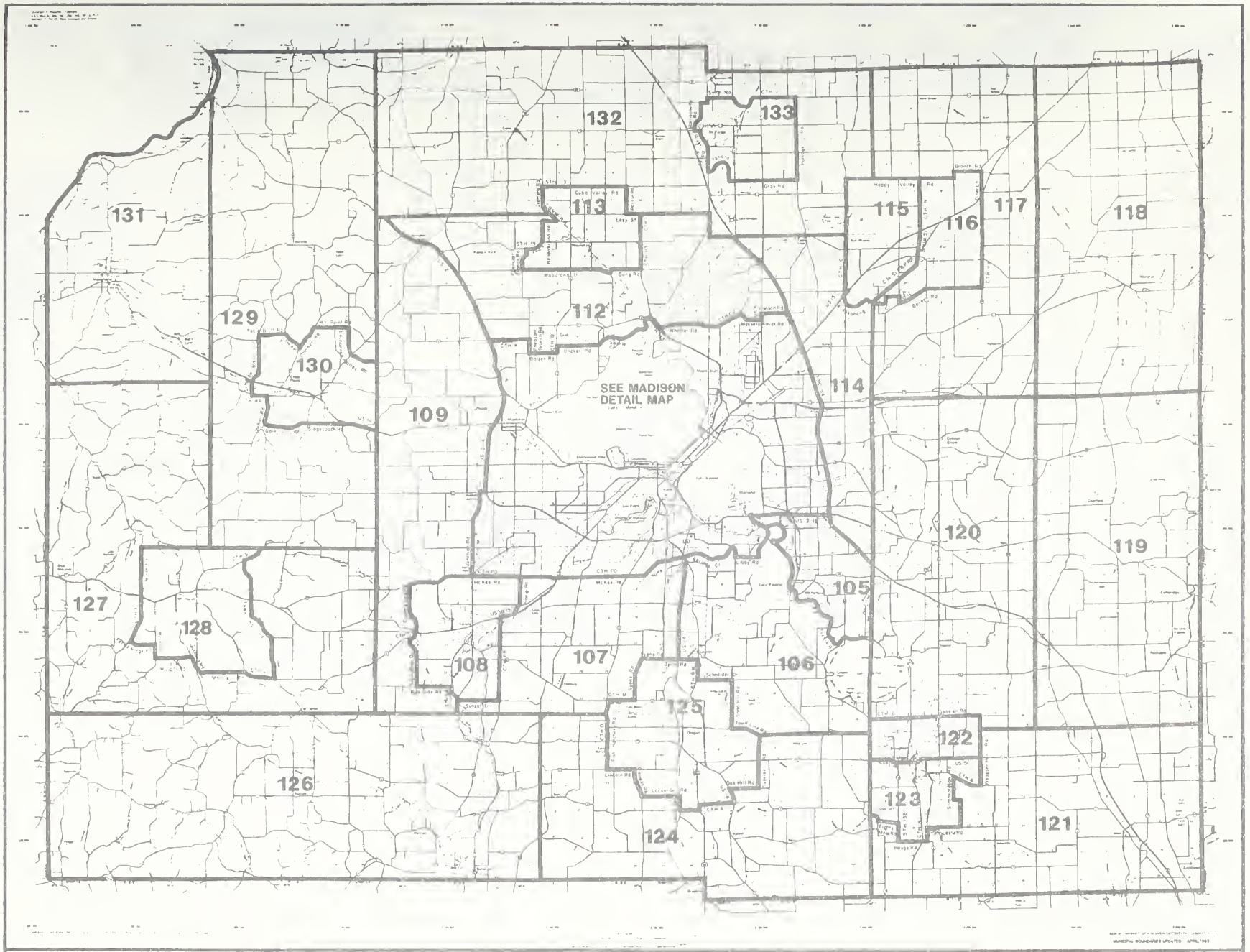


FIGURE 3-2
1980 CENSUS TRACTS
DANE COUNTY, WISCONSIN

4/82

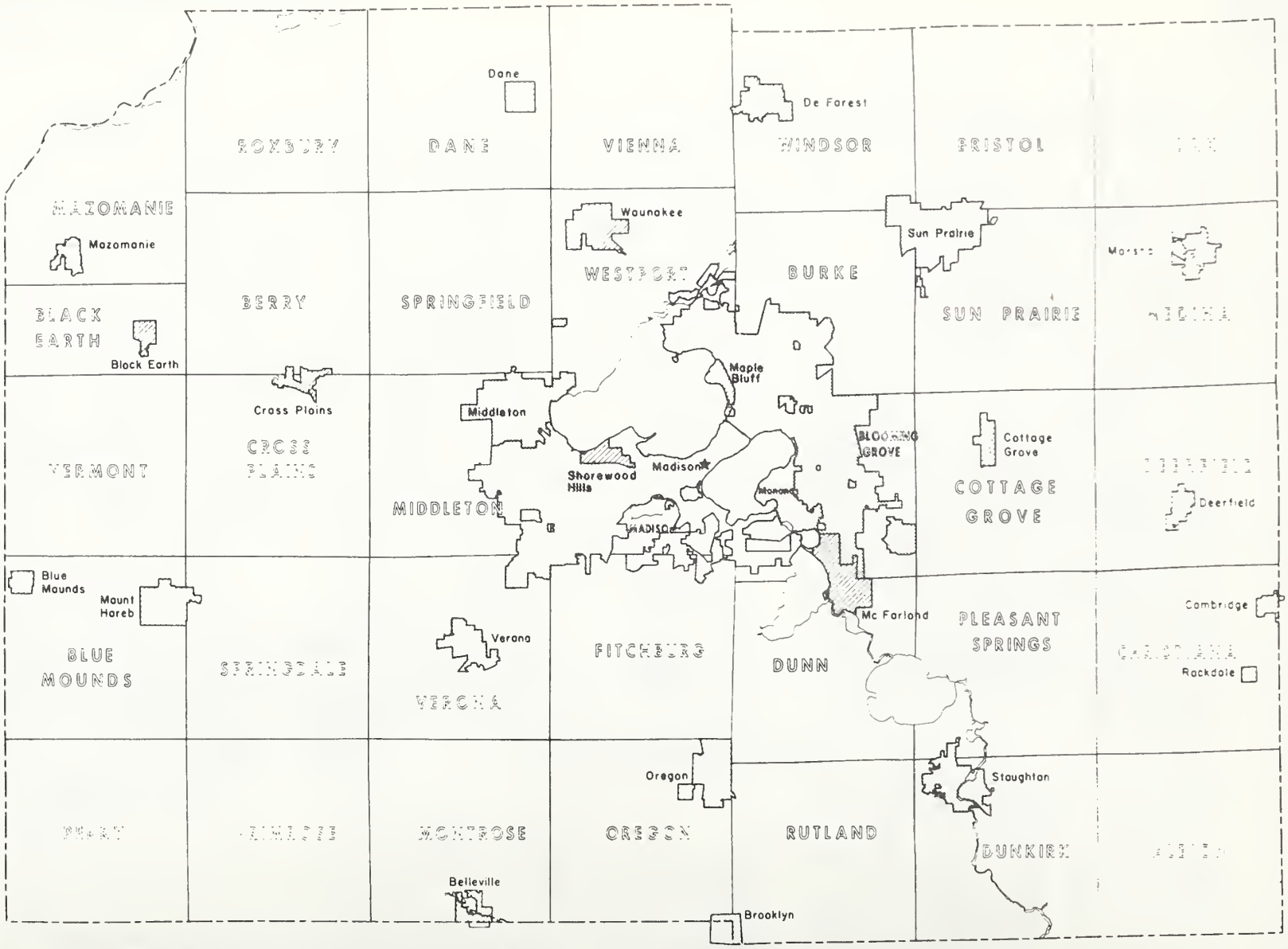


FIGURE 3-3
UNITS OF GOVERMENT
DANE COUNTY, WISCONSIN

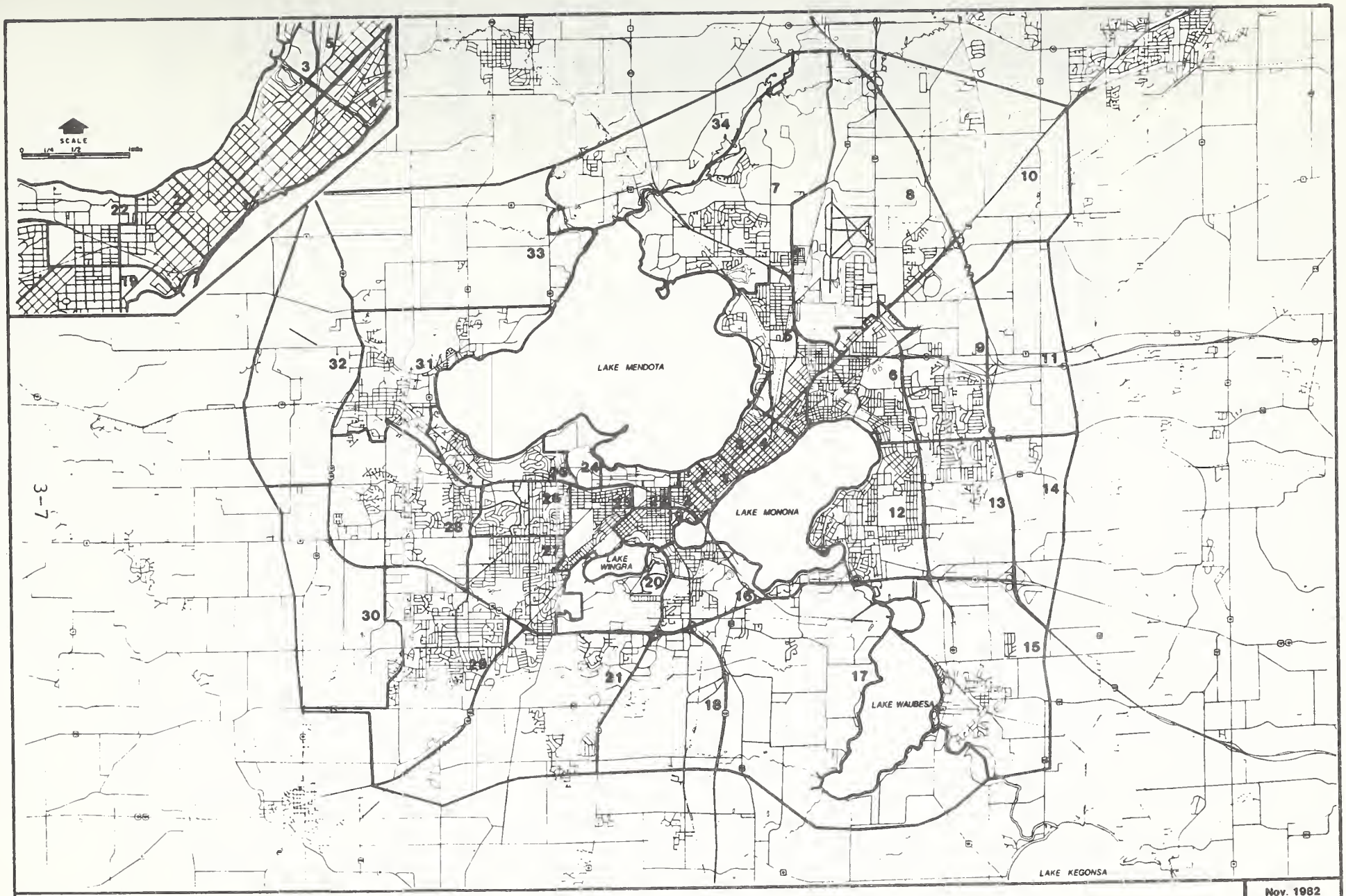


FIGURE 3-4
SUPER DISTRICTS

Nov. 1982

Prepared by THE DANE COUNTY REGIONAL PLANNING COMMISSION

TABLE 3-1A

TRIP FREQUENCY
(PERSON TRIPS PER HOUSEHOLD PER YEAR)

CATEGORY	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
	NPTS[1]	CENSUS[2]	MODEL[3]	NPTS	CENSUS	MODEL	NPTS	CENSUS	MODEL
URBAN	684.7	512[a]	433	2160.4	NA	2873	2845.1	NA	3306
RURAL	691.9	722[a]	NA	2090.7	NA	NA	2782.6	NA	NA
SATELLITE	NA	691[a]	NA	NA	NA	NA	NA	NA	NA
URBAN									
Single Family	722.5	NA	NA	2384.5	NA	NA	3107.0	NA	NA
Multi-family	603.9	NA	NA	1718.9	NA	NA	2322.8	NA	NA
RURAL									
Single Family	698.4	NA	NA	2167.8	NA	NA	2866.2	NA	NA
Multi-family	650.6	NA	NA	1546.7	NA	NA	2197.3	NA	NA
SATELLITE									
Single Family	NA	NA	NA	NA	NA	NA	NA	NA	NA
Multi-family	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] 1977 Data.

[2] 1975 Data.

[3] 1980 Data.

[a] Non-Farm Household Trips.

NOTE: The values in this table are derived from more detailed information. See Appendix A for a description of the circumstances involved in deriving these numbers.

NA: Not available in raw data form. Can be estimated if certain assumptions are made.

Prepared by Dane County Regional Planning Commission, November, 1982.

2. While households in rural areas make more work trips per year than households in urban areas, they also make significantly fewer non-work trips per year than households in urban areas, resulting in fewer total trips made;

3. Households in satellite communities fall in between the range of work trips made by households in rural and urban areas;

4. According to NPTS data, single family households in the rural area make fewer work trips per year than an urban area household, and multi-family households in rural areas make more work trips per year than multifamily households in urban areas. According to local data single family households in rural areas make more work trips than their urban counterparts.

Because each of the data sources did not report information for all the categories shown in TABLE 3-1A the remaining unknown values were estimated based on the relationships of the existing data and are shown in Table 3-1B. The method of factoring which was used to arrive at these numbers is described in a general fashion in the next section and in greater detail in Appendix B.

The trip frequency rate reported by the model in Table 3-1A is considerably less than the NPTS data because of the geographic and cultural circumstances of the central urban area. The University of Wisconsin main campus, the Madison Area Technical College, and other major activity centers are located in the downtown area and generate a significant number of bicycle and pedestrian trips. These trips have been excluded from the analysis because the approach of the project is to estimate vehicle miles traveled (VMT). The value produced by the model was expected to be lower than the NPTS data and this was confirmed by the census figures. Unless otherwise specified, local data as shown in 3-1B has been used throughout the analysis.

By Census Tract. The next level of analysis examines the trip frequency characteristics of the region at the census tract level. FIGURE 3-2 illustrates the census tract boundaries for that portion of the County located outside the central urban area. Inside the central urban area a different set of boundaries will be used instead of census tract boundaries. FIGURE 3-4 shows a set of boundaries called superdistricts. These districts are an aggregation of traffic area analysis zones and contain more discrete traffic related information than the census tracts. Many of the census tract boundaries are coterminous with the superdistrict.

TABLE 3-1B

1980 ESTIMATED TRIP FREQUENCY
(PERSON TRIPS PER HOUSEHOLD PER YEAR)

CATEGORY	WORK TRIPS	NON-WORK TRIPS	ALL TRIPS
Urban	433	2,873	3,306
Rural	760	2,372	3,132
Satellite	694	2,213	2,907
Urban			
Single family	506	3,557	4,063
Multifamily	358	2,201	2,559
Rural			
Single family	784	2,479	3,263
Multifamily	690	1,884	2,573
Satellite			
Single family	729	2,405	3,134
Multifamily	618	1,760	2,378

Prepared by Dane County Regional Planning Commission, January, 1983.

Column three of TABLE 3-2 shows the annual person work trips per dwelling unit for each of the census tracts outside the central urban area. Also shown in the table are the number of non-farm dwelling units within the census tract, the percentage of the work trips which are made by mass transit and the trip length associated with that work trip. Non-farm households are being used instead of total households because farm households do not make the typical work trip. They live where they work, hence, no trip is made.

The annual person work trips per dwelling unit for those census tracts outside the central urban area range from a low of 477 trips (census tracts 106 and 121) to a high of 1,335 trips (census tract 124) with the average being 707 trips. If the satellite communities are segregated from this total their average value becomes 691 trips/d.u. while the rural area becomes 722 trips/d.u. (see TABLES 3-3 and 3-4). These values are the ones reported earlier in TABLE 3-1A.

Because census data does not report non-work related trips, this information is not available at this level of detail for analysis. To arrive at some kind of estimate it is possible to generate values based on the relationships that exist in the NPTS data. For instance, it is known from the NPTS data shown in TABLE 3-1A that the ratio of non-work trips to work trips in the rural area is 3.02 (or 2,091 divided by 692). This factor can then be applied to each of the work trip values shown in TABLE 3-2 to arrive at a non-work trip estimate. For example, for census tracts 106 and 107 the values would be:

Trips/d.u. x Ratio = Non-Work Trip Estimate
477 x 3.02 = 1,441
and
794 x 3.02 = 2,398

A similar type of process can also be used to allocate the annual work trips between households in single family and multi-family dwelling units. For instance, the NPTS data shown in TABLE 3-1A indicates that the ratio of single family to multifamily rural work trips is 1.07 (or 698 divided by 651). When this value is incorporated into a simultaneous equation, the allocation for census tract 106 would be 481 annual person work trips for a household in a single family dwelling unit and 449 annual person work trips for a household in a multifamily dwelling unit. For a detailed presentation on these simultaneous equations see Appendix B.

TABLE 3-2

1975 CENSUS PERSON WORK TRIPS
OUTSIDE CENTRAL URBAN AREA

CENSUS TRACT	NON-FARM D.U.'s	ANNUAL TRIPS/D.U.	% TRANSIT	TRIP LENGTH (MILES)
106	1512	477	0	12.5
107	1101	794	2.8	7.5
108	1121	556	2.0	6.8
109	704	554	6.4	8.1
112	996	810	3.0	9.2
113	962	718	0	8.3
114	581	986	0	10.0
115	3111	786	2.5	7.3
116	1058	732	1.8	7.3
117	398	966	0	10.0
118	756	686	0	15.3
119	1605	592	0	9.8
120	1219	892	0	11.6
121	602	477	0	13.0
122	1738	560	2.5	8.6
123	1329	482	2.0	8.6
124	333	1335	2.6	12.9
125	1283	814	0	8.5
126	655	814	2.2	14.4
127	458	605	0	17.6
128	1066	525	0	10.5
129	527	939	2.4	17.2
130	600	948	0	10.1
131	1127	490	0	15.8
132	876	932	0	13.4
133	801	882	0	12.3
TOTAL	26519	707*	1.2*	10.1*

*Average.

Prepared by Dane County Regional Planning Commission, November, 1982.

TABLE 3-3

SATELLITE 1975 CENSUS PERSON WORK TRIPS PER DWELLING UNIT

CENSUS TRACT	NON-FARM D.U.'s	ANNUAL TRIPS/D.U.	% TRANSIT	TRIP LENGTH (MILES)
108	1121	556	2.0	6.8
113	962	718	0	8.3
115	3111	786	2.5	7.3
116	1058	732	1.8	7.3
122	1738	560	2.5	8.6
123	1329	482	2.0	8.6
125	1283	814	0	8.5
128	1066	525	0	10.5
130	600	948	0	10.1
133	801	882	0	12.3
TOTAL	13069	691*	1.4*	8.5*

*Average.

TABLE 3-4

RURAL 1975 CENSUS PERSON WORK TRIPS PER DWELLING UNIT

CENSUS TRACT	NON-FARM D.U.'s	ANNUAL TRIPS/D.U.	% TRANSIT	TRIP LENGTH (MILES)
106	1512	477	0	12.5
107	1101	794	2.8	7.5
109	704	554	6.4	8.1
112	996	810	3.0	9.2
114	581	986	0	10.0
117	398	966	0	10.0
118	756	686	0	15.3
119	1605	592	0	9.8
120	1219	892	0	11.6
121	602	477	0	13.0
124	333	1335	2.6	12.9
126	655	814	2.2	14.4
127	458	605	0	17.6
129	527	939	2.4	17.2
131	1127	490	0	15.8
132	876	932	0	13.4
TOTAL	13450	722*	1.1*	11.9*

*Average.

Prepared by Dane County Regional Planning Commission, November, 1982.

In a similar fashion to TABLES 3-2 through 3-4, TABLE 3-5 provides annual person work trips per dwelling unit within each superdistrict of the central urban area. The average annual person work trip per dwelling unit in the central urban area is 433 trips while the non-work trip is 2,873 trips for a total 3,306 trips. Those persons living downtown and around the university have significantly fewer work trips per dwelling unit (110 to 220) compared to any other district (300 to 700) (see FIGURE 3-5). The same analogy can be made about the non-work trips as illustrated in FIGURE 3-6.

When the work trips and non-work trips are allocated between households in single family and multifamily dwelling units in each superdistrict based on the ratios of the NPTS data, it is apparent that households in single family dwelling units make significantly more trips than households in multifamily dwelling units. The results are shown in TABLE 3-6.

By Individual Unit of Government. The third and final level of analysis allocates the census and model data derived above to each unit of government. TABLE 3-7 provides annual person work trips per dwelling unit and annual person non-work trips per dwelling unit for each unit of government. It is important to note that the trips per dwelling unit have changed slightly in value in the aggregate from TABLE 3-1A because 1980 dwelling unit counts are being used in TABLE 3-7, whereas 1975 dwelling unit counts were used in TABLE 3-1A. Even though the numbers have changed, the overall relationships of those numbers have basically not changed. For instance, while households in rural areas on the average have more work trips than households in satellite and urban areas, they have fewer non-work trips resulting in fewer total trips per dwelling unit. One slight difference does occur when households in village satellite communities are separated out from households in all the satellite communities. Households in village satellite communities on the average also have more work trips than households in urban areas (the 4th class cities) and fewer non-work trips resulting in fewer total trips per dwelling unit. This aspect of the non-work trips for village satellite households is the only difference that exists between TABLES 3-1A and 3-7. The reason being that some of the 4th class cities are included as satellite communities in the computation of TABLE 3-1A which have more non-work trips per dwelling unit than the smaller villages.

Finally, TABLE 3-8 shows the allocation of trips per dwelling unit and trip length between single family and multifamily residences. Households in single family dwelling units continue to have more trips per dwelling unit than multifamily households no matter what area they are in. The same results apply to non-work trips. The relationship mentioned earlier of town households having on the average more work trips per dwelling unit but fewer non-work trips per dwelling unit resulting in total fewer trips per dwelling unit compared to households in villages and cities still holds for single family units. That same relationship holds in comparing the

TABLE 3-5

TRIP FREQUENCY AND TRIP LENGTH BY SUPER DISTRICT

SUPER DISTRICT	DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
		TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
1	3,487	111	2.7	27.6	1,410	2.1	16.8	1,521	2.1	17.6
2	6,660	219	2.3	42.2	1,531	1.9	17.9	1,750	2.0	20.9
3	2,646	334	2.8	28.9	2,270	2.7	9.4	2,604	2.7	11.9
4	2,931	386	2.9	29.3	2,341	2.8	8.2	2,727	2.8	11.2
5	5,161	475	3.7	16.9	2,799	3.4	3.6	3,274	3.4	5.5
6	5,436	428	3.8	14.8	2,490	3.2	2.9	2,918	3.3	4.6
7	3,489	556	5.9	8.2	3,558	5.1	1.7	4,114	5.2	2.6
8	1,910	499	5.4	14.4	3,398	4.9	1.7	3,897	5.0	3.3
9	2,760	571	5.6	2.7	3,498	4.3	1.1	4,069	4.5	1.3
10	439	438	8.9	0	3,497	7.7	2.0	3,935	7.8	1.8
11	117	470	6.6	0	4,068	5.8	1.3	4,538	5.9	1.2
12	6,557	474	5.3	6.7	3,423	4.5	1.2	3,897	4.6	1.9
13	1,752	420	6.0	5.3	3,577	4.9	1.9	3,997	5.0	2.3
14	153	435	9.0	0	4,239	7.3	0.8	4,674	7.5	0.7
15	1,670	513	8.1	2.7	3,264	6.4	1.3	3,777	6.6	1.5
16	3,983	500	3.7	15.0	2,326	4.1	3.8	2,826	4.0	5.8
17	2,016	395	6.7	5.8	3,395	6.3	0.9	3,790	6.3	1.4
18	1,665	455	5.2	3.3	3,687	4.8	1.7	4,142	4.8	1.9
19	2,650	174	2.6	25.5	2,637	2.5	7.2	2,811	2.5	8.3
20	250	464	4.6	0	3,258	4.4	1.0	3,722	4.4	0.9
21	4,482	705	6.1	8.7	3,388	5.1	1.2	4,093	5.3	2.5
22	3,274	128	2.9	30.9	828	2.1	16.4	956	2.2	18.3
23	3,870	570	3.0	20.5	3,838	2.8	5.4	4,408	2.8	7.4
24	1,215	384	3.4	21.3	2,422	4.1	3.4	2,806	4.0	5.8
25	1,618	460	4.3	7.6	3,452	3.6	1.3	3,912	3.7	2.0
26	4,200	421	3.8	12.0	3,088	3.0	2.8	3,509	3.1	3.9
27	3,853	492	4.2	8.6	3,341	3.4	1.5	3,833	3.5	2.4
28	4,454	367	4.8	4.7	3,189	3.4	0.9	3,556	3.5	1.3
29	5,394	652	6.3	6.8	3,396	4.6	1.0	4,048	4.9	1.9
30	318	487	8.1	0	3,974	6.2	0.9	4,461	6.4	0.8
31	4,632	437	5.4	3.8	3,007	3.9	0.6	3,444	4.1	1.0
32	144	457	6.9	0	5,366	5.4	0.5	5,823	5.5	0.5
33	183	460	8.0	0.9	3,852	7.2	0.5	4,312	7.3	0.5
34	316	460	7.9	7.0	4,480	7.3	0.9	4,940	7.4	1.5
AVERAGE	93,685*	433	4.8	12.1	2,873	3.9	3.4	3,306	4.0	4.5

*Total.

Prepared by Dane County Regional Planning Commission, November, 1982.

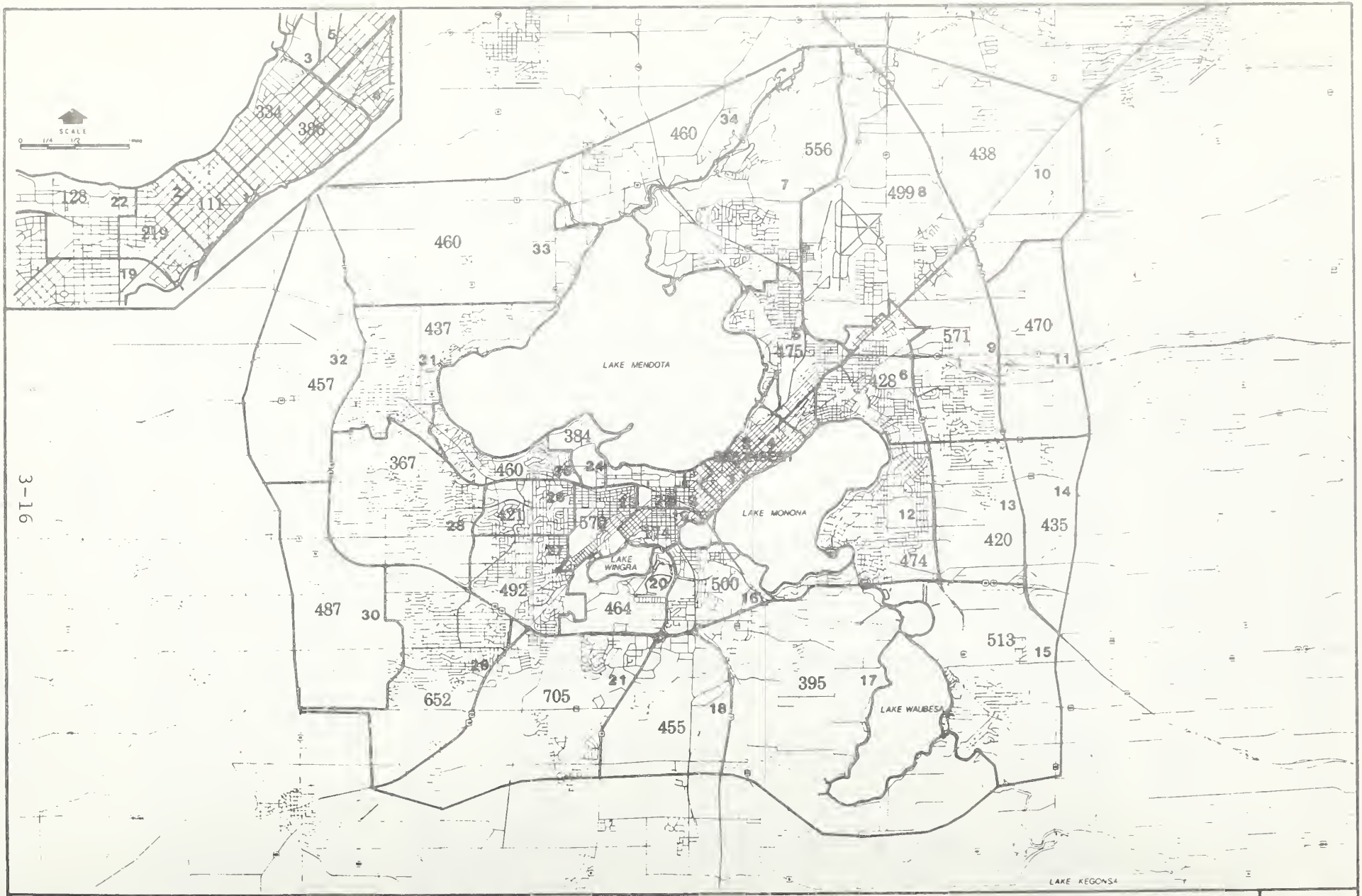
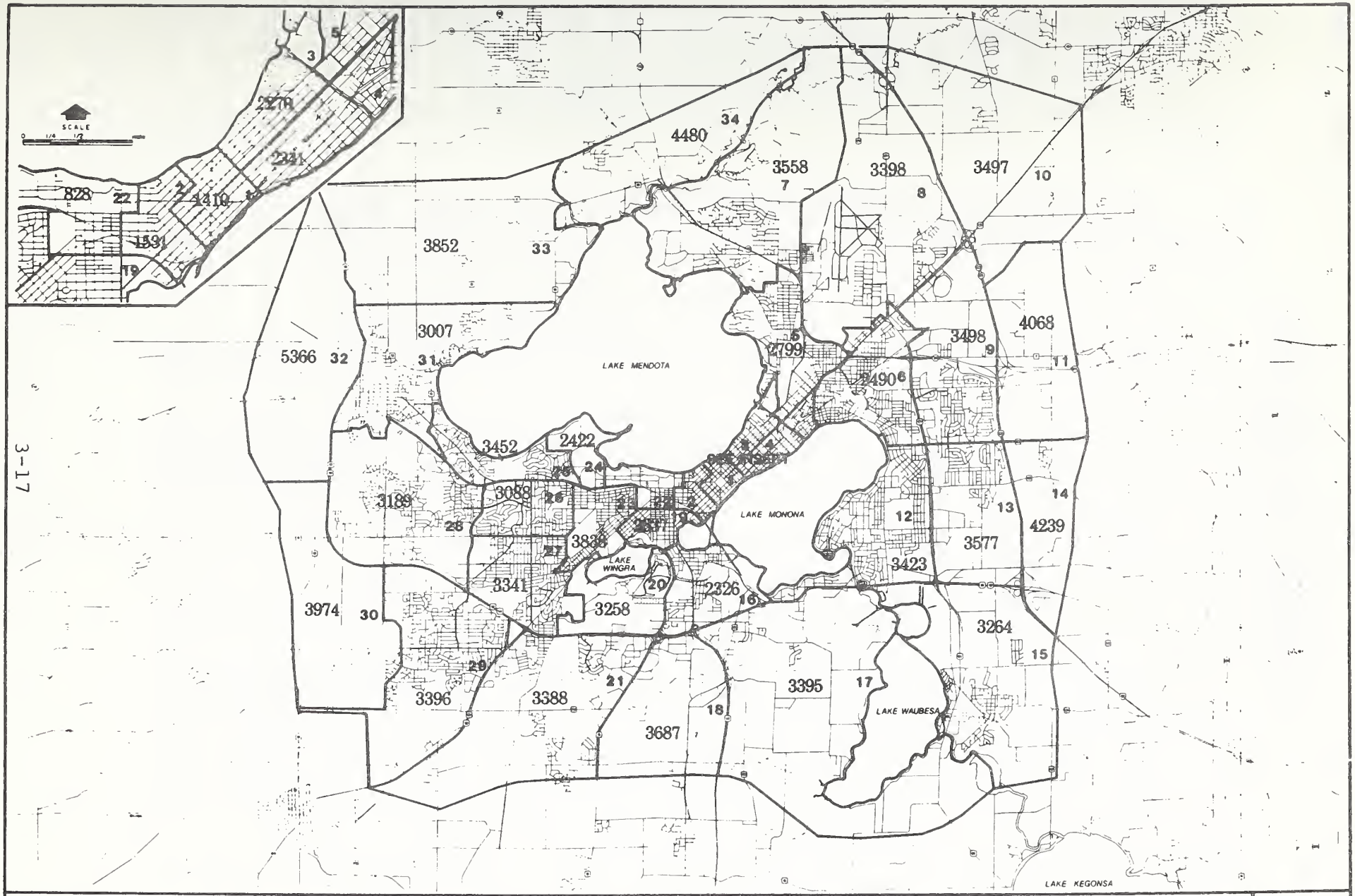


FIGURE 3-5
DISTRIBUTION OF ANNUAL PERSON WORK TRIPS /PER DWELLING UNIT

Nov. 1982



3-17

FIGURE 3-6
DISTRIBUTION OF ANNUAL PERSON NON-WORK TRIPS/PER DWELLING UNIT

Nov. 1982

TABLE 3-6

SINGLE FAMILY AND MULTIFAMILY
TRIP FREQUENCY AND TRIP LENGTH
BY SUPER DISTRICT

SUPER DISTRICT		DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
			TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
1	S.F.	112	132	3.4		1,949	2.1		2,081	2.2	
	M.F.	3,375	110	2.7		1,392	2.1		1,502	2.1	
	TOT.	3,487	111	2.7	27.6	1,410	2.1	16.8	1,521	2.1	17.6
2	S.F.	364	259	2.8		2,098	1.9		2,357	2.0	
	M.F.	6,296	217	2.3		1,498	1.9		1,715	2.0	
	TOT.	6,660	219	2.3	42.2	1,531	1.9	17.9	1,750	2.0	20.9
3	S.F.	854	376	3.2		2,815	2.7		3,191	2.8	
	M.F.	1,792	314	2.6		2,010	2.7		2,324	2.7	
	TOT.	2,646	334	2.8	28.9	2,270	2.7	9.4	2,604	2.7	11.9
4	S.F.	1,016	432	3.3		2,878	2.8		3,310	2.9	
	M.F.	1,915	361	2.6		2,056	2.8		2,417	2.8	
	TOT.	2,931	386	2.9	29.3	2,341	2.8	8.2	2,727	2.8	11.2
5	S.F.	3,224	506	4.0		3,135	3.4		3,641	3.5	
	M.F.	1,937	423	3.2		2,239	3.4		2,662	3.3	
	TOT.	5,161	475	3.7	16.9	2,799	3.4	3.6	3,274	3.4	5.5
6	S.F.	3,650	452	4.0		2,748	3.2		3,200	3.3	
	M.F.	1,786	378	3.2		1,963	3.2		2,341	3.2	
	TOT.	5,436	428	3.8	14.8	2,490	3.2	2.9	2,918	3.3	4.6
7	S.F.	2,913	572	6.1		3,734	5.1		4,306	5.2	
	M.F.	576	478	4.8		2,667	5.0		3,145	5.0	
	TOT.	3,489	556	5.9	8.2	3,558	5.1	1.7	4,114	5.2	2.6
8	S.F.	614	562	6.2		4,215	4.9		4,720	5.2	
	M.F.	1,296	469	4.9		3,011	4.9		3,433	5.0	
	TOT.	1,910	499	5.4	14.4	3,398	4.9	1.7	3,897	5.0	3.3
9	S.F.	1,937	600	5.9		3,824	4.3		4,424	4.5	
	M.F.	823	502	4.7		2,731	4.3		3,233	4.4	
	TOT.	2,760	571	5.6	2.7	3,498	4.3	1.1	4,069	4.5	1.3
10	S.F.	439	438	8.9		3,497	7.7		3,935	7.8	
	M.F.	0	0	0		0	0		0	0	
	TOT.	439	438	8.9	0	3,497	7.7	2.0	3,935	7.8	1.8
11	S.F.	111	474	6.7		4,129	5.8		4,603	5.9	
	M.F.	6	396	5.3		2,949	5.7		3,345	5.7	
	TOT.	117	470	6.6	0	4,068	5.8	1.3	4,538	5.9	1.2
12	S.F.	4,631	498	5.6		3,737	4.5		4,235	4.6	
	M.F.	1,926	416	4.4		2,669	4.5		3,085	4.5	
	TOT.	6,557	474	5.3	6.7	3,423	4.5	1.2	3,897	4.6	1.9
13	S.F.	1,548	428	6.1		3,700	4.9		4,128	5.0	
	M.F.	204	358	4.9		2,643	4.8		3,001	4.9	
	TOT.	1,752	420	6.0	5.3	3,577	4.9	1.9	3,997	5.0	2.3
14	S.F.	153	435	9.0		4,239	7.3		4,674	7.5	
	M.F.	0	0	0		0	0		0	0	
	TOT.	153	435	9.0	0	4,239	7.3	0.8	4,674	7.5	0.7
15	S.F.	1,394	527	8.3		3,426	6.4		3,953	6.7	
	M.F.	276	441	6.6		2,447	6.3		2,888	6.4	
	TOT.	1,670	513	8.1	2.7	3,264	6.4	1.3	3,777	6.6	1.5
16	S.F.	1,184	565	4.3		2,910	4.1		3,475	4.2	
	M.F.	2,799	472	3.4		2,079	4.1		2,551	4.0	
	TOT.	3,983	500	3.7	15.0	2,326	4.1	3.8	2,826	4.0	5.8
17	S.F.	944	433	7.4		4,003	6.3		4,436	6.4	
	M.F.	1,072	362	5.9		2,859	6.3		3,221	6.2	
	TOT.	2,016	395	6.7	5.8	3,395	6.3	0.9	3,790	6.3	1.4
18	S.F.	639	506	5.9		4,475	4.8		4,981	4.9	
	M.F.	1,026	423	4.7		3,196	4.8		3,619	4.8	
	TOT.	1,665	455	5.2	3.3	3,687	4.8	1.7	4,142	4.8	1.9

Continued next page

TABLE 3-6 Continued

SUPER DISTRICT		DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
			TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
19	S.F.	925	195	3.0		3,240	2.5		3,435	2.6	
	M.F.	1,725	163	2.4		2,314	2.5		2,477	2.5	
	TOT.	2,650	174	2.6	25.5	2,637	2.5	7.2	2,811	2.5	8.3
20	S.F.	120	507	5.1		3,827	4.4		4,334	4.5	
	M.F.	130	424	4.0		2,733	4.4		3,157	4.3	
	TOT.	250	464	4.6	0	3,258	4.4	1.0	3,722	4.4	0.9
21	S.F.	1,334	797	7.1		4,239	5.1		5,036	5.4	
	M.F.	3,148	666	5.6		3,028	5.1		3,694	5.2	
	TOT.	4,482	705	6.1	8.7	3,388	5.1	1.2	4,093	5.3	2.5
22	S.F.	143	152	3.6		1,139	2.1		1,291	2.3	
	M.F.	3,131	127	2.9		814	2.1		941	2.2	
	TOT.	3,274	128	2.9	30.9	828	2.1	16.4	956	2.2	18.3
23	S.F.	2,352	609	3.2		4,322	2.8		4,931	3.0	
	M.F.	1,518	509	2.6		3,087	2.8		3,596	2.7	
	TOT.	3,870	570	3.0	20.5	3,838	2.8	5.4	4,408	2.8	7.4
24	S.F.	50	456	4.2		3,336	4.1		3,792	4.2	
	M.F.	1,165	381	3.4		2,383	4.1		2,764	4.0	
	TOT.	1,215	384	3.4	21.3	2,422	4.1	3.4	2,806	4.0	5.8
25	S.F.	1,344	473	4.4		3,628	3.6		4,101	3.7	
	M.F.	274	396	3.5		2,591	3.6		2,987	3.6	
	TOT.	1,618	460	4.3	7.6	3,452	3.6	1.3	3,912	3.7	2.0
26	S.F.	2,104	459	4.2		3,602	3.0		4,061	3.2	
	M.F.	2,096	383	3.3		2,573	3.0		2,956	3.0	
	TOT.	4,200	421	3.8	12.0	3,088	3.0	2.8	3,509	3.1	3.9
27	S.F.	3,440	501	4.3		3,445	3.4		3,946	3.5	
	M.F.	413	419	3.4		2,462	3.4		2,881	3.4	
	TOT.	3,853	492	4.2	8.6	3,341	3.4	1.5	3,833	3.5	2.4
28	S.F.	2,889	390	5.1		3,545	3.4		3,935	3.6	
	M.F.	1,565	326	4.1		2,532	3.4		2,858	3.4	
	TOT.	4,454	367	4.8	4.7	3,189	3.4	0.9	3,556	3.5	1.3
29	S.F.	3,165	699	6.8		3,851	4.6		4,550	5.0	
	M.F.	2,229	585	5.4		2,751	4.6		3,336	4.7	
	TOT.	5,394	652	6.3	6.8	3,396	4.6	1.0	4,048	4.9	1.9
30	S.F.	256	503	8.4		4,208	6.2		4,711	6.4	
	M.F.	62	421	6.7		3,006	6.1		3,427	6.2	
	TOT.	318	487	8.1	0	3,974	6.2	0.9	4,461	6.4	0.8
31	S.F.	1,939	483	6.1		3,606	3.9		4,089	4.2	
	M.F.	2,693	404	4.8		2,576	3.9		2,980	4.0	
	TOT.	4,632	437	5.4	3.8	3,007	3.9	0.6	3,444	4.1	1.0
32	S.F.	124	468	7.1		5,588	5.4		6,056	5.5	
	M.F.	20	391	5.6		3,991	5.3		4,382	5.4	
	TOT.	144	457	6.9	0	5,366	5.4	0.5	5,823	5.5	0.5
33	S.F.	183	460	8.0		3,852	7.2		4,312	7.3	
	M.F.	0	0	0		0	0		0	0	
	TOT.	183	460	8.0	0.9	3,852	7.2	0.5	4,312	7.3	0.5
34	S.F.	294	465	8.0		4,571	7.3		5,036	7.4	
	M.F.	22	389	6.4		3,265	7.2		3,654	7.1	
	TOT.	316	460	7.9	7.0	4,480	7.3	0.9	4,940	7.4	1.5
TOT.	S.F.	46,389	506	5.3		3,557	3.9		4,063	4.1	
	M.F.	47,296	358	4.2		2,201	3.9		2,559	3.9	
	TOT.	93,685	433	4.8	12.1	2,873	3.9	3.4	3,306	4.0	4.5

Prepared by Dane County Regional Planning Commission, November, 1982.

TABLE 3-7

TRIP FREQUENCY* AND TRIP LENGTH BY UNIT OF GOVERNMENT

CATEGORIES	DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
		TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
TOWNS										
Albion	647	477	20.2	0	1,441	15.6	0	1,918	16.7	0
Berry	337	934	15.1	2.4	2,836	11.4	0	3,775	12.3	0.6
Black Earth	127	490	17.4	0	1,480	16.7	0	1,970	16.9	0
Blooming Grove	720	98	10.2	0	2,078	9.4	0	3,964	9.6	0
Blue Mound	213	605	18.7	0	1,827	13.0	0	2,432	14.0	0
Bristol	523	966	11.8	0	2,917	10.4	0	3,883	10.7	0
Burke	951	986	10.8	0	2,978	9.9	0	3,964	9.8	0
Christiana	377	592	14.1	0	1,784	15.0	0	2,380	16.4	0
Cottage Grove	916	892	11.7	0	2,694	9.8	0	3,586	10.3	0
Cross Plains	313	939	11.1	2.4	2,836	9.7	0	3,775	10.0	0.6
Dane	262	932	16.3	0	2,815	15.4	0	3,747	15.6	0
Deerfield	339	592	16.3	0	1,788	13.0	0	2,380	13.8	0
Dunkirk	705	477	12.8	0	1,441	9.2	0	1,918	10.1	0
Dunn	1,789	477	11.7	0	1,441	10.7	0	1,918	10.9	0
Fitchburg	5,273	794	9.0	2.8	2,398	7.7	0	3,192	7.8	0.7
Madison	2,446	500	3.7	15.0	2,326	4.1	3.8	2,826	4.0	5.8
Mazomanie	318	490	17.7	0	1,480	13.4	0	1,970	14.5	0
Medina	326	686	16.0	0	2,078	12.9	0	2,764	13.7	0
Middleton	820	554	9.4	6.4	1,673	7.4	0	2,227	7.9	1.6
Montrose	332	814	14.5	2.2	2,458	13.2	0	3,272	13.5	0.5
Oregon	551	1,335	12.7	2.6	4,032	11.5	0	5,367	11.7	0.6
Perry	202	814	23.3	2.2	2,458	22.6	0	3,272	22.8	0.5
Pleasant Springs	794	892	13.9	0	2,694	11.6	0	3,586	12.2	0
Primrose	204	814	20.5	2.2	2,458	19.4	0	3,272	19.7	0.5
Roxbury	445	939	18.8	2.4	2,836	15.6	0	3,775	16.4	0.6
Rutland	473	1,335	13.6	2.6	4,032	12.3	0	5,367	12.6	0.6
Springdale	397	605	15.0	0	1,827	13.1	0	2,432	13.6	0
Springfield	618	810	11.5	3.0	2,446	11.0	0	3,256	11.1	0.1
Sun Prairie	552	966	11.5	0	2,917	10.2	0	3,883	10.5	0
Vermont	227	605	18.1	0	1,827	16.6	0	2,432	17.0	0
Verona	619	544	10.0	6.4	1,643	7.8	0	2,187	8.3	1.6
Vienna	393	932	13.4	0	2,815	11.8	0	3,747	12.2	0
Westport	782	810	9.8	3.0	2,446	9.3	0	3,256	9.4	0.7
Windsor	1,250	932	10.6	0	2,815	8.0	0	3,747	8.6	0
York	215	686	16.9	0	2,072	16.4	0	2,758	16.5	0
SUBTOTAL	25,456	760	11.3	2.4	2,372	9.8	0.4	3,132	10.1	0.8
VILLAGES										
Belleville	452	814	15.3	2.2	2,564	10.4	0	3,378	11.6	0.5
Black Earth	417	490	15.4	0	1,544	11.5	0	2,034	12.4	0
Blue Mound	143	605	18.7	0	1,906	16.9	0	2,511	17.3	0
Brooklyn	89	1,335	14.8	2.6	4,205	13.8	0	5,540	14.0	0.6
Cambridge	318	592	16.9	0	1,865	9.3	0	2,457	11.1	0
Cottage Grove	289	892	11.2	0	2,810	9.5	0	3,702	9.9	0
Cross Plains	683	948	12.4	0	2,986	10.7	0	3,934	11.1	0
Dane	177	932	16.2	0	2,936	14.0	0	3,868	14.5	0
Deerfield	512	592	15.6	0	1,865	11.4	0	2,457	12.4	0
DeForest	1,149	882	9.9	0	2,778	5.6	0	3,660	6.6	0
McFarland	1,363	513	8.1	2.7	3,264	6.4	1.3	3,777	6.6	1.5
Maple Bluff	695	475	3.7	16.9	2,799	3.4	3.6	3,274	3.4	5.5
Marshall	914	686	15.2	0	2,161	9.7	0	2,847	11.0	0
Mazomanie	483	490	16.3	0	1,544	14.9	0	2,034	15.2	0
Mount Horeb	1,269	525	12.6	0	1,654	6.0	0	2,179	7.6	0
Oregon	1,411	818	10.3	0	2,577	8.6	0	3,395	9.0	0
Rockdale	79	592	18.9	0	1,865	16.3	0	2,457	16.9	0
Shorewood Hills	644	460	4.3	7.6	3,452	3.6	1.3	3,912	3.7	2.0
Waunakee	1,276	718	10.8	0	2,262	7.4	0	2,980	8.2	0
SUBTOTAL	12,305	673	11.4	1.3	2,481	7.9	0.5	3,154	8.6	0.7
4TH CLASS CITIES										
Middleton	5,199	437	5.4	3.8	3,007	3.9	0.6	3,444	4.1	1.0
Monona	3,698	434	5.3	6.7	3,423	4.5	1.2	3,897	4.6	1.9
Stoughton	2,886	526	8.6	2.3	1,657	3.4	0	2,183	4.7	0.6
Sun Prairie	4,574	772	8.0	2.3	2,432	4.3	0	3,204	5.2	0.6
Verona	1,711	566	9.0	2.0	1,751	6.4	0	2,307	7.0	0.5
SUBTOTAL	17,069	555	7.1	3.4	2,638	4.2	0.5	3,196	4.7	1.1
MADISON	72,377	422	4.6	13.5	2,770	3.7	4.0	3,192	3.8	5.3
DANE COUNTY	127,720	532	7.7	7.4	2,645	5.2	2.6	3,177	5.6	3.4

* Person Trips/HHLD/YR

Prepared by Dane County Regional Planning Commission, November, 1982.

TABLE 3-8

SINGLE FAMILY AND MULTIFAMILY
TRIP FREQUENCY AND TRIP LENGTH
BY UNIT OF GOVERNMENT

TOWNS		DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
			TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
Albion	S.F.	592	481	20.3		1,491	15.6		1,972	16.7	
	M.F.	55	437	19.0		1,040	18.0		1,477	18.3	
	TOT.	647	477	20.2	0	1,441	15.6	0	1,918	16.7	0
Berry	S.F.	331	941	15.1		2,917	11.4		3,858	12.3	
	M.F.	6	855	14.1		2,035	13.1		2,890	13.4	
	TOT.	337	939	15.1	2.4	2,836	11.4	0	3,775	12.3	0.6
Black Earth	S.F.	120	492	17.5		1,525	16.6		2,017	16.8	
	M.F.	7	448	16.3		1,066	19.1		1,514	18.3	
	TOT.	127	490	17.4	0	1,480	16.7	0	1,970	16.9	0
Blooming Grove	S.F.	539	1,009	10.4		3,128	9.1		4,137	9.4	
	M.F.	181	917	9.7		2,182	10.5		3,099	10.3	
	TOT.	720	986	10.2	0	2,978	9.4	0	3,964	9.6	0
Blue Mound	S.F.	205	607	16.9		1,882	13.0		2,489	14.0	
	M.F.	8	512	15.8		1,219	14.9		1,731	15.2	
	TOT.	213	605	16.9	0	1,827	13.0	0	2,432	14.0	0
Bristol	S.F.	494	971	11.8		3,010	10.3		3,981	10.7	
	M.F.	29	883	11.1		2,102	11.9		2,985	11.7	
	TOT.	523	966	11.8	0	2,917	10.4	0	3,883	10.7	0
Burke	S.F.	804	1,000	10.9		3,100	9.3		4,100	9.7	
	M.F.	147	909	10.2		2,163	10.8		3,072	10.6	
	TOT.	951	986	10.8	0	2,978	9.5	0	3,964	9.8	0
Christiana	S.F.	364	594	18.1		1,841	15.7		2,435	16.3	
	M.F.	13	540	17.0		1,285	18.2		1,825	17.8	
	TOT.	377	592	18.1	0	1,788	15.8	0	2,380	16.4	0
Cottage Grove	S.F.	873	896	11.7		2,778	9.8		3,674	10.3	
	M.F.	43	814	11.0		1,937	11.2		2,751	11.1	
	TOT.	916	892	11.7	0	2,694	9.8	0	3,586	10.3	0
Cross Plains	S.F.	299	943	11.1		2,923	9.7		3,866	9.8	
	M.F.	14	857	10.4		2,040	11.1		2,897	10.9	
	TOT.	313	939	11.1	2.4	2,836	9.7	0	3,775	10.0	0.6
Dane	S.F.	254	935	16.3		2,898	15.3		3,833	15.5	
	M.F.	8	850	15.3		2,023	17.7		2,873	17.0	
	TOT.	262	932	16.3	0	2,815	15.4	0	3,747	15.6	0
Deerfield	S.F.	309	597	16.4		1,851	12.9		2,448	13.8	
	M.F.	30	543	15.3		1,292	14.8		1,835	14.9	
	TOT.	339	592	16.3	0	1,788	13.0	0	2,380	13.8	0
Dunkirk	S.F.	662	480	12.8		1,488	9.1		1,968	10.0	
	M.F.	43	436	12.0		1,038	10.5		1,474	10.9	
	TOT.	705	477	12.8	0	1,441	9.2	0	1,918	10.1	0
Dunn	S.F.	1,693	479	11.7		1,484	10.6		1,963	10.9	
	M.F.	96	436	11.0		1,038	12.3		1,474	11.9	
	TOT.	1,789	477	11.7	0	1,441	10.7	0	1,918	10.9	0
Fitchburg	S.F.	1,931	843	8.3		2,613	7.1		3,456	7.4	
	M.F.	3,342	766	7.9		1,823	8.2		2,589	8.1	
	TOT.	5,273	794	8.0	2.8	2,398	7.7	0	3,192	7.8	0.7
Madison	S.F.	783	565	4.3		2,910	4.1		3,475	4.2	
	M.F.	1,663	472	3.4		2,079	4.1		2,551	4.0	
	TOT.	2,446	500	3.7	15.0	2,326	4.1	3.8	2,826	4.0	5.8
Mazomanie	S.F.	304	492	17.7		1,525	13.3		2,017	14.4	
	M.F.	14	447	16.6		1,064	15.4		1,511	15.8	
	TOT.	318	490	17.7	0	1,480	13.4	0	1,970	14.5	0
Medina	S.F.	310	689	16.0		2,136	12.8		2,825	13.6	
	M.F.	16	626	15.0		1,490	14.8		2,116	14.9	
	TOT.	326	686	16.0	0	2,078	12.9	0	2,764	13.7	0

Continued next page

TABLE 3-8 Continued

TOWNS		DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
			TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
Middleton	S.F.	777	557	9.1		1,727	7.4		2,284	7.8	
	M.F.	43	506	8.5		1,204	8.5		1,710	8.5	
	TOT.	820	554	9.1	6.4	1,673	7.4	0	2,227	7.9	1.6
Montrose	S.F.	316	818	14.5		2,536	13.1		3,354	13.4	
	M.F.	16	743	13.6		1,768	15.1		2,511	14.7	
	TOT.	332	814	14.5	2.2	2,458	13.2	0	3,272	13.5	0.5
Oregon	S.F.	535	1,339	12.2		4,151	11.5		5,490	11.7	
	M.F.	16	1,217	11.4		2,896	13.2		4,113	12.7	
	TOT.	551	1,335	12.2	2.6	4,032	11.5	0	5,367	11.7	0.6
Perry	S.F.	195	817	23.3		2,533	22.5		3,350	22.7	
	M.F.	7	742	21.8		1,766	26.0		2,508	24.8	
	TOT.	202	814	23.3	2.2	2,458	22.6	0	3,272	22.8	0.5
Pleasant Springs	S.F.	759	896	13.9		2,778	11.5		3,674	12.1	
	M.F.	35	814	13.0		1,937	13.3		2,751	13.2	
	TOT.	794	892	13.9	0	2,694	11.6	0	3,586	12.2	0
Primrose	S.F.	194	818	20.6		2,536	19.3		3,354	19.6	
	M.F.	10	743	19.2		1,768	22.6		2,511	21.6	
	TOT.	204	814	20.5	2.2	2,458	19.4	0	3,272	19.7	0.5
Roxbury	S.F.	423	943	18.9		2,923	15.5		3,866	16.3	
	M.F.	22	857	17.6		2,040	17.9		2,897	17.8	
	TOT.	445	939	18.8	2.4	2,836	15.6	0	3,775	16.4	0.6
Rutland	S.F.	453	1,340	13.6		4,154	12.2		5,494	12.5	
	M.F.	20	1,218	12.7		2,899	14.1		4,117	13.7	
	TOT.	473	1,335	13.6	2.6	4,032	12.3	0	5,367	12.6	0.6
Springdale	S.F.	380	607	15.0		1,882	13.0		2,489	13.5	
	M.F.	17	552	14.1		1,314	15.0		1,866	14.7	
	TOT.	397	605	15.0	0	1,827	13.1	0	2,432	13.6	0
Springfield	S.F.	569	816	11.6		2,530	10.9		3,346	11.1	
	M.F.	49	742	10.8		1,766	12.6		2,508	12.1	
	TOT.	618	810	11.5	3.0	2,446	11.0	0	3,256	11.1	0.7
Sun Prairie	S.F.	486	977	11.6		3,029	10.1		4,006	10.5	
	M.F.	66	888	10.8		2,113	11.6		3,001	11.4	
	TOT.	552	966	11.5	0	2,917	10.2	0	3,883	10.5	0
Vermont	S.F.	223	606	18.1		1,879	16.6		2,485	17.0	
	M.F.	4	551	16.9		1,311	19.1		1,862	18.4	
	TOT.	227	605	18.1	0	1,827	16.6	0	2,432	17.0	0
Verona	S.F.	532	551	10.1		1,708	7.7		2,259	8.3	
	M.F.	87	501	9.4		1,192	8.6		1,693	8.8	
	TOT.	619	544	10.0	6.4	1,643	7.8	0	2,187	8.3	1.6
Vienna	S.F.	363	939	13.5		2,911	11.7		3,850	12.1	
	M.F.	30	853	12.6		2,030	13.5		2,883	13.2	
	TOT.	393	932	13.4	0	2,815	11.8	0	3,747	12.2	0
Westport	S.F.	675	820	9.9		2,542	9.2		3,362	9.4	
	M.F.	107	746	9.2		1,775	10.6		2,521	10.2	
	TOT.	782	810	9.8	3.0	2,446	9.3	0	3,256	9.4	
Windsor	S.F.	954	953	10.8		2,954	7.8		3,907	8.5	
	M.F.	296	866	10.1		2,061	9.0		2,927	9.3	
	TOT.	1,250	932	10.6	0	2,815	8.0	0	3,747	8.6	0
York	S.F.	212	687	16.9		2,130	16.4		2,817	16.5	
	M.F.	3	624	16.8		1,485	18.9		2,109	18.0	
	TOT.	215	686	16.9	0	2,072	16.4	0	2,758	16.5	0
Total Towns	S.F.	18,913	784	12.3		2,479	10.4		3,263	10.9	
	M.F.	6,543	690	7.9		1,884	7.8		2,573	7.8	
	TOT.	25,456	760	11.3	2.4	2,372	9.8	0.4	3,132	10.1	0.8

Continued next page

TABLE 3-8 Continued

VILLAGES		DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
			TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
Belleville	S.F.	325	854	16.1		2,818	10.4		3,672	11.8	
	M.F.	127	712	12.8		2,029	10.3		2,741	11.0	
	TOT.	452	814	15.3	2.2	2,564	10.4	0	3,378	11.6	0.5
Black Earth	S.F.	355	502	15.8		1,657	11.5		2,159	12.5	
	M.F.	62	419	12.6		1,194	11.4		1,613	11.7	
	TOT.	417	490	15.4	0	1,544	11.5	0	2,034	12.4	0
Blue Mounds	S.F.	124	619	19.1		2,043	16.9		2,662	17.4	
	M.F.	19	516	15.2		1,471	16.7		1,987	16.3	
	TOT.	143	605	18.7	0	1,906	16.9	0	2,511	17.3	0
Brooklyn	S.F.	83	1,350	15.0		4,455	13.8		5,805	14.0	
	M.F.	6	1,125	11.9		3,206	13.7		4,331	13.1	
	TOT.	89	1,335	14.8	2.6	4,205	13.8	0	5,540	14.0	0.6
Cambridge	S.F.	240	617	17.7		2,036	9.3		2,653	11.2	
	M.F.	78	514	14.0		1,465	9.2		1,919	10.5	
	TOT.	318	592	16.9	0	1,865	9.3	0	2,457	11.1	0
Cottage Grove	S.F.	225	926	11.7		3,056	9.5		3,982	10.0	
	M.F.	64	772	9.3		2,200	9.4		2,972	9.4	
	TOT.	289	892	11.2	0	2,810	9.5	0	3,702	9.9	0
Cross Plains	S.F.	512	989	13.0		3,264	10.7		4,253	11.2	
	M.F.	171	824	10.3		2,348	10.6		3,172	10.5	
	TOT.	683	948	12.4	0	2,986	10.7	0	3,934	11.1	0
Dane	S.F.	155	952	16.6		3,142	14.0		4,094	14.6	
	M.F.	22	793	13.1		2,260	13.9		3,053	13.6	
	TOT.	177	932	16.2	0	2,936	14.0	0	3,868	14.5	0
Deerfield	S.F.	337	628	16.6		2,072	11.4		2,700		
	M.F.	175	523	13.2		1,491	11.3		2,014		
	TOT.	512	592	15.6	0	1,865	11.4	0	2,457	12.4	0
DeForest	S.F.	855	921	10.4		3,039	5.6		3,960	6.7	
	M.F.	294	768	8.2		2,189	5.6		2,957	6.3	
	TOT.	1,149	882	9.9	0	2,778	5.6	0	3,660	6.6	0
McFarland	S.F.	1,067	527	8.3		3,426	6.4		3,953	6.7	
	M.F.	296	441	6.6		2,447	6.3		2,888	6.4	
	TOT.	1,363	513	8.1	2.7	3,264	6.4	1.3	3,777	6.6	1.5
Maple Bluff	S.F.	548	506	4.0		3,135	3.4		3,641	3.5	
	M.F.	147	423	3.2		2,239	3.4		2,662	3.3	
	TOT.	694	475	3.7	16.9	2,799	3.4	3.6	3,274	3.4	5.5
Marshall	S.F.	773	704	15.6		2,323	9.7		3,027	11.1	
	M.F.	141	587	12.4		1,673	9.6		2,260	10.4	
	TOT.	914	686	15.2	0	2,161	9.7	0	2,847	11.0	0
Mazomanie	S.F.	391	506	16.9		1,670	14.9		2,176	15.4	
	M.F.	92	422	13.4		1,203	14.8		1,625	14.3	
	TOT.	483	490	16.3	0	1,544	14.9	0	2,034	15.2	0
Mt. Horeb	S.F.	900	552	13.3		1,822	6.0		2,374	7.7	
	M.F.	369	460	10.6		1,311	6.0		1,771	7.2	
	TOT.	1,269	525	12.6	0	1,654	6.0	0	2,179	7.6	0
Oregon	S.F.	953	865	10.9		2,854	8.6		3,719	9.2	
	M.F.	458	721	8.7		2,055	8.5		2,776	8.6	
	TOT.	1,411	818	10.3	0	2,577	8.6	0	3,395	9.0	0
Rockdale	S.F.	73	600	19.2		1,980	16.3		2,580	17.0	
	M.F.	6	500	15.2		1,425	16.1		1,925	15.9	
	TOT.	79	592	18.9	0	1,865	16.3	0	2,457	16.9	0
Shorewood Hills	S.F.	627	473	4.4		3,628	3.6		4,101	3.7	
	M.F.	17	396	3.5		2,591	3.6		2,987	3.6	
	TOT.	644	460	4.3	7.6	3,452	3.6	1.3	3,912	3.7	2.0
Waunakee	S.F.	843	761	11.5		2,511	7.4		3,272	8.4	
	M.F.	435	634	9.1		1,807	7.3		2,441	7.8	
	TOT.	1,278	718	10.8	0	2,262	7.4	0	2,980	8.2	0
Total Villages	S.F.	9,386	697	12.1		2,714	7.8		3,411	8.7	
	M.F.	2,979	604	9.6		1,898	7.8		2,501	8.2	
	TOT.	12,365	673	11.4	1.3	2,518	7.8	0.5	3,191	8.6	0.7

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TABLE 3-8 Continued

4th CLASS CITIES		DWELLING UNITS	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
			TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT	TRIPS/ D.U.	TRIP LENGTH	% TRANSIT
Middleton	S.F.	2,262	483	6.1		3,606	3.9		4,089	4.2	
	M.F.	2,927	404	4.8		2,576	3.9		2,980	4.0	
	TOT.	5,189	437	5.4	3.8	3,007	3.9	0.6	3,444	4.1	1.0
Monona	S.F.	2,416	498	5.6		3,737	4.5		4,235	4.6	
	M.F.	1,282	416	4.4		2,669	4.5		3,085	4.5	
	TOT.	3,698	474	5.3	6.7	3,423	4.5	1.2	3,897	4.6	1.9
Stoughton	S.F.	1,989	554	9.1		1,828	3.4		2,382	4.8	
	M.F.	857	461	7.2		1,314	3.4		1,775	4.5	
	TOT.	2,846	526	8.6	2.3	1,657	3.4	0	2,183	4.7	0.6
Sun Prairie	S.F.	2,676	829	8.7		2,736	4.3		3,565	5.3	
	M.F.	1,902	691	6.9		1,969	4.3		2,660	5.0	
	TOT.	4,578	772	8.0	2.3	2,432	4.3	0	3,204	5.2	0.6
Verona	S.F.	826	587	9.6		1,937	6.4		2,524	7.1	
	M.F.	385	489	7.6		1,394	6.4		1,883	6.7	
	TOT.	1,211	556	9.0	2.0	1,751	6.4	0	2,307	7.0	0.5
Total 4th Class Cities	S.F.	10,169	600	7.8		2,925	4.3		3,525	4.9	
	M.F.	7,353	491	6.0		2,226	4.1		2,718	4.4	
	TOT.	17,522	555	7.1	3.4	2,632	4.2	0.5	3,187	4.7	1.1
City of Madison	S.F.	32,297	464	5.1		3,279	3.7		3,743	3.9	
	M.F.	40,080	387	4.1		2,359	3.7		2,746	3.7	
	TOT.	72,377	422	4.6	13.5	2,770	3.7	4.0	3,192	3.8	5.3
Dane County	S.F.	70,765	600	9.1		2,939	5.8		3,539	6.4	
	M.F.	56,955	447	5.4		2,263	4.3		2,710	4.5	
	TOT.	127,720	532	7.7	7.4	2,645	5.2	2.6	3,177	5.6	3.4

Prepared by Dane County Regional Planning Commission, November, 1982.

average village single family household units with these in 4th class cities. This relationship, however, does not hold when comparing total average trips per dwelling unit of village multi-family units with town and 4th class city multifamily units. It appears that households in multifamily dwelling units in satellite villages have fewer trips per dwelling unit than households in any other area. If, however, the households in village satellites were merged with the households in 4th class city satellite communities, this special finding would disappear, and would take on the same relationship of the single family dwelling unit.

This completes the discussion and analysis of trip frequency. This represents the first half of the equation to arrive at the estimate of annual vehicle miles traveled (VMT) per dwelling unit for specific geographic locations in the county.

Step 4: Determine Trip Length for Each Subarea

Trip length is the second half of the equation needed to arrive at the desired VMT factor. As in the analysis of trip frequency, trip lengths will be estimated for the households of each dwelling unit type for each specific geographic location in the county.

By Geographic Area. TABLE 3-9A shows the length (miles/trip) for work trips, non-work trips and all trips for the three primary data sources. This format is the same as TABLE 3-1A. The data is according to the first level of analysis which is by major geographic subarea (urban, rural, and satellite). Each subarea reports trip length according to households in single family and multifamily dwelling unit types. The general relationships expressed in TABLE 3-9A can be summarized as follows:

1. For either work trips or non-work trips, the trip length associated with each is longer for residents in the rural areas than for residents in the satellite communities or the urban areas;

2. That households in single family dwelling units in urban areas have longer work trip lengths than households in multifamily dwelling units in urban areas;

3. That according to NPTS data the work trip length and the non-work trip length appear to be about the same for the single family dwelling unit in the urban area as for the single family dwelling unit in the rural area while local data shows the non-work trip length to be shorter than the work trip.

Because each of the data sources did not report information for all the categories shown in TABLE 3-9A, the remaining unknown values were estimated based on the relationship of the existing data and are shown in TABLE 3-9B. It should be pointed out that the rural and satellite values shown under the model column in TABLE 3-9A were estimated using a different computer model than was used for the urban area.

TABLE 3-9A

TRIP LENGTH
(MILES/TRIP)

CATEGORY	WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
	NPTS (1)	CENSUS (2)	MODEL (3)	NPTS	CENSUS	MODEL	NPTS	CENSUS	MODEL
URBAN	7.3	5.2	4.8	7.8	NA	3.9	7.7	NA	4.0
RURAL	10.0	11.9	13.6	10.1	NA	11.5	10.1	NA	12.3
SATELLITE	NA	8.5	10.1	NA	NA	6.9	NA	NA	8.2
URBAN									
Single Family	7.8	NA	NA	7.8	NA	NA	7.8	NA	NA
Multi-family	6.2	NA	NA	7.7	NA	NA	7.3	NA	NA
RURAL									
Single Family	10.1	NA	NA	9.8	NA	NA	9.8	NA	NA
Multi-family	9.4	NA	NA	11.3	NA	NA	10.7	NA	NA
SATELLITE									
Single Family	NA	NA	NA	NA	NA	NA	NA	NA	NA
Multi-family	NA	NA	NA	NA	NA	NA	NA	NA	NA

Prepared by Dane County Regional Planning Commission, November, 1982.

NA: Not available in raw data form. Can be estimated if certain assumptions are made.

(1) 1977 data.

(2) 1975 data.

(3) 1980 data.

TABLE 3-9B

1980 ESTIMATED TRIP LENGTHS
(MILES/TRIP)

CATEGORY	WORK TRIP	NON-WORK TRIP	ALL TRIPS
Urban	4.8	3.9	4.0
Rural	11.3	9.8	10.1
Satellite	10.7	6.6	7.6
Urban			
Single family	5.3	3.9	4.1
Multifamily	4.2	3.9	3.9
Rural			
Single family	12.3	10.4	10.9
Multifamily	7.9	7.8	7.8
Satellite			
Single family	11.8	6.8	7.9
Multifamily	8.6	6.1	6.7

Prepared by Dane County Regional Planning Commission, January, 1983.

The model can be described as a skim-tree network. The centroid of each community was assigned a number of trip productions and attractions and was connected to other community centroids by highway links with specified mileage. The model produced an estimate of the average trip length for the rural and satellite communities. The results are slightly higher than the census figures.

By Census Tract. The next level of analysis examines trip length at the census tract level. The census tract boundaries for that portion of the County outside the central urban area are the same as shown earlier in FIGURE 3-2. The boundaries inside the central urban area are by superdistrict, also shown earlier in FIGURE 3-4. Column five of TABLE 3-2 shows the average trip length of the work trips for all dwelling units of each census tract outside the central urban area. The trip lengths range in value from a low of 6.8 miles to a high of 17.6 miles with the average for all the census tracts combined of 10.1 miles. If the satellite communities are separated from this total, their average work trip length value is 8.5 miles, while the remaining rural area becomes 11.9 miles. See TABLES 3-3 and 3-4.

In a similar fashion, TABLE 3-5 provides trip length information not only for work trips but also for non-work trips for each of the superdistricts within the central urban area. The average work trip length for the entire central urban area is 4.8 miles while the non-work trip length is 3.9 miles long. For all trips the average is 4.0 miles long. As expected, those persons living in the downtown area, the isthmus and the university area have shorter trip lengths than those persons living in other parts of the central urban area.

By Individual Unit of Government. The third and final level of analysis allocates the trip length census and model data derived above to each unit of government. TABLE 3-7 provides trip lengths for work trips and non-work trips for each unit of government. It is important to note again that TABLE 3-7 provides a different aggregation of communities than was used for TABLE 3-9A. In addition, 1980 dwelling unit counts were used for TABLE 3-7 which shifted the weighting slightly.

As in the trip frequency estimate, the village satellite communities show a slightly different result from that of all of the satellite communities combined. The average work trip length for the village satellite communities is about the same as the average work trip length for the towns. When the work trip length of the 4th class cities are included, the trip length becomes shorter, reflecting the value shown in TABLE 3-9A.

Finally, TABLE 3-8 shows the allocation of trip length between single family and multifamily dwelling units. Single family dwelling units continue to have longer trip lengths per dwelling unit than multifamily units no matter what area they are in. The same results apply to non-work trip lengths. It is interesting to point out that while single family dwelling units in towns have a longer trip length than those in the villages, the reverse occurs for multifamily units for work trips only.

This completes the discussion and analysis of trip lengths. This represents the second half of the equation to arrive at the estimate of annual vehicle miles traveled (VMT) per dwelling unit for specific geographic locations in the County.

Step 5: Calculation of VMT

With the completion of Steps 3 and 4 of this methodology, it is now possible to estimate the desired VMT factors. TABLES 3-5 and 3-7 contain the necessary information to estimate VMT for each of the superdistricts in the central urban area and for each unit of government in Dane County.

For example, to estimate the annual work trip VMT for a single family dwelling unit in superdistrict one, the percent of transit trips are subtracted from the number of person work trips per dwelling unit. This new total is called person auto work trips per dwelling unit. This total is then divided by the estimated number of occupants for each auto. For work trips in Dane County, the auto occupancy factor used was 1.21, and for non-work trips the auto occupancy factor used was 1.88[17]. This new total reflects total auto work trips per single family dwelling unit which is then multiplied by its associated trip length, yielding the annual VMT of a work trip for a single family dwelling unit in superdistrict number one. This same process is done for the non-work trip. The results are shown in TABLES 3-10 and 3-11. TABLE 3-10 shows the VMT factors for the superdistricts and TABLE 3-11 shows the VMT factors for each unit of government. These factors are important because they are the building blocks for estimating energy use, and deriving locational and density relationships.

Step 6: Allocation of VMT to Existing Fleet

This step seeks the determination of the characteristics of the existing fleet in the region. Information on the number, age, and class of vehicles is necessary because of the significant differences in miles per gallon ratings within the fleet. Once the fleet characteristics are known, total VMT can be allocated among the classes and age groups.

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[17] Vehicle Occupancy: 1977 NPTS, U.S. Department of Transportation, FHWA, Office of Highway Planning, April, 1981, Report No. 6, Appendix A.
NOTE: This source has been provided in Appendix C of this report.

TABLE 3-10

VEHICLE MILES TRAVELED PER DWELLING UNIT PER YEAR
BY SUPERDISTRICT

SUPER DISTRICT	DWELLING UNITS			VMT/D.U./YR.								
				WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
	S.F.	M.F.	TOTAL	S.F.	M.F.	AVERAGE	S.F.	M.F.	AVERAGE	S.F.	M.F.	AVERAGE
1	112	3,375	3,487	269	178	179	1,811	1,294	1,310	2,080	1,472	1,489
2	364	6,296	6,660	346	238	240	1,741	1,243	1,270	2,087	1,481	1,510
3	854	1,792	2,646	707	479	550	3,663	2,615	2,953	4,370	3,094	3,503
4	1,016	1,915	2,931	833	548	654	3,935	2,811	3,201	4,768	3,359	3,855
5	3,224	1,937	5,161	1,390	930	1,207	5,466	3,903	4,879	6,856	4,833	6,086
6	3,650	1,786	5,436	1,273	852	1,145	4,542	3,244	4,116	5,815	4,096	5,261
7	2,913	576	3,489	2,647	1,777	2,489	9,957	6,973	9,464	12,604	8,750	11,953
8	614	1,296	1,910	2,465	1,626	1,906	10,799	7,714	8,706	13,264	9,340	10,612
9	1,937	823	2,760	2,847	1,897	2,571	8,650	6,178	7,913	11,497	8,075	10,484
10	439	0	439	3,222	0	3,222	14,036	0	14,036	17,258	0	17,258
11	111	6	117	2,625	1,735	2,564	12,573	8,825	12,381	15,198	10,560	14,945
12	4,631	1,926	6,557	2,150	1,411	1,937	8,838	6,312	8,096	10,988	7,723	10,033
13	1,548	204	1,752	2,043	1,373	1,972	9,460	6,620	9,130	11,503	7,993	11,102
14	153	0	153	3,236	0	3,236	16,328	0	16,328	19,564	0	19,564
15	1,394	276	1,670	3,517	2,341	3,341	11,511	8,093	10,946	15,028	10,434	14,287
16	1,184	2,799	3,983	1,707	1,127	1,300	6,105	4,362	4,880	7,812	5,489	6,180
17	944	1,072	2,016	2,495	1,663	2,060	13,294	9,494	11,273	15,789	11,157	13,333
18	639	1,026	1,665	2,386	1,589	1,891	11,231	8,021	9,253	13,617	9,610	11,144
19	925	1,725	2,650	360	241	279	3,998	2,856	3,254	4,358	3,097	3,533
20	120	130	250	2,137	1,402	1,764	8,867	6,332	7,549	11,004	7,734	9,313
21	1,334	3,148	4,482	4,270	2,814	3,245	11,361	8,116	9,082	15,631	10,930	12,327
22	143	3,131	3,274	312	210	212	1,064	760	773	1,376	970	985
23	2,352	1,518	3,870	1,280	870	1,124	6,089	4,349	5,407	7,369	5,219	6,531
24	50	1,165	1,215	1,246	843	849	7,028	5,020	5,103	8,274	5,863	5,952
25	1,344	274	1,618	1,589	1,058	1,510	6,857	4,897	6,525	8,446	5,955	8,035
26	2,104	2,096	4,200	1,402	919	1,163	5,587	3,991	4,790	6,989	4,910	5,953
27	3,440	413	3,853	1,627	1,076	1,561	6,137	4,386	5,949	7,764	5,462	7,510
28	2,889	1,565	4,454	1,567	1,053	1,387	6,353	4,538	5,716	7,920	5,591	7,103
29	3,165	2,229	5,394	3,661	2,433	3,164	9,328	6,664	8,227	12,989	9,097	11,391
30	256	62	318	3,492	2,331	3,260	13,753	9,666	12,956	17,245	11,997	16,216
31	1,939	2,693	4,632	2,342	1,542	1,876	7,436	5,312	6,201	9,778	6,854	8,077
32	124	20	144	2,746	1,810	2,606	15,970	11,195	15,307	18,716	13,005	17,913
33	183	0	183	3,014	0	3,014	14,679	0	14,679	17,693	0	17,693
34	294	22	316	2,859	1,913	2,793	17,589	12,392	17,227	20,448	14,305	20,020
TOTAL	46,389	47,296	93,685	1,948*	1,092*	1,510*	7,128*	4,410*	5,757*	9,076*	5,502*	7,267*

* AVERAGE

Prepared by Dane County Regional Planning Commission, November, 1982.

TABLE 3-11

VEHICLE MILES TRAVELED PER DWELLING UNIT PER YEAR BY UNIT OF GOVERNMENT

UNIT OF GOVERNMENT	DWELLING UNITS			VMT/D.U./YR.								
				WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
	S.F.	M.F.	TOTAL	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.
T. Albion	592	55	647	8,070	6,862	7,963	12,372	9,957	12,167	20,442	16,819	20,130
T. Berry	331	6	337	11,461	9,724	11,437	17,688	14,180	17,626	29,149	23,904	29,063
T. Black Earth	120	7	127	7,116	6,035	7,046	13,465	10,830	13,320	20,581	16,865	20,366
T. Blooming Grove	539	181	720	8,672	7,351	8,312	15,141	12,187	14,398	23,813	19,538	22,710
T. Blue Mounds	205	8	213	8,478	6,686	8,450	13,014	9,661	12,888	21,492	16,347	21,338
T. Bristol	494	29	523	9,469	8,100	9,420	16,491	13,305	16,314	25,960	21,405	25,734
T. Burke	804	147	951	9,008	7,663	8,801	15,335	12,426	14,885	24,343	20,089	23,686
T. Christiana	364	13	377	8,885	7,587	8,856	15,374	12,440	15,273	24,259	20,027	24,129
T. Cottage Grove	873	43	916	8,664	7,400	8,625	14,481	11,540	14,343	23,145	18,940	22,968
T. Cross Plains	299	14	313	8,443	7,189	8,407	15,081	12,045	14,946	23,524	19,234	23,353
T. Dane	254	8	262	12,595	10,748	12,555	23,585	19,046	23,446	36,180	29,794	36,001
T. Deerfield	309	30	339	8,092	6,866	7,975	12,701	10,171	12,477	20,793	17,037	20,452
T. Dunkirk	662	43	705	5,078	4,324	5,046	7,203	5,797	7,117	12,281	10,121	12,163
T. Dunn	1,693	96	1,789	4,632	3,964	4,612	8,367	6,791	8,283	12,999	10,755	12,895
T. Fitchburg	1,931	3,342	5,273	5,621	4,861	5,103	9,868	7,951	8,653	15,489	12,812	13,756
T. Madison	783	1,663	2,446	1,707	1,127	1,300	6,105	4,362	4,920	7,812	5,489	6,220
T. Mazomanie	304	14	318	7,197	6,132	7,168	10,789	8,716	10,697	17,986	14,848	17,865
T. Medina	310	16	326	9,111	7,760	9,071	14,543	11,730	14,405	23,654	19,490	23,476
T. Middleton	777	43	820	3,921	3,327	3,900	6,798	5,444	6,727	10,719	8,771	10,627
T. Montrose	316	16	332	9,587	8,167	9,540	17,671	14,200	17,504	27,258	22,367	27,044
T. Oregon	535	16	551	13,150	11,168	13,110	25,392	20,334	25,245	38,542	31,502	38,355
T. Perry	195	7	202	15,386	13,074	15,330	30,315	24,423	30,111	45,701	37,497	45,441
T. Pleasant Springs	759	35	794	10,293	8,745	10,247	16,993	13,703	16,848	27,286	22,448	27,095
T. Primrose	194	10	204	13,620	11,530	13,488	26,034	21,254	25,800	39,654	32,784	39,288
T. Roxbury	423	22	445	14,376	12,166	14,239	24,099	19,423	23,868	38,475	31,589	38,107
T. Rutland	453	20	473	14,670	12,452	14,615	26,957	21,742	26,736	41,627	34,194	41,351
T. Springdale	380	17	397	7,525	6,432	7,500	13,014	10,484	12,906	20,539	16,916	20,406
T. Springfield	569	49	618	7,588	6,424	7,467	14,669	11,836	14,444	22,257	18,260	21,911
T. Sun Prairie	486	66	552	9,366	7,926	9,181	16,273	13,038	15,886	25,639	20,964	25,067
T. Vermont	223	4	227	9,065	7,696	9,050	16,591	13,319	16,534	25,656	21,015	25,584
T. Verona	532	87	619	4,305	3,643	4,208	6,996	5,453	6,779	11,301	9,096	10,987
T. Vienna	363	30	393	10,476	8,882	10,321	18,116	14,577	17,846	28,592	23,459	28,167
T. Westport	675	107	782	6,508	5,502	6,365	12,440	10,008	12,107	18,948	15,510	18,472
T. Windsor	954	296	1,250	8,506	7,229	8,165	12,256	9,866	11,690	20,762	17,095	19,855
T. York	212	3	215	9,595	8,148	9,581	18,581	14,929	18,530	28,176	23,077	28,111
T. TOTAL	18,913	6,543	25,456	7,770*	4,390*	6,970*	13,659*	7,785*	12,315*	21,429*	12,175*	19,285*
V. Belleville	325	127	452	11,113	7,366	10,066	15,589	11,116	14,332	26,702	18,482	24,398
V. Black Earth	355	62	417	6,555	4,363	6,236	10,136	7,240	9,705	16,691	11,603	15,941
V. Blue Mounds	124	19	143	9,771	6,482	9,350	18,365	13,067	17,661	28,136	19,549	27,011
V. Brooklyn	83	6	89	16,300	10,776	15,904	32,702	23,363	32,072	49,002	34,139	47,976
V. Cambridge	240	78	318	9,026	5,947	8,268	10,072	7,169	9,360	19,098	13,116	17,628
V. Cottage Grove	225	64	289	8,954	5,934	8,257	15,443	11,000	14,459	24,397	16,934	22,716
V. Cross Plains	512	171	683	10,626	7,014	9,715	18,577	13,239	17,240	29,203	20,253	26,955
V. Dane	155	22	177	13,060	8,585	12,478	23,398	16,710	22,567	36,458	25,295	35,045
V. Deerfield	337	175	512	8,616	5,705	7,632	12,564	8,962	11,333	21,180	14,667	18,965
V. DeForest	855	294	1,149	7,916	5,204	7,216	9,052	6,520	8,404	16,968	11,724	15,620
V. McFarland	1,067	296	1,363	3,517	2,341	3,341	11,511	8,093	10,769	15,028	10,434	14,110
V. Maple Bluff	548	147	695	1,390	930	1,207	5,466	3,903	5,135	6,856	4,833	6,342
V. Marshall	773	141	914	9,076	6,016	8,618	11,986	8,543	11,455	21,062	14,559	20,073
V. Mazomanie	391	92	483	7,067	4,673	6,601	13,236	9,470	12,518	20,303	14,143	19,119
V. Mt. Horeb	900	369	1,269	6,067	4,030	5,467	5,815	4,184	5,341	11,882	8,214	10,808

Continued next page

TABLE 3-11 Continued

UNIT OF GOVERNMENT	DWELLING UNITS			VMT/D.U./YR.								
				WORK TRIPS			NON-WORK TRIPS			ALL TRIPS		
	S.F.	M.F.	TOTAL	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.
V. Oregon	953	458	1,411	7,792	5,184	6,963	13,056	9,291	11,834	20,848	14,475	18,797
V. Rockdale	73	6	79	9,521	6,281	9,247	17,167	12,203	16,790	26,688	18,484	26,037
V. Shorewood Hills	627	17	644	1,589	1,058	1,510	6,857	4,897	6,805	8,446	5,955	8,315
V. Waunakee	843	435	1,278	7,233	4,768	6,409	9,884	7,017	8,908	17,117	11,785	15,317
V. TOTAL	9,386	2,979	12,365	6,903*	4,784*	6,395*	11,204*	7,835*	10,395*	18,107*	12,619*	16,790*
C. Middleton	2,262	2,927	5,189	2,342	1,542	1,876	7,436	5,312	6,238	9,778	6,854	8,114
C. Monona	2,416	1,282	3,698	2,150	1,411	1,937	8,838	6,312	7,962	10,988	7,723	9,899
C. Stoughton	1,989	857	2,846	4,071	2,680	3,653	3,306	2,376	3,026	7,377	5,056	6,679
C. Sun Prairie	2,676	1,902	4,578	5,823	3,850	4,987	6,258	4,504	5,529	12,081	8,354	10,516
C. Verona	826	385	1,211	4,564	3,010	4,053	6,594	4,746	6,006	11,158	7,756	10,059
C. TOTAL	10,169	7,353	17,522	3,731*	2,326*	3,140*	6,657*	4,830*	5,581*	10,388*	7,156*	8,991*
C. Madison	32,297	40,080	72,377	1,681	1,134	1,388	6,195	4,457	5,234	7,876	5,591	6,622
Dane County	70,765	56,955	127,720	4,296	1,853	3,206	8,831	5,041	7,126	13,127	6,894	10,332

* AVERAGE

Prepared by Dane County Regional Planning Commission, November, 1982.

Unfortunately, this kind of information was not available at the County level. The information which was available was on a statewide basis which yielded the characteristics of a composite statewide car and is described in the next step.

Step 7: Estimation of Gallons of Fuel Consumed

As mentioned in the previous step, no information was available at the County level for a miles per gallon (MPG) rating. Instead a statewide estimate based on a composite statewide car was used. The Wisconsin Department of Transportation in 1981 used the R.L. Polk National Vehicle Population Profile file for Wisconsin to calculate an "over the road" MPG for gas and diesel consuming vehicles. The Department also used the Division of Revenue Forecasting model to provide seasonally adjusted MPG figures by quarter. The recommended MPG efficiency rating for gasoline vehicles statewide is 15.76. For the urban areas the efficiency rating is 13.71 and for the rural areas the rating is 18.91. These values of course will vary from region to region and will vary from year to year as technological changes are incorporated into the motorized fleet.

When these values are applied to TABLES 3-10 and 3-11, the results are an estimate of the gallons of fuel consumed by dwelling unit type and by location in Dane County and are shown in TABLES 3-12 and 3-13.

As expected, the City of Madison has the lowest consumption of gasoline on a per dwelling unit basis at 483 gallons per year. The entire central urban area is next at 530 gallons/d.u./yr. followed by the 4th class cities, villages and towns. The towns are the highest at 1,020 gallons/d.u./yr. Countywide, single family residences consume almost twice as much on a per unit basis compared with multifamily residences. The average number of gallons of gasoline consumed countywide on a per dwelling basis is 646.

Step 8: Conversion of Gallons to BTUs

In this step the gallons of fuel consumed by subareas are multiplied by energy conversion factors for a total estimate of BTUs. This BTU value or values permits comparisons with non-transportation related energy uses and activites. TABLES 3-14A and 3-14B summarize the amount of gallons of gasoline consumed and its associated energy value according to dwelling unit type, and geographic subarea.

TABLE 3-12

ANNUAL VEHICLE MILES TRAVELED, GALLONS AND COST PER DWELLING UNIT BY SUPER DISTRICT

SUPER DISTRICT	DWELLING UNITS			VMT/D.U./YR. ALL TRIPS			GALLONS/D.U./YR. ALL TRIPS			COST/D.U./YR. ALL TRIPS		
	S.F.	M.F.	TOTAL	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.
1	112	3,375	3,487	2,080	1,472	1,489	152	107	109	185	131	133
2	364	6,296	6,660	2,087	1,481	1,510	152	108	110	185	132	134
3	854	1,792	2,646	4,370	3,094	3,503	319	226	256	389	276	312
4	1,016	1,915	2,931	4,768	3,359	3,855	348	245	245	425	299	343
5	3,224	1,937	5,161	6,856	4,833	6,086	500	353	444	610	431	542
6	3,650	1,786	5,436	5,815	4,096	5,261	424	299	384	517	365	468
7	2,913	576	3,489	12,604	8,750	11,953	920	639	872	1,122	780	1,064
8	614	1,296	1,910	13,264	9,340	10,612	968	682	775	1,181	832	946
9	1,937	823	2,760	11,497	8,075	10,484	839	589	765	1,024	719	933
10	439	0	439	17,258	0	17,258	1,260	0	1,260	1,537	0	1,537
11	111	6	117	15,198	10,560	14,945	1,109	771	1,091	1,353	941	1,331
12	4,631	1,926	6,557	10,988	7,723	10,033	802	564	732	978	688	893
13	1,548	204	1,752	11,503	7,993	11,102	840	583	810	1,025	711	988
14	153	0	153	19,564	0	19,564	1,428	0	1,428	1,742	0	1,742
15	1,394	276	1,670	15,028	10,434	14,287	1,097	762	1,043	1,338	930	1,272
16	1,184	2,799	2,983	7,812	5,489	6,180	570	401	451	695	489	550
17	944	1,072	2,016	15,789	11,157	13,333	1,152	814	973	1,405	993	1,187
18	639	1,026	1,665	13,617	9,610	11,144	994	701	813	1,213	855	992
19	925	1,725	2,650	4,358	3,097	3,533	318	226	258	388	276	315
20	120	130	250	11,004	7,734	9,313	803	565	680	980	689	830
21	1,334	3,148	4,482	15,631	10,930	12,327	1,141	798	900	1,392	974	1,098
22	143	3,131	3,274	1,376	970	985	100	71	72	122	87	88
23	2,352	1,518	3,870	7,369	5,219	6,531	538	381	477	656	465	582
24	50	1,165	1,215	8,274	5,863	5,952	604	428	434	737	522	529
25	1,344	274	1,618	8,446	5,955	8,035	616	435	586	752	531	715
26	2,104	2,096	4,200	6,989	4,910	5,953	510	358	435	622	432	531
27	3,440	413	3,853	7,764	5,462	7,510	567	399	548	692	487	669
28	2,889	1,565	4,454	7,920	5,591	7,103	578	408	518	705	498	632
29	3,165	2,229	5,394	12,989	9,097	11,391	948	664	831	1,157	810	1,014
30	256	62	318	17,245	11,997	16,216	1,259	876	1,184	1,536	1,069	1,444
31	1,939	2,693	4,632	9,778	6,854	8,077	714	500	590	871	610	720
32	124	20	144	18,716	13,005	17,913	1,366	949	1,308	1,667	1,158	1,596
33	183	0	183	17,693	0	17,693	1,291	0	1,291	1,575	0	1,575
34	294	22	316	20,448	14,305	20,020	1,493	1,044	1,461	1,821	1,274	1,782
TOTAL	46,389	47,296	93,685	9,076*	5,502*	7,267*	662*	402*	530*	808*	490*	647*

* AVERAGE

Prepared by Dane County Regional Planning Commission, November, 1982.

TABLE 3-13

ANNUAL VEHICLE MILES TRAVELED, GALLONS AND COST PER DWELLING UNIT BY UNIT OF GOVERNMENT

UNIT OF GOVERNMENT	DWELLING UNITS			VMT/D.U./YR.[a] ALL TRIPS			GALLONS/D.U./YR.[b] ALL TRIPS			COST/D.U./YR.[c] ALL TRIPS		
	S.F.	M.F.	TOTAL	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.
T. Albion	592	55	647	20,442	16,819	20,130	1,082	890	1,065	1,320	1,086	1,299
T. Berry	331	6	337	29,149	23,904	29,063	1,542	1,265	1,538	1,881	1,543	1,876
T. Black Earth	120	7	127	20,581	16,865	20,366	1,089	892	1,078	1,329	1,088	1,315
T. Blooming Grove	539	181	720	23,813	19,538	22,710	1,260	1,034	1,202	1,537	1,261	1,466
T. Blue Mounds	205	8	213	21,492	16,347	21,338	1,137	865	1,129	1,387	1,055	1,377
T. Bristol	494	29	523	25,960	21,405	25,734	1,374	1,133	1,362	1,676	1,382	1,662
T. Burke	804	147	951	24,343	20,089	23,686	1,288	1,063	1,253	1,571	1,297	1,529
T. Christiana	364	13	377	24,259	20,027	24,129	1,284	1,060	1,277	1,566	1,293	1,558
T. Cottage Grove	873	43	916	23,145	18,940	22,968	1,225	1,002	1,215	1,494	1,222	1,482
T. Cross Plains	299	14	313	23,524	19,234	23,353	1,245	1,018	1,236	1,519	1,242	1,508
T. Dane	254	8	262	36,180	29,794	36,001	1,914	1,576	1,905	2,335	1,923	2,324
T. Deerfield	309	30	339	20,793	17,037	20,452	1,100	901	1,082	1,342	1,099	1,320
T. Dunkirk	662	43	705	12,281	10,121	12,163	650	536	644	793	654	786
T. Dunn	1,693	96	1,789	12,999	10,755	12,895	688	569	682	839	694	832
T. Fitchburg	1,931	3,342	5,273	15,489	12,812	13,756	820	678	728	1,000	827	888
T. Madison	783	1,663	2,446	7,812	5,489	6,220	413	290	329	504	354	401
T. Mazomanie	304	14	318	17,986	14,848	17,865	952	786	945	1,161	959	1,153
T. Medina	310	16	326	23,654	19,490	23,476	1,252	1,031	1,242	1,527	1,258	1,515
T. Middleton	777	43	820	10,719	8,771	10,627	567	464	562	692	566	686
T. Montrose	316	16	332	27,258	22,367	27,044	1,442	1,183	1,431	1,759	1,443	1,746
T. Oregon	535	16	551	38,542	31,502	38,355	2,039	1,667	2,029	2,488	2,034	2,475
T. Perry	195	7	202	45,701	37,497	45,441	2,418	1,984	2,404	2,950	2,420	2,933
T. Pleasant Springs	759	35	794	27,286	22,448	27,095	1,444	1,188	1,434	1,762	1,449	1,749
T. Primrose	194	10	204	39,654	32,784	39,288	2,098	1,735	2,079	2,560	2,117	2,536
T. Roxbury	423	22	445	38,475	31,589	38,107	2,036	1,671	2,016	2,484	2,039	2,460
T. Rutland	453	20	473	41,627	34,194	41,351	2,202	1,809	2,188	2,686	2,207	2,669
T. Springdale	380	17	397	20,539	16,916	20,406	1,087	895	1,080	1,326	1,092	1,318
T. Springfield	569	49	618	22,257	18,260	21,911	1,178	966	1,159	1,437	1,179	1,414
T. Sun Prairie	486	66	552	25,639	20,964	25,067	1,357	1,109	1,326	1,656	1,353	1,618
T. Vermont	223	4	227	25,656	21,015	25,584	1,357	1,112	1,354	1,656	1,357	1,652
T. Verona	532	87	619	11,301	9,096	10,987	598	481	581	730	587	709
T. Vienna	363	30	393	28,592	23,459	28,167	1,513	1,241	1,490	1,846	1,514	1,818
T. Westport	675	107	782	18,948	15,510	18,472	1,003	821	977	1,224	1,002	1,192
T. Windsor	954	296	1,250	20,762	17,095	19,855	1,099	904	1,051	1,341	1,103	1,282
T. York	212	3	215	28,176	23,077	28,111	1,491	1,221	1,487	1,819	1,490	1,814
T. TOTAL	18,913	6,543	25,456	21,429*	12,175*	19,285*	1,134*	644*	1,020*	1,383*	786*	1,244*
V. Belleville	325	127	452	26,702	18,482	24,398	1,413	978	1,291	1,724	1,193	1,575
V. Black Earth	355	62	417	16,691	11,603	15,941	883	614	843	1,077	749	1,028
V. Blue Mounds	124	19	143	28,136	19,549	27,011	1,489	1,034	1,429	1,817	1,261	1,743
V. Brooklyn	83	6	89	49,002	34,139	47,976	2,593	1,806	2,538	3,163	2,203	3,096
V. Cambridge	240	78	318	19,098	13,116	17,628	1,010	694	933	1,232	847	1,138
V. Cottage Grove	225	64	289	24,397	16,394	22,716	1,291	867	1,202	1,575	1,058	1,466
V. Cross Plains	512	171	683	29,203	20,253	26,955	1,545	1,072	1,426	1,885	1,308	1,740
V. Dane	155	22	177	36,458	25,295	35,045	1,929	1,338	1,854	2,353	1,632	2,262
V. Deerfield	337	175	512	21,180	14,667	18,965	1,121	776	1,003	1,368	947	1,224
V. DeForest	855	294	1,149	16,968	11,724	15,620	898	620	826	1,096	756	1,008
V. McFarland	1,067	296	1,363	15,028	10,434	14,110	1,097	762	1,030	1,338	930	1,257
V. Maple Bluff	548	147	695	6,856	4,833	6,342	500	353	463	610	431	565
V. Marshall	773	141	914	21,062	14,559	20,073	1,114	770	1,062	1,359	939	1,296
V. Mazomanie	391	92	483	20,303	14,143	19,119	1,074	748	1,012	1,310	913	1,235
V. Mt. Horeb	900	369	1,269	11,882	8,214	10,808	629	435	572	767	531	698
V. Oregon	953	458	1,411	20,848	14,475	18,797	1,103	766	995	1,346	935	1,214
V. Rockdale	73	6	79	26,688	18,484	26,037	1,412	978	1,378	1,723	1,193	1,681
V. Shorewood Hills	627	17	644	8,446	5,955	8,315	616	435	607	752	531	741
V. Waunakee	843	435	1,278	17,117	11,785	15,317	906	624	810	1,105	761	988
V. TOTAL	9,386	2,979	12,315	18,107*	12,619*	16,790*	1,016*	700*	944*	1,240*	854*	1,152*

Continued next page

TABLE 3-13 Continued

UNIT OF GOVERNMENT	DWELLING UNITS			VMT/D.U./YR. ALL TRIPS			GALLONS/D.U./YR. ALL TRIPS			COST/D.U./YR. ALL TRIPS		
	S.F.	M.F.	TOTAL	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.	S.F.	M.F.	AVE./ D.U.
C. Middleton	2,262	2,927	5,189	9,778	6,854	8,114	714	500	592	871	610	722
C. Monona	2,416	1,282	3,698	10,988	7,723	9,899	802	564	723	978	688	882
C. Stoughton	1,989	857	2,846	7,377	5,056	6,679	390	268	353	476	327	431
C. Sun Prairie	2,676	1,902	4,578	12,081	8,354	10,516	639	442	556	780	539	678
C. Verona	826	385	1,211	11,158	7,756	10,059	590	410	532	720	500	649
C. TOTAL	10,169	7,353	17,522	10,388*	7,156*	8,991*	642*	464*	567*	783*	566*	692*
C. Madison	32,297	40,080	72,377	7,876	5,591	6,622	575	408	483	702	498	589
Dane County	70,765	56,955	127,720	13,216	6,917	10,448	793	458	646	967	559	788

*AVERAGE

(a) Applies to non-farm dwelling units.

(b) Statewide 1981 MPG efficiency for gasoline vehicles was 15.76, 13.7 for urban areas and 18.9 for rural areas.

(c) Statewide price of gasoline for 3rd quarter of 1982 in Wisconsin was $1.22.

Note: For Table 3-13

1) Villages of McFarland, Maple Bluff, and Shorewood Hills used 13.7 MPG to compute Gallons/D.U./YR., all other villages used 18.9 MPG.

2) Cities of Madison, Middleton, and Monona used 13.7 MPG to compute Gallons/D.U./YR., Stoughton, Sun Prairie, and Verona used 18.9 MPG.

3) The Total Gallons/D.U./YR. values for the villages and 4th class cities were computed by summing the Gallons/YR. (D.U. x Gallons/D.U./YR.) and then dividing the sum for each category by the D.U. in the category.

Prepared by Dane County Regional Planning Commission, November, 1982.

TABLE 3-14B shows that countywide, single family and multi-family dwelling units consume 68 percent and 22 percent respectively, the gasoline used annually for automotive travel in the region. The City of Madison is the largest in its share at 43 percent, the towns are second with 31 percent of the total, and the villages and 4th class cities are about equal in their share (14 percent and 12 percent of the total).

Step 9: Density and Transportation Energy Relationships

One potential use of the person trips/d.u. factors and the VMT/d.u. factors, besides estimating energy consumption, is to examine each factor's relationship with its associated density in the region. A linear regression was done to determine if there was a straight line relationship between either VMT/d.u./yr. or trips/ d.u./yr and density within the region. Net residential acreage was used for the density variable.

The results of that analysis show that for person trips/d.u./yr. there is a good linear correlation (r=0.83) with density within the central urban area. Outside the central urban area, the correlation weakens to 0.55 when the satellite communities are added, and weakens even further to 0.40 when the towns are added. Inside the central urban area the densities range from 1.1 d.u./acre to 68.7 d.u./acre, the satellites range from 2.5 d.u./acre to 4.7 d.u./acre, and the towns range from 0.5 d.u./acre to 1.6 d.u./acre. It appears that outside the central urban area, densities are not high enough to affect trip making behavior in a linear fashion.

When VMT/d.u./yr. was analyzed with density, the correlation was low at 0.65 within the central urban area and even lower countywide at 0.46. Thus, it would appear that there is a weak correlation between VMT and density.

Step 10: System for Tracking Impacts

The final step in the process is to incorporate the transportation energy factors into a system which will track the energy impacts of development and convey the results in a timely way to the public, to local elected officials and implementing agency officials. Presently, the Dane County Regional Planning Commission produces an annual Regional Trends Report which tracks development in the County and provides an opportunity to report impacts.

As demonstrated in this project, the factors will be applied to actual residential land use development in the region, using building permit and land subdivision development data which is now collected quarterly for urban and rural portions of the region.

TABLE 3-14A

GASOLINE AND ENERGY CONSUMPTION PER DWELLING UNIT PER YEAR

	GALLONS/D.U./YR.			BTU/D.U./YR. x 10^6		
CATEGORY	S.F.	M.F.	AVERAGE	S.F.	M.F.	AVERAGE
Towns	1,134	644	1,020	141.8	80.5	127.5
Villages	1,016	700	944	127.0	87.5	118.0
4th Class	642	464	567	80.3	58.0	70.9
City of Madison	575	408	483	71.9	51.0	60.4
Dane County	793	458	646	99.1	57.3	80.9

TABLE 3-14B

TOTAL GASOLINE AND ENERGY CONSUMPTION PER YEAR

	TOTAL GALLONS/YR x 10^6			TOTAL BTU/YR x 10^{12}			
CATEGORY	S.F.	M.F.	TOTAL	S.F.	M.F.	TOTAL	% OF TOTAL
Towns	21.4	4.2	25.6	2.7	0.5	3.2	31
Villages	9.5	2.1	11.6	1.2	0.3	1.5	14
4th Class Cities	6.5	3.4	9.9	0.8	0.4	1.2	12
City of Madison	18.6	16.4	35.0	2.3	2.1	4.4	43
Dane County	56.0	26.1	82.1	7.0	3.3	10.3	100
% of Total	68	32	100				

Prepared by Dane County Regional Planning Commission, November, 1982.

The reporting will include energy consumption (gallons/year) and energy costs (energy dollars/year) for various subareas of the region. For a simple example, TABLE 3-15 shows the number of new residential units added between 1980 and 1981 for each major subarea in the County; the associated VMT factors, energy factors and cost factors; and the expected increases in VMT, gallons of gasoline consumed and its cost. Thus, countywide, the new residential development that occurred in 1981 is expected to potentially increase gasoline consumption by 999,000 gallons per year. This impact can be addressed by examining alternative development scenarios. In addition to reporting trends and impacts by major subarea, the trends report will also report the same impacts for each of the 61 units of government in the region. Other reporting techniques of the impacts will also be used besides the trends report and are discussed in detail in Chapter 4.

To conclude this chapter on methodology, FIGURE 3-7 illustrates all ten steps in a flow chart diagram. The process is basically a straight line sequential process. Steps 3 and 4 which estimate trip frequency and trip length values can be done at the same time. Steps 8 and 9 can also be done simultaneously and can even be eliminated from the process. While they are not essential in the derivation of the factors, they do, however, allow one to put the factors in perspective with other energy types, uses, and relationships. It is recommended that all the steps in the process be used.

Steps 3 and 4 were the most difficult to complete but they represent the heart of the project. Very little data exists on trip frequency and trip length by dwelling unit type. Most of the data found dealt primarily with work trips in urban areas without regard to dwelling unit type or the location of that dwelling unit.

To overcome this critical data shortage, transportation surveys were examined to see if any of them asked the kind of questions which would provide the kind of raw data needed by the project. Two such surveys were found to be desirable: the 1977 National Personal Transportation Study (NPTS) and a 1975-1976 Annual Housing Survey conducted by the Bureau of Census in the region which contained a journey to work survey supplement. The NPTS survey provided the kind of data from a national perspective against which the local data could be compared.

A copy of the computer tapes of the NPTS survey was found at Wisconsin's State Department of Transportation. The department made the tapes available to the project as well as the time of a computer programmer to write a program to extract the information needed from the survey tapes. (Details relating to the information extracted including those portions which were deemed unusable can be found in Appendix A). Of importance is the fact that this data provided the necessary relationships and ratios between work trips and non work trips for single family and multifamily dwelling units to fill the gaps in the local data. The details of which have been described earlier and in Appendix B.

The local data, on the other hand, provided the real numbers needed for the actual factors which would be applied to local building permit data. The special census survey was instrumental in providing values for the rural and satellite communities in the region and a computer model was used to generate values in the central urban area (see Appendix A).

Census values could have been used in the central urban area if the model data were not available for 1980, which would have slightly overstated the number of work trips per year.

For those who wish to generate similar factors for other regions of the country will probably find the same data problems as this project experienced. If census data or special studies such as this project do not overcome the problems then special individualized surveys will have to be conducted or qualified literature values substituted. However, most urbanized areas should have similar data and the process identified here should be helpful.

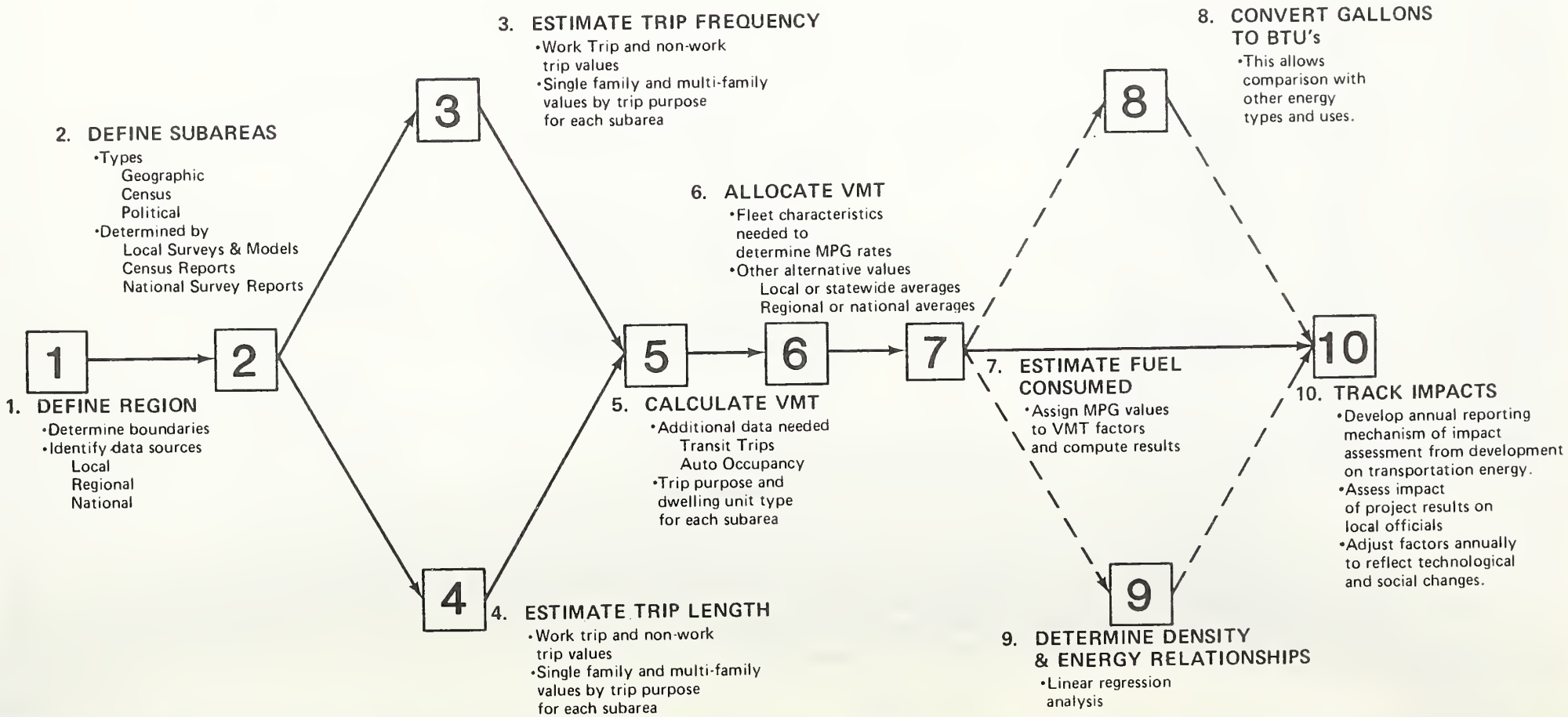
TABLE 3-15

TRANSPORTATION ENERGY IMPACTS
FROM 1981 RESIDENTIAL DEVELOPMENT
IN DANE COUNTY

CATEGORY		1981 D.U.s	FACTORS/D.U./YR.			TOTAL IMPACTS x 10^3		
			VMT	GALLONS	COST	VMT	GALLONS	COST
Towns	S.F.	237	21,429	1,134	1,383	5,079	269	328
	M.F.	89	12,175	644	786	1,084	57	70
	TOT.	326				6,163	326	398
Villages	S.F.	46	18,107	1,016	1,240	833	47	57
	M.F.	114	12,619	700	854	1,439	80	97
	TOT.	160				2,272	127	154
4th Class Cities	S.F.	85	10,388	642	783	883	55	67
	M.F.	47	7,156	464	566	336	22	27
	TOT.	132				1,219	77	94
City of Madison	S.F.	149	7,876	575	702	1,174	86	105
	M.F.	939	5,591	408	498	5,250	383	468
	TOT.	1,088				6,424	469	573
Dane County	S.F.	517				7,969	457	557
	M.F.	1,189				8,109	542	662
	TOT.	1,706				16,078	999	1,219

Prepared by Dane County Regional Planning Commission, November, 1982.

Figure 3-7
Flow Chart of Methodology



CHAPTER 4

PROJECT REPORTING ACTIVITIES

The preceding chapters of this report have discussed the status of planning and the energy situation in the region, a summary of the problems and project overview, and methodology used in the conduct of the study. This chapter discusses the project reporting activities, both those used during the course of the project development and findings, as well as follow up activities to encourage local use of the project findings.

Reporting Project Development and Findings

The Dane County Regional Planning Commission routinely uses a variety of means to report the progress and status of various projects to public officials and the general public in this region. These routine techniques include: advisory committees; RPC Newsletter; RPC Annual Report; annual Regional Trends reporting; and project summaries and full reports.

Periodic progress reports relating to this project have been presented to two of the Commission's advisory committees: an RPC Citizen Advisory Committee composed of representatives of major interest groups in the region; and a Transportation Technical Coordinating Committee composed of representatives of transportation and planning agencies in the area.

The Transportation Energy Conservation Project has also received special attention in the RPC newsletter and the RPC Annual Report. The newsletter has a distribution of about 2,000 in this region with copies directed to all local elected officials as well as neighborhood groups and interested individuals. The Annual Report is distributed to local units of government and is made available to others upon request.

A Regional Trends report, which reviews growth and development activities in the region, has also been modified to report the annual effects of housing development on transportation energy consumption by dwelling unit type and location in the region.

Finally, the project summary and the full report will be made available to all interested parties in the area. The project summary, which is always the most popular, will receive the widest distribution and will contain the findings of the project and the suggested means by which each local unit of government can utilize the transportation energy consumption factors in considering local land use decisions.

Questionnaire Results. In addition to the above routine reporting on the project development and findings, the DCRPC conducted a before and after survey questionnaire of local officials. While designed to survey their understanding of transportation energy consumption, the survey also provided a dimension of increasing awareness and education on this project.

Local Use of Project Findings

Local use of the findings of this Transportation Energy Conservation Project can be considered as: (1) those uses in monitoring progress and annual summaries at the regional level; and (2) use by local units of government as they consider local land use decisions and development planning. Each of these will be reported in the following paragraphs.

Regional Monitoring and Annual Reporting. The annually published Regional Trends report will be the primary means of annually summarizing the impact of new development upon transportation energy consumption in the region. This report is already annually prepared to summarize building permit and subdivision plat data in the region, and has been expanded in recent years to note transportation developments and various other monitoring data for the preceding year. This report and data are routinely presented each spring to report regional trends at a public hearing which permits consideration of comments to change any of the adopted regional plans and programs. Additionally, this Regional Trends report is distributed to all local units of government and libraries in the region, and is made available upon request to other groups and interested citizens. This has been a popular and widely used document over the past several years, particularly among potential developers.

This Transportation Energy Conservation Project has provided 1980 base year data for transportation energy consumption in the region, and has provided factors for calculation of transportation energy consumption for each new dwelling unit in each local unit of government. Using the data determined in this project, it is a simple matter of computing transportation energy consumption per dwelling unit times the number of new dwellings to note the additional transportation energy consumption for each local unit of government.

The format of the Regional Trends report will be modified slightly to include a section to summarize the impacts of new development. Generally the impacts of new development for the previous year will be discussed, and wherever possible quantified, within the matrix format noted on FIGURE 4-1 on the next page. This Transportation Energy Conservation Project provides data which permits us to quantify only this one factor of impacts of regional growth, although other factors can be discussed within this matrix framework. In time, other factors of impacts may be able to be quantified.

FIGURE 4-1

REGIONAL GROWTH
IMPACT MATRIX

Categories of Impacts	GROGRAPHIC AREAS						
	GOVERNMENTAL UNITS				DEVELOPING AREAS		
	Towns	Villages	4th Class Cities	City of Madison	Rural Areas	Satellite Communities	Central (Madison) Urban Area
A. Social Impacts							
B. Economic Impacts							
C. Environmental/ Physical Impacts							
D. Institutional Impacts							
E. Energy Impacts							
1. Transportation Energy Consumption							
2. Other Energy Impacts							

The Regional Growth Impact Matrix attempts to organize all potential regional growth impacts into five categories which are felt to encompass the universe of all potential regional impacts. The following comments help suggest the impact factors that might be addressed within each of the five categories of impacts; however, the individual factors can be either more or less inclusive within each category:

a. Social Impacts: Can include convenience, safety, social interactions, mobility and accessibility.

b. Economic Impacts: Can include personal or family costs of development, and can include community or regionwide public development costs, and could include public plus private costs of development. This Transportation Energy Conservation Project provides data to permit calculation of transportation fuel cost per dwelling unit per year for each summary geographic areas.

c. Environmental/Physical Impacts: Can address the spatial distribution of development and their impacts, can address environmental impacts, land use impacts, and the like.

d. Institutional Impacts: Can address organizational and political acceptability impacts such as land use control ordinances, institutional structures, and the like.

e. Energy Impacts: Can include the array of transportation and non-transportation impacts related to development in various locations.

This type of Regional Growth Impact Analyses will be added to the Regional Trends report starting in spring, 1983 for transportation energy consumption factors, and will be expanded to other quantifiable factors as possible.

Local Decision Maker Use of Project Findings. Local decision makers are expected to be able to use the transportation energy consumption factors developed as a product of this project in two basic ways: as a factor when considering individual land use change decisions; and as a factor when considering overall local land use plans and zoning ordinances.

Individual zoning and subdivision plat decisions which are under consideration within each town, village or city can be affected by the increased awareness of transportation energy consumption by dwelling unit. For example, the extent to which a developer provides multifamily dwelling units and single family dwelling units within a single major development may be affected by knowledge of the transportation energy consumption factors. In addition, knowledge of the relative transportation energy consumption factors may affect the decision to approve greater or lesser numbers of dwelling units as part of any given proposed land use development. While the above examples of individual decision making can be affected by the transportation energy consumption factors, it is recognized there is a broad array of factors that are considered when these individual land use development decisions are to be made and that transportation energy consumption is only one factor.

The local town, village or city can be expected to use these transportation energy consumption factors by dwelling unit type and location at such time as they are updating their local land use plans and zoning ordinance maps. Most of the 60 local units of government within Dane County have updated their land use plans in recent years and have included policies to continue periodic plan updates in the future. The Commission, by making these transportation energy consumption factors available to each local unit of government, and by continuing to provide DCRPC staff assistance in updating local land use plans, it is expected that local land use plans will generally be improved in a manner to lessen transportation energy consumption. These transportation energy consumption factors can aid in planning the distribution and densities of proposed new residential land uses with a community. In addition, an understanding and awareness of transportation energy consumption in a community can also lead to other local policy decisions to encourage transit and ridesharing usage, and other policies which might reduce transportation energy consumption.

Survey of Local Officials

As mentioned previously in this report, the ultimate objective of this demonstration project is to develop transportation energy consumption factors which can be considered by local officials when making future land use decisions. In order to evaluate the success of efforts to inform the local decision makers on the results of this demonstration project, a "before and after" survey of officials was included in the study design. The "before" survey was designed to assess the officials' perceptions of energy consumption relationships prior to receiving any information from the study, the level of interest in receiving further information and the most useful means of receiving the study information. The "after" survey was distributed following the release of the study results to assess the success of the efforts to disseminate the information. Copies of both survey questionnaires are included in Appendix D.

The population to be surveyed was local officials in all the local units of government who were involved in making land use decisions. The population included both elected officials and appointed planning committee members from the county, cities, villages and towns. The sample which was surveyed included the Regional Planning Commission and its advisory committees in addition to all of the municipalities chief executives, three members of each planning committee, the county board, Madison Common Council and City of Madison Energy Committee. The following is a breakdown of the survey sample.

GROUP	NO. SURVEYED	NO. RETURNED 6/82	NO. RETURNED 2/83
Planning Committees (town, village and city)	171	32	24
Chief Executives (town, village, city and county)	61	10	10
County Board	41	7	5
Madison Common Council	22	7	3
Regional Planning Commission	5	3	1
	(6 additional members are included in the County Board)		
RPC Citizen Advisory Committee	12	5	11
RPC Technical Coordinating Committee	20	8	13
Madison Energy Committee	5	2	2
Unidentified		14	1
TOTAL	337	88	70

The survey was conducted through the mail. Questionnaires were mailed out to local officials in late June with a cover letter briefly explaining the purpose of the survey and requesting the officials' assistance with the study. Members of the RPC and the RPC advisory committees were requested to return the forms at their regularly scheduled meetings. Of the 337 questionnaires mailed out, 88 were returned for a response rate of 26 percent.

Tabulations of the responses to each question are shown on the sample questionnaire included in Appendix D. Overall results indicate a significant majority of the respondents indicated they thought urban area households would travel fewer miles and consume less fuel annually than households located in the rural areas of the county. Approximately 73 percent of the respondents indicated urban area households would travel less and 69 percent indicated urban area households would use less fuel than rural households. The perceptions of the relationships between small cities and rural areas and between single family and multifamily residents were less clear cut. Just over 50 percent of the respondents indicated they believed households in small cities would travel less than rural households. The remaining responses split evenly between small city households traveling more and households in both locations traveling the same. Fifty-five percent of the respondents thought residents of single family homes would travel more than residents of multifamily, 15 percent said less and 30 percent said the same. Responses did not differ significantly between town, village or city officials.

When asked if they now considered energy impacts when making land use decisions, over 35 percent said yes at least occasionally. Thirty-one percent said no because the information was not available and 24 percent said energy was not an important factor.

Eighty percent of the respondents said they would find energy consumption information for differing types of development to be of interest. These results indicate an interest on the part of local officials for energy information and an indication that if the information were available, many of them would consider energy impacts when making land use decisions.

The final section of the survey asked the officials for any comments they had on the study. Several comments expressed opinions on the different nature of travel in the rural areas from urban areas and that although miles traveled in the rural areas might be greater, the fuel efficiency would also be greater in the rural areas. One respondent indicated a desire for energy consumption factors to be developed for other energy uses as well as transportation.

Following completion of the calculation of energy factors, preliminary results of the study were presented to local officials. A four-page summary of the preliminary findings of the study was prepared and mailed in mid-January to the same sample of local officials selected for the initial survey. The summary also indicated to the officials they would soon be receiving a survey questionnaire as a follow-up to the survey in which they participated at the beginning of the study.

The following week the survey questionnaire was mailed to the local officials. A sample questionnaire is included in Appendix D. The first four questions (Part A) of the initial survey were repeated in the follow-up survey as the measure of the level of understanding of energy consumption/land use relationships. Part B of the follow-up survey asked about data reporting. Officials were asked if the summary of preliminary findings had been of interest to them and which method(s) of further reporting would be the most helpful. Of the 337 questionnaires mailed out, 70 were returned for a response rate of 21 percent.

The results show that 63 percent of the respondents thought annual VMT for persons residing in single family homes would be greater than that for persons residing in multifamily dwellings. This compares with 55 percent in the initial survey. Sixty-seven percent of the respondents thought annual VMT for households in small cities and villages would be less than for households in the rural areas. Fifty-two percent indicated less on the initial survey. In comparing the annual VMT for a household located in the Madison urban area with a household located in the rural areas of the county, 83 percent thought the former would travel fewer miles. This compares with 73 percent in the initial survey.

The final question in Part A proved to be somewhat confusing to respondents as there were two possible interpretations of the question. Respondents were confused as to whether the question was referring to the total number of households in the urban area compared to the total number of households in the rural area or the average household in each area. The correct response to the former interpretation would be "more" and the correct response to the latter would be "less". For this reason the results of this question are less clear cut than for the other questions. Over 28 percent of the respondents in the follow-up survey selected "more" as the answer with just over 58 percent selecting "less". This compares with 21 percent and 69 percent from the initial survey.

When asked if the preliminary information provided them on the results of the study had been of interest, 77 percent indicated it had. There were few comments made on the survey by respondents. Some respondents had questions about the results and some requested more information on the variables used.

The results of the follow-up survey show that the level of awareness of transportation energy consumption/land use relationships increased over that shown from the initial survey. With the exception of question four, the number of correct responses increased from 8 to 15 percent on the individual questions. These results were obtained from distributing a four page summary of preliminary results as mentioned earlier. The follow-up survey was conducted immediately following the distribution of the preliminary results to enable inclusion of the survey results in this final project report. More extensive distribution of the project results is planned through the release of the full project report, the project summary and the upcoming 1982 Regional Trends report prepared by the DCRPC. This distribution will be more extensive and will provide more detailed final results than those available for the preliminary summary. Awareness of and interest in the transportation energy/land use relationships illustrated by this study are expected to increase further following the release of these documents.

CHAPTER 5

CONCLUSIONS

Findings and Observations

This demonstration project has produced factors which will help to identify the transportation energy impacts from residential development. Of special merit is the ability to quantify these impacts for not only single family dwelling units, but also for multifamily dwelling units for any geographic location in the region. The factors have been developed in a manner for simple calculation of these impacts and for establishing simple quantitated relationships of transportation energy consumption from residential development in the region.

One of the major purposes for wanting to develop these factors, besides their quantitative merit, is the value they have as an educational tool in conveying a complex multifactor system in a way which is easy for the general public to understand. When local elected officials are trying to make a decision about the type and location of development in their area, these factors will provide them with an additional piece of information which will assist them in that decision. When an individual is trying to make a decision about where to build or buy a home in the region and transportation energy costs are an important factor in that decision, knowing the fact that the transportation energy costs of the average dwelling unit located in one of the satellite communities is approximately two times higher than a dwelling unit in the central urban area, and even three times higher in the rural area, may have an influence on the decision. It is important to stress that decisions on the type of development or where to locate development are not made solely on transportation energy costs, but rather on a whole range of factors of which transportation energy costs is one important part.

Meeting Objectives. The project has clearly achieved the objectives it set out to accomplish. (1) Detailed as well as generalized transportation energy factor by dwelling unit type and location in the region have been developed. (2) The project has incorporated these factors into its annual trends report of the Regional Planning Commission which brings this information to the attention of the public as well as local elected and agency officials. Since the trends report shows not only the magnitude of residential development but also the trend of that development, it will also show the magnitude of the transportation energy impact from that development and the trend of that impact. (3) The project has developed these factors in a 10 step process so that other regions in the country can develop comparable factors for their area. (4) Through the public opinion survey conducted as a part of this demonstration effort as well as through the agency's normal reporting activities such as the newsletter, citizen advisory committee meetings, and the annual conference, significant

attention has been brought to bear on the project and a heightened awareness is already manifesting itself by decision-makers of the transportation energy implications of their decisions. (5) Not only will all the local planning committees, respective agency officials, and local units of government be given the results of the project, but also DCRPC staff in the various divisions of the agency will continually advise the respective County and local committees responsible for making land use decisions, about the transportation energy factors which have been developed and the potential impacts that their decisions will have. And lastly (6) the final report on the project and the popular summary will act as information mechanisms which will aid in conserving transportation energy throughout the Dane County region.

Problems Encountered. Most of the problems encountered by the project were the usual data problems. For instance, the NPTS data was not reporting trip frequency or trip length by dwelling unit type. Fortunately, the Wisconsin Department of Transportation had a copy of the computer survey tapes and provided the project with a computer programmer to write the necessary programs to retrieve the kind of information needed.

Detailed dwelling unit counts and land acreages from the Land Use Inventory were also incomplete, which resulted in having to go through a more difficult process of getting the information from building permit data for each of the 60 units of government.

Finally, the sample sizes being reported by the NPTS were too small for some of the aggregations being sought. In these instances, the data was not used and other aggregations had to be generated which provided more reliable results. The impact from these kind of data setbacks slowed the project, but not seriously enough to put it in any kind of jeopardy. No other serious kind of problems were encountered.

Trip Frequency. The following is a summary of the observations made about trip frequency:

1. For either community or housing type, there are approximately three times as many non-work trips as work trips made per household each year;

2. While households in rural areas make more trips per year than households in urban areas, they also make significantly fewer non-work trips per year than households in urban areas, resulting in fewer total trips made;

3. Households in satellite communities fall in between the range of work trips made by households in rural and urban areas;

Trip Length. The following is a summary of the observations made about trip length:

1. For either work trips or non-work trips, the trip length associated with each is longer for residents in rural areas than for residents in the satellite communities or the urban areas;

2. That households in single family dwelling units in urban areas have longer work trip lengths than households in multifamily dwelling units in urban areas;

3. Single family households in urban or rural areas drive shorter distances when traveling for non-work purposes.

Final Factors. A summary of the detailed factors generated in TABLES 3-12 and 3-13 of Chapter 3 is provided in TABLE 5-1. This table shows the factors on a per dwelling unit basis for estimating the annual amount of vehicle miles traveled (VMT), the annual amount of gasoline consumed and the annual cost of the gallons of gasoline consumed for each class of community in Dane County.

If the City of Madison is the base against which the other classes of communities are compared, TABLE 5-1 shows that dwelling units in:

(a) 4th class cities travel 36 percent, and consume and spend 17 percent more, or a factor of 1.2;

(b) Villages travel 2.5 times further, and consume and spend 96 percent more or a factor of 2.0; and

(c) Towns travel three times further, and consume and spend 111 percent more or a factor of 2.1, than those dwelling units in the City of Madison.

When the number of dwelling units in each community class are multiplied by these factors the results illustrate the approximate percentage share of the total miles traveled and the total gallons of gasoline consumed for each class (see TABLE 5-2). The towns as a whole represent a 31 percent share and the City of Madison holds a 43 percent share. The villages and the 4th class cities are also almost equal to each other, with 14 percent and 12 percent respectively.

Another way of looking at the same data is by major geographic area (Central Urban Area, Satellite, and Rural) instead of by community class. The results are shown in TABLE 5-3. It is important to note that the factors have changed significantly for each of the subcategories while the County total remains basically the same. In this special aggregation, some of the 4th class cities, villages, and portions of towns are incorporated into the central urban area, while other 4th class cities and villages are combined into the satellite category.

Table 5-1

VEHICLE MILES TRAVELED, GALLONS, AND COST PER DWELLING UNIT PER YEAR
BY COMMUNITY CLASS

CATEGORY	VMT/D.U./YR.			GALLONS/D.U./YR.			COST/D.U./YR.		
	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.
Towns	21,429	12,175	19,285	1,134	644	1,020	1,383	786	1,244
Villages	18,107	12,619	16,790	1,016	700	944	1,240	854	1,152
4th Class Cities	10,388	7,156	8,991	642	464	567	783	566	692
City of Madison	7,876	5,591	6,622	575	408	483	702	498	589
DANE COUNTY	13,216	6,917	10,448	793	458	646	967	559	788

Table 5-2

TOTAL VEHICLE MILES TRAVELED, GALLONS, AND COST PER YEAR
BY COMMUNITY CLASS

CATEGORY	TOTAL VMT/YR.x10^6			TOTAL GALS./YR.x10^6			COST/YR.x10^6			
	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	PERCENT
Towns	405.2	79.7	484.9	21.4	4.2	25.6	26.1	5.1	31.2	31
Villages	170.0	37.6	207.6	9.5	2.1	11.6	11.6	2.5	14.1	14
4th Class Cities	105.6	52.6	158.2	6.5	3.4	9.9	8.0	4.2	12.2	12
City of Madison	254.4	224.1	478.5	18.6	16.4	35.0	22.7	20.0	42.7	43
DANE COUNTY	935.2	394.0	1,329.2	56.0	26.1	82.1	68.4	31.8	100.2	100
% of Total	70%	30%	100%							

Table 5-3

VEHICLE MILES TRAVELED, GALLONS, AND COST PER DWELLING UNIT PER YEAR
BY GEOGRAPHIC AREA

CATEGORY	VMT/D.U./YR.			GALLONS/D.U./YR.			COST/D.U./YR.		
	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.	S.F.	M.F.	AVE.
Rural	26,669	19,228	25,142	1,411	1,017	1,330	1,721	1,241	1,623
Satellite	15,915	10,048	14,097	842	532	746	1,027	649	910
Central Urban	9,076	5,502	7,267	662	402	530	808	490	647
DANE COUNTY	13,216	6,917	10,448	793	458	646	967	559	788

Table 5-4

TOTAL VEHICLE MILES TRAVELED, GALLONS, AND COST PER YEAR
BY GEOGRAPHIC AREA

CATEGORY	TOTAL VMT/YR.x10^6			TOTAL GALS./YR.x10^6			COST/YR.x10^6			
	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	S.F.	M.F.	TOT.	PERCENT
Rural	313.1	76.9	390.0	16.0	4.1	20.1	19.6	5.0	24.6	25
Satellite	201.1	56.9	258.0	10.0	3.0	13.0	12.2	3.6	15.8	16
Central Urban	421.0	260.2	681.2	30.0	19.0	49.0	36.6	23.2	59.8	59
DANE COUNTY	935.2	394.0	1,329.2	56.0	26.1	82.1	68.4	31.8	100.2	100
% of Total	70%	30%	100%							

Table 5-5

VEHICLE MILES TRAVELED, GALLONS, AND COST PER CAPITA PER YEAR
BY COMMUNITY CLASS

CATEGORY	1980 Population	VMT/YR./PERSON	GALLONS/YR./PERSON	COST/YR./PERSON
Towns	74,545	6,505	343	419
Villages	33,940	6,117	342	415
4th Class Cities	44,444	3,560	223	275
City of Madison	170,616	2,805	205	250
DANE COUNTY	323,545	4,108	254	310

Note:

(35) Towns: 1980 Population Range -- 406 - 11,973; Average Population = 2,130
(19) Villages: 1980 Population Range -- 250 - 3,876; Average Population = 1,786
(5) 4th Class Cities: 1980 Population Range -- 3,336 - 12,931; Ave. Pop. = 8,889
City of Madison: 1980 Population = 170,616
Dane County: 1980 Population - 323,545

Prepared by Dane County Regional Planning Commission
February, 1983.

If the central urban area is the base against which the other categories are compared, TABLE 5-3 shows that dwelling units in:

(a) Satellite communities travel two times further, and consume and spend 41 percent more or a factor of 1.4; and

(b) Towns travel 3.5 times further, and consume and spend 150 percent more or a factor of 2.5, than those dwelling units in the Central Urban Area.

When the factors are multiplied by the dwelling units in each category, the total share of VMT and/or gallons for the towns is 25 percent while the satellite communities and the Central Urban Area are 16 percent and 59 percent respectively (see TABLE 5-4).

In comparing single family dwelling units with multifamily dwelling units on a per dwelling unit basis, multifamily dwelling units travel on the average 48% less than single family dwellings on a countywide basis.

On a per person basis, households in towns and villages are about the same in the number of miles traveled which is a little over two times the number of miles traveled by each person in the City of Madison. Each person in the 4th class cities travels about 30 percent more than someone residing in Madison, see TABLE 5-5.

Finally, when these factors are compared with density in the region, the analysis done in Chapter 3 shows that while no linear correlation appears to exist between VMT and density, there is a linear correlation between trip frequency and density within the central urban area.

Impact on Decision-making Process. While it is early in the process to fully document the impact of the transportation energy factors on the decision-making process, comments have been received from public opinion surveys and from the DCRPC advisory committees. The public opinion survey conducted as part of this demonstration project shows positive results on the reporting methods used by the DCRPC to increase the level of awareness of local officials about transportation energy related impacts from development. The survey shows that the overall level of awareness increased 20% following the release of the project's results. For specific questions the number of correct responses increased from 8% to 15%. It is expected that the overall percentage will increase over the next year as regional planning staff continue to work with local officials in making informed land use decisions.

Another indication of the project's impact has been the amount of debate generated at Commission and advisory committee meetings. The fact that meaningful dialogue on development issues from a transportation energy perspective is occurring for the first time is a clear indication of the project's success. Having information on the expected amount and cost of gasoline consumption by dwelling unit type and location in this region, will greatly assist the DCRPC and local units of government in marshalling support for energy efficient land use implementation.

Follow-up Planning

A project of this type does not close once the final report is completed. One of the essential ingredients of the effort was to make it process oriented. As such, there will not only be changes to the original transportation energy factors as new and more refined data are incorporated, but also there will be changes in the process itself as new ideas and new situations bring about those changes. Auto occupancy rates, miles per gallon (mpg) efficiency rates and cost of fuel are areas where change is expected to occur.

The information produced so far by this project is already raising questions about how the transportation energy factors relate to such variables as income, dwelling unit size, number of autos per dwelling unit, and so on. Time and money were not sufficient to explore these other questions; however, as additional resources are made available, there may be opportunities to do so.

Because the DCRPC is committed to promoting good land use planning and transportation planning, there is every expectation that the Commission will continue to use its influence in bringing about energy efficient development. It is through the reporting activities discussed in Chapter 4 and the decision-making process identified in Chapter 2, that the DCRPC works to mold and shape public opinion, and strives to assist decision-makers in making informed decisions. Because it is through informed public opinion followed by informed decision-making which is likely to result in sustaining significant change.

Appendices

and

Bibliography

Appendix A

NPTS, Census, and Model Data

1. NPTS Data

In 1977, a National Personal Transportation Study (NPTS) was conducted by the Bureau of Census under sponsorship of the Department of Transportation as part of the expanded scope of the National Travel Program. The computer tapes of this survey as well as the time of a computer programmer were made available to the project by the Wisconsin Department of Transportation in order to extract the information from the survey in the form needed by the project. What was needed was the number of trips per year per household (work trips and non-work trips) by dwelling unit type and the associated trip lengths.

The information was extracted by three SMSA sizes: under 100,000 population; 100,000 to 249,000 population; and 250,000 to 499,000 population. It was also extracted by the categories of urban and rural (as defined by the U.S. Bureau of the Census) for all communities under 500,000. This population limit was imposed in order to compare the results with local Dane County data. Dane County has a central urban area population of around 234,000 and a countywide SMSA total of approximately 320,000.

The data received for trips and trip length by SMSA size was not used because small sample sizes made the data unreliable. The sample sizes under the urban and rural categories were much larger and yielded more reliable results. Tables A-1 through A-4 show those results.

Table A-1 indicates the number of urban person work trips by dwelling unit type and the associated trip length. Of specific interest are the single family and multifamily categories which were combined to yield one result for each category. Thus, an average urban single family household makes approximately 723 person work trips per year with an average trip length of 7.8 miles. The average urban multifamily household makes 604 person work trips per year with an average trip length of 6.2 miles.

In the same manner as Table A-1, Table A-2 shows the number of rural work trips and trip length by dwelling unit type. In addition, Tables A-3 and A-4 show the non-work trips and trip length by dwelling unit type for all urban and rural communities under 500,000 population.

TABLE A-1

URBAN PERSON WORK TRIPS
BY DWELLING UNIT TYPE

DWELLING UNIT TYPE	SAMPLE SIZE	MILES/YR PER HHLD	TRIP LENGTH (MILES)	TRIPS/YR PER HHLD
S.F. Detached (01)	3,735	5,648	7.7	729
S.F. Attached (02)	259	4,356	6.9	633
Trailer (03)	74	4,114	7.4	558
M.F., 2-4 Units (04)	696	3,607	5.8	619
M.F., > 4 Units (05)	822	3,954	6.7	592
Other (06)	32	5,504	8.8	626
No Answer (99)	191	4,403	6.9	640
ALL HOUSEHOLDS	5,809	5,021	7.3	685
S.F. (01, 02)	3,994	5,564	7.8	723
M.F. (04, 05)	1,518	3,795	6.2	604

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-2

RURAL PERSON WORK TRIPS
BY DWELLING UNIT TYPE

DWELLING UNIT TYPE	SAMPLE SIZE	MILES/YR PER HHLD	TRIP LENGTH (MILES)	TRIPS/YR PER HHLD
S.F. Detached (01)	1,886	7,063	10.1	702
S.F. Attached (02)	33	7,627	14.8	516
Trailer (03)	233	5,427	8.6	634
M.F., 2-4 Units (04)	65	6,286	10.2	614
M.F., > 4 Units (05)	55	6,000	8.6	698
Other (06)	4	3,680	5.3	697
No Answer (99)	81	8,809	11.3	781
ALL HOUSEHOLDS	2,357	6,905	10.0	692
S.F. (01, 02)	1,919	7,073	10.1	699
M.F. (04, 05)	120	6,155	9.4	651

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-3
URBAN NON-WORK TRIPS
BY DWELLING UNIT TYPE

DWELLING UNIT TYPE	SAMPLE SIZE	MILES/YR PER HHLD	TRIP LENGTH (MILES)	TRIPS/YR PER HHLD
S.F. Detached (01)	6,486	18,945	7.8	2,423
S.F. Attached (02)	453	12,068	6.4	1,897
Trailer (03)	150	11,306	7.8	1,452
M.F., 2-4 Units (04)	1,302	12,406	6.8	1,818
M.F., > 4 Units (05)	1,546	14,216	8.7	1,642
Other (06)	132	19,186	7.9	2,441
No Answer (99)	366	13,608	7.8	1,756
ALL HOUSEHOLDS	10,435	16,755	7.8	2,160
S.F. (01, 02)	6,939	18,496	7.8	2,385
M.F. (04, 05)	2,848	13,389	7.7	1,719

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-4
RURAL NON-WORK TRIPS
BY DWELLING UNIT TYPE

DWELLING UNIT TYPE	SAMPLE SIZE	MILES/YR PER HHLD	TRIP LENGTH (MILES)	TRIPS/YR PER HHLD
S.F. Detached (01)	3,664	21,228	9.8	2,177
S.F. Attached (02)	61	14,536	8.7	1,666
Trailer (03)	424	16,527	8.9	1,865
M.F., 2-4 Units (04)	121	21,865	15.1	1,450
M.F., > 4 Units (05)	85	13,858	8.1	1,708
Other (06)	21	31,528	18.8	1,679
No Answer	165	36,947	20.2	1,825
ALL HOUSEHOLDS	4,541	21,198	10.1	2,091
S.F. (01, 02)	3,725	21,118	9.8	2,168
M.F. (03, 04)	206	18,561	11.3	1,547

Source: Dane County Regional Planning Commission, January, 1983.

2. Census Data

Trip Frequency. A special survey was conducted in this region in 1975 by the U.S. Bureau of Census which provided an estimate of the number of work trips by census tract for a 24 hour period. This data was extremely valuable in giving some idea of the number of work trips outside the central urban area. Once this value was known, it would be possible to estimate total trips based on the relationship of work trips to non-work trips from the NPTS data and the model data for the central urban area.

For convenience, Figure 3-2 from the main report has been incorporated here and shows the census tracts outside the central urban area. Table A-5 shows the number of one way work trips for a 24 hour period for each of those census tracts. To arrive at an estimate of the total annual work trips, each of the total one way trips was multiplied by a factor of 500 (250 work days per year x 2 for a round trip estimate).

For an estimate of work trips per dwelling unit, dwelling unit counts for 1975 would be needed. These dwelling units counts for a mid-census year were not easily obtainable. The 1970 census provided single family and multifamily dwelling unit counts for each census tract, but the 1980 census data only had total dwelling unit counts. To arrive at the needed 1975 estimates the following procedure was used.

Annual building permit data for single family and multifamily dwelling units were added to the 1970 census totals for a 1975 total and a 1980 total. The 1980 total generally differed from the 1980 census due to annexations, permits issued for units never built, census count time lags, and dwelling units not classified as single family or multifamily. Correction factors were applied to the building permit data to bring it into conformance with the 1980 census totals. The same correction factors were applied to the 1975 totals, and the results are shown in Table A-6. Because farms do not normally make the typical work trip, these dwelling units were subtracted out and are also shown in Table A-6. The estimate of farm dwelling units by census tract were obtained from a detailed countywide land use inventory.

Combining Table A-5 with Table A-6 provided the project with the necessary 1975 work trip per dwelling unit estimates for those census tracts outside the central urban area, and are shown in Table A-7.

For those census tracts inside the central urban area, the total number of 1975 person work trips was divided by the total number of estimated dwelling units (using building permit data) to arrive at the number of person work trips per dwelling unit (see Table A-8).

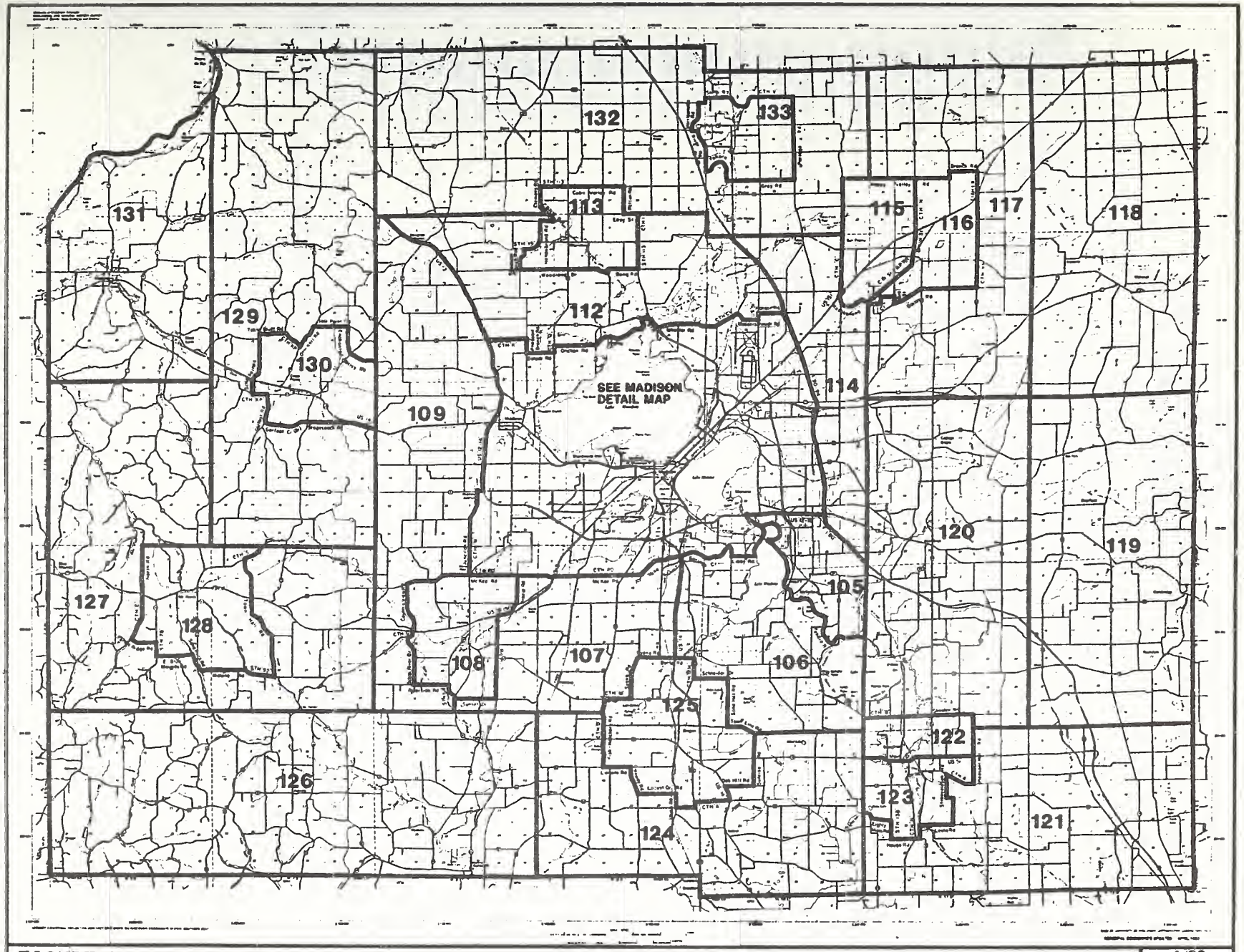


FIGURE 3-2
1980 CENSUS TRACTS
DANE COUNTY, WISCONSIN

4/82

TABLE A-5

1975 ANNUAL PERSON WORK TRIPS
BY CENSUS TRACT

CENSUS TRACT	ONE WAY WORK TRIPS/DAY				TOTAL ANNUAL WORK TRIPS
	DRIVES ALONE	CARPOOL	MASS TRANSIT	TOTAL	
106	1,124	317	0	1,441	720,500
107	1,335	364	49	1,748	874,000
108	897	325	25	1,247	623,500
109	560	170	50	780	390,000
112	1,127	438	48	1,613	806,500
113	820	562	0	1,382	691,000
114	1,000	146	0	1,146	573,000
115	3,938	828	123	4,889	2,444,500
116	1,136	388	25	1,549	774,500
117	576	193	0	769	384,500
118	653	384	0	1,037	518,500
119	1,529	370	0	1,899	949,500
120	1,736	439	0	2,175	1,087,500
121	408	166	0	574	287,000
122	1,529	367	49	1,945	972,500
123	870	386	26	1,282	641,000
124	675	191	23	889	444,500
125	1,431	657	0	2,088	1,044,000
126	780	263	23	1,066	533,000
127	507	47	0	544	277,000
128	805	315	0	1,120	560,000
129	626	340	24	990	495,000
130	702	436	0	1,138	564,000
131	597	508	0	1,105	552,500
132	1,041	592	0	1,633	816,500
133	830	583	0	1,413	706,500
TOTAL	27,232	9,775	465	37,472	18,736,000

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-6

ESTIMATE OF 1975 DWELLING UNITS
BY CENSUS TRACT

CENSUS TRACTS	1975 DWELLING UNITS			FARM D.U.'s	TOTAL NON-FARM D.U.'s
	SF	MF	TOTAL		
106	1,454	176	1,630	118	1,512
107	473	736	1,209	108	1,101
108	802	371	1,173	52	1,121
109	822	107	929	225	704
112	812	293	1,105	109	996
113	683	324	1,007	45	962
114	542	142	684	103	581
115	1,943	1,189	3,132	21	3,111
116	697	405	1,102	44	1,058
117	600	69	669	271	398
118	917	155	1,072	316	756
119	1,733	234	1,967	362	1,605
120	1,500	117	1,617	398	1,219
121	845	79	924	322	602
122	1,232	527	1,759	21	1,738
123	1,060	317	1,377	48	1,329
124	598	26	624	291	333
125	998	380	1,378	95	1,283
126	931	121	1,052	397	655
127	743	41	784	326	458
128	818	319	1,137	71	1,066
129	818	40	858	331	527
130	463	176	639	39	600
131	1,068	166	1,234	107	1,127
132	1,136	139	1,275	399	876
133	629	213	842	41	801
TOTAL	24,317	6,862	31,179	4,660	26,519

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-7

ANNUAL NON-FARM PERSON WORK TRIP
PER DWELLING UNIT
BY CENSUS TRACT

CENSUS TRACT	TOTAL ANNUAL PERSON WORK TRIPS	TOTAL 1975 NON-FARM D.U.'s	ANNUAL PERSON WORK TRIPS/D.U.
106	720,500	1,512	477
107	874,000	1,101	794
108	623,500	1,121	556
109	390,000	704	554
112	806,500	996	810
113	691,000	962	718
114	573,000	581	986
115	2,444,500	3,111	786
116	774,500	1,058	732
117	384,500	398	966
118	518,500	756	686
119	949,500	1,605	592
120	1,087,500	1,219	892
121	287,000	602	477
122	972,500	1,738	560
123	641,000	1,329	482
124	444,500	333	1,335
125	1,044,000	1,283	814
126	533,000	655	814
127	277,000	458	605
128	560,000	1,066	525
129	495,000	527	939
130	564,000	600	940
131	552,500	1,127	490
132	816,500	876	932
133	706,500	801	882
	TOTAL = 18,736,000	TOTAL = 26,519	AVERAGE = 707

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-8

1975 CENSUS PERSON WORK TRIPS
FOR CENTRAL URBAN AREA

CENSUS TRACT	ONE WAY WORK TRIP/DAY				ANNUAL	1975 D.U.'s	ANNUAL WORK TRIP PER D.U.
	AUTO	CARPOOL	BUS	TOTAL			
1 & 110	2,051	380	255	2,686	1,343,000	(Data Not Available)	(Data Not Available)
2.01 & 2.02	1,769	600	231	2,600	1,300,000		
2.03	565	115	92	772	386,000		
3, 8	2,348	808	578	3,734	1,867,000		
4.01	1,010	455	182	1,647	823,500		
4.02	1,012	345	159	1,516	758,000		
4.03	1,287	390	230	1,907	953,500		
5.01	1,725	207	208	2,140	1,070,000		
5.02	1,427	500	71	1,998	999,000		
6	1,312	523	262	2,097	1,048,500		
7	856	278	230	1,364	682,000		
9	1,063	766	438	2,267	1,133,500		
10	324	163	92	579	289,500		
11	22	-	92	114	57,000		
12	1,020	416	254	1,690	845,000		
13, 14.01	1,972	818	563	3,353	1,676,500		
14.02	3,035	1,148	337	4,520	2,260,000		
15	1,438	467	117	2,022	1,011,000		
16.01, 16.02	503	183	273	959	479,500		
17	484	159	206	849	424,500		
18	1,406	279	533	2,218	1,109,000		
19	1,422	551	578	2,551	1,275,500		
20, 26.01, 27	4,385	1,146	720	6,251	3,125,500		
21	1,310	510	278	2,098	1,049,000		
22	1,379	789	207	2,375	1,187,500		
23.01, 23.02	1,085	323	139	1,547	773,500		
24.01, 24.02	1,723	643	271	2,637	1,318,500		
25	184	114	47	345	172,500		
26.02	740	324	45	1,109	554,500		
28, 29	1,983	745	347	3,075	1,537,500		
30	1,485	546	161	2,192	1,096,000		
31	1,573	479	91	2,143	1,071,500		
101	304	192	105	601	300,500		
102	393	193	23	609	304,500		
103, 104	3,353	948	389	4,690	2,345,000		
105	826	297	-	1,123	561,500		
111	2,786	974	170	3,930	1,965,000		
TOTAL	51,560	17,774	8,974	78,308	39,154,000	76,477	512 (Average)

Source: Dane County Regional Planning Commission, January, 1983.

Trip Length. The only census data available for trip lengths in those tracts outside the central urban area are for peak period (6 a.m. - 9 a.m.) work trips. Therefore, it was assumed that the trip length for the work trip during the 24 hour period was the same as the peak period work trip. In addition, the trips had to be divided by dividing peak period person miles traveled (PMT) by peak period trips, see Table A-9. The census tracts for the satellite communities were computed separately yielding an average work trip length of 8.5 miles, see Table A-10. The satellite total was then subtracted from the total of all the census tracts and yielded a rural work trip length of 11.9 miles. The central urban area census tracts, shown in Table A-11, produced an average work trip length of 5.2 miles.

3. Model Data

This model data comes from a battery of mathematical computer programs which simulates existing and future travel patterns in the Madison area. In working with the travel forecasting models, the existing or forecast system is simulated by a computerized network of nodes and links. The mathematical models require a socioeconomic data base which contains variables relating to the area's population and development. Typical variables considered in the travel forecasting process are population, dwelling units, autos owned, employment, school enrollment, and commercial or residential land use. The model is used only in the Central Urban Area of the County.

The data is reported by traffic area analysis zones called TAZ's which are smaller than the usual census tracts. This data can be aggregated up to larger areas called super districts, which encompass one or two census tracts. The data used in this study is by these larger areas. See Figure 3-4 in the main report.

Table A-12 shows the estimated 1980 home based person work trips for each of the super districts in the Central Urban Area using the transportation system model. Also shown is the average trip length in miles for each of those person work trips and the annual number of person work trips per dwelling unit. The average number of annual work trips per dwelling unit for all 34 districts is 433 trips with an average trip length of 4.8 miles.

Table A-13 shows the estimated 1980 person non-work trips for each of the super districts. Non-home based trips and person miles traveled (PMT) were assigned using adjustment factors shown at the bottom of the table. As in Table A-12, Table A-13 also reports the average trip length of the person non-work trips and the annual number of non-work trips per dwelling unit. The average number of annual non-work trips per dwelling unit for all 34 districts is 2,882 trips with an average trip length of 3.9 miles. Both Table A-12 and A-13 have been combined to produce Table 3-5 in the main body of the report.

TABLE A-9

TRIP LENGTH FOR CENSUS TRACTS
OUTSIDE CENTRAL URBAN AREA

CENSUS TRACT	COMPUTER CODE	PERK PERIOD PMT	PERK PERIOD TRIPS	TRIP LENGTH (MILES)
106	46	13,753	1,101	12.5
107	47	9,137	1,213	7.5
108	38	5,830	858	6.8
109	48	3,994	491	8.1
112	49	11,111	1,203	9.2
113	39	8,903	1,070	8.3
114	50	6,146	616	10.0
115	40	28,410	3,893	7.3
116	Combined with Census Tract 115			
117	51	3,874	387	10.0
118	52	6,303	413	15.3
119	53	11,750	1,195	9.8
120	54	15,648	1,348	11.6
121	55	2,207	170	13.0
122	41	18,142	2,107	8.6
123	Combined with Census Tract 122			
124	56	6,483	502	12.9
125	42	10,401	1,220	8.5
126	57	10,122	703	14.4
127	58	4,262	242	17.6
128	43	7,640	730	10.5
129	59	10,791	627	17.2
130	44	7,352	728	10.1
131	60	11,740	743	15.8
132	61	11,830	881	13.4
133	45	10,849	879	12.3
TOTAL		236,678	23,320	10.1 (Average)

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-10

TRIP LENGTH FOR SATELLITE
CENSUS TRACTS

CENSUS TRACTS	COMPUTER CODE	PEAK PERIOD PMT	PEAK PERIOD TRIPS	TRIP LENGTH (MILES)
108	38	5,830	858	6.8
113	39	8,903	1,070	8.3
115, 116	40	28,410	3,893	7.3
122, 123	41	18,142	2,107	8.6
125	42	10,401	1,220	8.5
128	43	7,640	730	10.5
130	44	7,352	728	10.1
133	45	10,849	879	12.3
TOTAL		97,527	11,485	8.5 (Average)

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-11

TRIP LENGTH FOR CENTRAL URBAN
AREA CENSUS TRACTS

CENSUS TRACTS	COMPUTER CODE	PEAK PERIOD PMT	PEAK PERIOD TRIPS	TRIP LENGTH (MILES)
1 & 110	22	10,036	1,862	5.4
2.01 & 2.02	23	10,011	1,893	5.3
2.03	24	3,480	544	6.4
3 & 8	9	9,692	2,706	3.4
4.01	10	6,417	1,568	4.1
4.02	11	3,884	993	3.9
4.03	25	10,437	1,474	7.1
5.01	26	8,358	1,551	5.4
5.02	27	7,863	1,295	6.1
6	28	11,268	1,500	7.5
7	12	4,470	995	4.5
9	1	5,603	1,628	3.4
11	2	51	46	1.1
12	3	3,125	912	3.4
13 & 14.01	13	8,044	1,960	4.1
14.02	29	17,137	3,157	5.4
15	30	7,232	1,256	5.8
16.01 & 16.02	4	1,394	367	3.8
17	5	1,399	390	3.6
18	6	4,510	1,254	3.6
19	7	5,279	1,343	3.9
20, 26.01, 27	14	16,056	3,649	4.4
21	15	5,612	1,388	4.0
22	16	7,796	1,598	4.9
23.01, 23.02	31	6,054	1,046	5.8
24.01, 24.02	32	11,060	1,596	6.9
25	17	1,806	255	7.1
26.02	33	3,125	653	4.8
28, 29	18	13,078	2,003	6.5
30	34	7,501	1,239	6.1
31	35	8,299	1,417	5.9
101	19	1,024	328	3.1
102	20	1,334	416	3.2
103, 104	21	17,096	3,236	5.3
105	36	6,962	732	9.5
111	37	18,513	2,818	6.6
TOTAL		265,006	51,068	5.2 (Average)

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-12

1980 HOME BASED PERSON
WORK TRIPS

SUPER DISTRICT	DWELLING UNIT	PERSON TRIPS/DAY AUTO	BUS	TOTAL	% TRANSIT	DAILY PMT	AVERAGE TRIP LENGTH (MILES)	ANNUAL WORK TRIPS PER D.U.
1	3,487	1,118	426	1,544	27.6	4,135.6	2.7	111
2	6,660	3,366	2,458	5,824	42.2	13,246.8	2.3	219
3	2,646	2,513	1,020	3,533	28.9	9,971.5	2.8	334
4	2,931	3,202	1,324	4,526	29.3	13,233.5	2.9	386
5	5,161	8,154	1,659	9,813	16.9	36,585.7	3.7	475
6	5,436	7,922	1,379	9,301	14.8	35,207.7	3.8	428
7	3,489	7,130	634	7,764	8.2	45,503.7	5.9	556
8	1,910	3,264	551	3,815	14.4	20,741.7	5.4	499
9	2,760	6,139	169	6,308	2.7	35,434.6	5.6	571
10	439	769	0	769	0.0	6,817.1	8.9	438
11	117	220	0	220	0.0	1,445.0	6.6	470
12	6,557	11,610	832	12,442	6.7	66,402.3	5.3	474
13	1,752	2,789	155	2,944	5.3	17,791.6	6.0	420
14	153	266	0	266	0.0	2,385.3	9.0	435
15	1,670	3,336	94	3,430	2.7	27,852.7	8.1	513
16	3,983	6,766	1,194	7,960	15.0	29,343.5	3.7	500
17	2,016	3,001	185	3,186	5.8	21,482.9	6.7	395
18	1,665	2,932	100	3,032	3.3	15,679.3	5.2	455
19	2,650	1,373	470	1,843	25.5	4,821.9	2.6	174
20	250	464	0	464	0.0	2,144.9	4.6	464
21	4,482	11,546	1,095	12,641	8.7	77,667.6	6.1	705
22	3,274	1,158	517	1,675	30.9	4,933.8	2.9	128
23	3,870	5,446	1,405	6,851	20.5	20,916.5	3.0	570
24	1,215	1,470	398	1,868	21.3	6,424.3	3.4	384
25	1,618	2,754	226	2,980	7.6	12,795.5	4.3	460
26	4,200	6,216	851	7,067	12.0	27,201.3	3.8	421
27	3,853	6,922	653	7,575	8.6	31,714.1	4.2	492
28	4,454	6,224	309	6,533	4.7	31,578.8	4.8	367
29	5,394	13,108	951	14,059	6.8	88,368.3	6.3	652
30	318	620	0	620	0.0	5,015.7	8.1	487
31	4,632	7,790	310	8,100	3.8	43,871.8	5.4	437
32	144	263	0	263	0.0	1,813.4	6.9	457
33	183	334	3	337	0.9	2,696.0	8.0	461
34	316	541	41	582	7.0	4,578.8	7.9	460
TOTAL	93,685	140,726	19,409	160,135	12.1	769,803.2	4.8	433

Source: Dane County Regional Planning Commission, January, 1983.

TABLE A-13

1980 PERSON NON-WORK TRIPS

SUPER DISTRICT	DWELLING UNIT	HOME BASED NONWORK TRIPS AUTO	HOME BASED NONWORK TRIPS TRANSIT	HOME BASED NONWORK TRIPS PMT	NON-HOME BASED + HOME BASED NONWORK TRIPS* AUTO TRIPS	NON-HOME BASED + HOME BASED NONWORK TRIPS* TRANSIT TRIPS	NON-HOME BASED + HOME BASED NONWORK TRIPS* TOTAL TRIPS	NON-HOME BASED + HOME BASED NONWORK TRIPS* PMT	% OF TRIPS BY TRANSIT	AVERAGE TRIP LENGTH (MILES)	ANNUAL NONWORK TRIPS PER DWELLING UNIT
1	3,487	8,136	1,816	20,512	11,198	2,268	13,466	27,991	16.8	2.1	1,410
2	6,660	16,665	3,995	39,353	22,937	4,990	27,927	53,701	17.9	1.9	1,531
3	2,646	10,833	1,236	32,929	14,910	1,544	16,454	44,936	9.4	2.7	2,270
4	2,931	12,546	1,228	38,856	17,268	1,534	18,802	53,023	8.2	2.8	2,341
5	5,161	27,718	1,147	98,741	38,150	1,433	39,583	134,743	3.6	3.4	2,799
6	5,436	26,176	849	86,000	36,028	1,060	37,088	117,356	2.9	3.2	2,490
7	3,489	24,302	452	126,684	33,448	565	34,013	172,874	1.7	5.1	3,558
8	1,910	12,704	236	64,246	17,485	295	17,780	87,671	1.7	4.9	3,398
9	2,760	19,005	232	83,970	26,158	290	26,448	114,586	1.1	4.3	3,498
10	439	2,994	68	23,838	4,121	85	4,206	32,530	2.0	7.7	3,497
11	117	935	14	5,553	1,287	17	1,304	7,578	1.3	5.8	4,068
12	6,557	44,165	569	201,612	60,787	711	61,498	275,121	1.2	4.5	3,423
13	1,752	12,234	264	61,053	16,838	330	17,168	83,313	1.9	4.9	3,577
14	153	1,281	11	9,562	1,763	14	1,777	13,048	0.8	7.3	4,239
15	1,670	10,710	156	70,198	14,741	195	14,936	95,793	1.3	6.4	3,264
16	3,983	19,556	704	75,602	24,425	961	25,386	103,167	3.8	4.1	2,326
17	2,016	13,498	138	86,636	18,578	172	18,750	118,224	0.9	6.3	3,395
18	1,665	12,019	224	59,305	16,542	280	16,822	80,928	1.7	4.8	3,687
19	2,650	12,905	1,109	35,060	17,762	1,385	19,147	47,843	7.2	2.5	2,637
20	250	1,605	18	7,151	2,209	22	2,231	9,758	1.0	4.4	3,258
21	4,482	29,853	416	154,554	41,088	520	41,608	210,906	1.2	5.1	3,388
22	3,274	4,509	979	11,110	6,206	1,223	7,429	15,161	16.4	2.1	828
23	3,870	27,970	1,758	82,785	38,497	2,196	40,693	112,969	5.4	2.8	3,838
24	1,215	5,621	262	19,959	7,736	327	8,063	27,236	3.4	4.1	2,422
25	1,618	10,971	163	40,004	15,100	204	15,304	54,590	1.3	3.6	3,452
26	4,200	25,095	794	78,291	34,540	992	35,532	106,837	2.8	3.0	3,088
27	3,853	25,248	411	88,306	34,750	513	35,263	120,503	1.5	3.4	3,341
28	4,454	28,029	268	95,727	38,578	335	38,913	130,630	0.9	3.4	3,189
29	5,394	36,108	397	169,418	49,697	496	50,193	231,189	1.0	4.6	3,396
30	318	2,492	26	15,633	3,430	32	3,462	21,333	0.9	6.2	3,974
31	4,632	27,546	195	110,410	37,913	244	38,157	150,666	0.6	3.9	3,007
32	144	1,531	8	8,340	2,107	10	2,117	11,381	0.5	5.4	5,366
33	183	1,397	7	10,229	1,923	9	1,932	13,599	0.5	7.2	3,852
34	316	2,792	29	20,816	3,843	36	3,879	28,406	0.9	7.3	4,480
TOTAL	93,685	519,149	20,179	2,132,437	714,533	25,203	739,736	2,909,941	3.4	3.9	2,882

Source: Dane County Regional Planning Commission, January, 1983.

* Based on:

Assumption made that non-home based trips and PMT are a fixed percentage of total nonwork trips and PMT:

Auto trips adjusted by a factor of 1.3764
Bus trips adjusted by a factor of 1.2496
PMT adjusted by a factor of 1.3646

Appendix B

Method Used To Apply NPTS Ratio's to Census and Model Data

Because the Census and Model data were insufficient in providing detailed information for work trips and non-work trips by dwelling unit type, it was possible to adjust the local data by the relationships found in the NPTS data.

For example, Tables 3-1A and 3-5 in the main report show that the model reports only work trip (433 work trips/HHLD/Yr) and non-work trip (2,873 non-work trips/HHLD/Yr) information. These values need to be allocated between single family and multifamily households. It is known from the NPTS data that the ratio of single family work trips to multifamily households work trips in the urban category is (722.5 divided by 603.9) approximately 1.20. The number of single family dwelling units and multifamily dwelling units for each super district in the central urban area is also known. If it is assumed that the ratio of work trips between single family and multifamily households is the same as the NPTS data, a set of simultaneous equations will provide the desired allocation for each super district. Equation (1) below is the mathematical relationship that needs solving for super district number one. Equation (2) is the mathematical relationship of the NPTS data.

$$(1) \quad 112x + 3{,}375y = 3{,}487 \ (111)$$

$$(2) \quad \frac{x}{y} = 1.2$$

Solving for "x" in equation (2) yields equation (3)

$$(3) \quad x = 1.2y$$

Substituting "x" into equation (1) yields

$$112(1.2y) + 3{,}375y = 3{,}487 \ (111)$$

Solving for "y" yields

$$134.4y + 3{,}375y = 387{,}057$$
$$3{,}509.4y = 387{,}057$$
$$y = 110$$

Substituting "y" into equation (3) yields

$$x = 1.2y$$
$$x = 1.2 \ (110)$$
$$x = 132$$

Therefore, for super district number one, the estimated number of annual work trips per single family household or dwelling unit is 132 and 110 for multifamily households. Applying this process to each super district for work trips, non-work trips, and trip length yields the results shown in Table 3-6 of the main report. The ratio used for the non-work trip allocation between single family households and multifamily households was 1.40. The ratios used for the allocation of the work trip length and the non-work trip length for the central urban area were 1.26 and 1.013 respectively.

This same process was also applied to the census data for the single family and multifamily allocation in the rural and satellite communities. Table 3-8 of the main report shows the results of this allocation process against the census data shown in Table 3-7. The ratio of single family work trips to rural multifamily work trips used was 1.10 and the ratio of non-work trips was 1.43. The ratios used for the satellite urban communities were the same as those used for the central urban area above.

As another example, Table 3-7 shows the trip frequency and trip length information for each unit of government in Dane County. Selecting the first unit, which is the town of Albion, and the ratios described above yields the following work trip equations for this rural unit of government:

$$592x + 55y = 647(477) \quad (4)$$

$$x = 1.1y \quad (5)$$

Substituting equation (5) into (4) yields

$$\begin{aligned} 592\,(1.1y) + 55y &= 647(477) \\ 651.2y + 55y &= 308619 \\ 706.2y &= 308619 \\ y &= 437 \end{aligned}$$

Therefore,

$$\begin{aligned} x &= 1.1y \\ x &= 1.1(437) \\ x &= 481 \end{aligned}$$

Where "x" equals the annual number of work trips for a single family dwelling unit in the town of Albion and "y" equals the annual number of work trips for a multifamily dwelling unit. The results are shown in Table 3-8 of the main report.

This same process was applied to non-work trips and their associated trip lengths.

Appendix C

NPTS Vehicle Occupancy

Table A-2. AVERAGE OCCUPANTS PER TRIP* BY TRIP PURPOSE AND HOUSEHOLD LOCATION INSIDE OR OUTSIDE SMSA's

PLACE OF RESIDENCE	EARNING A LIVING			FAMILY AND PERSONAL BUSINESS				CIVIC, EDUCATIONAL, & RELIGIOUS	SOCIAL AND RECREATIONAL					OTHER AND UNKNOWN	ALL PURPOSES	Percent of Vehicle Trips
	To Work	Work Related	All	Shopping	Medical, Dental	Other	All		Visit Friends & Relatives	Pleasure Driving	Vacation	Other	All			
Inside SMSA's																
Inside Central City	1.20	1.33	1.22	1.84	1.80	1.61	1.75	1.80	1.86	2.75	2.40	2.23	2.08	1.96	1.66	30.4
Outside Central City	1.20	1.28	1.22	1.76	1.75	1.62	1.70	1.88	1.84	2.39	3.46	2.30	2.10	1.94	1.65	36.4
All - Inside SMSA's	1.20	1.31	1.22	1.80	1.77	1.62	1.72	1.84	1.85	2.54	2.99	2.26	2.09	1.95	1.65	66.8
Outside SMSA's																
Areas Under 5,000 Population	1.28	1.28	1.28	1.82	2.18	1.66	1.75	2.09	1.98	2.27	1.99	2.19	2.09	1.95	1.70	16.3
Areas Over 5,000 Population	1.23	1.29	1.24	1.78	2.04	1.61	1.70	2.11	1.92	2.37	1.54	2.08	2.01	2.08	1.67	16.9
All - Outside SMSA's	1.26	1.29	1.26	1.80	2.12	1.63	1.73	2.10	1.95	2.30	1.89	2.13	2.05	2.01	1.69	33.2
All Places	1.22	1.30	1.23	1.80	1.87	1.62	1.73	1.93	1.89	2.43	2.84	2.22	2.08	1.97	1.67	-
Percent of Vehicle Trips	27.8	5.1	32.9	17.0	1.3	14.0	32.3	6.4	8.4	0.4	0.1	10.4	19.3	9.1	-	100.0**

*Includes trips in all private vehicles except motorcycles and mopeds.

**Total vehicle trips = 108,430,000 (108,826,000 less 396,000,000 by motorcycles and mopeds).

Source: Dane County Regional Planning Commission, January, 1983.

Appendix D

Survey Questionnaires

Dane County Regional Planning Commission
Room 114 City-County Bldg. Madison, Wisconsin 53709 Tel. 608 266-4137

To: Local Officials in Dane County

From: Charles Montemayor, Executive Director

Re: Dane County Regional Planning Commission Transportation Energy Conservation Project

Date: June 28, 1982

The Dane County Regional Planning Commission is undertaking a study to examine the relationship of land use patterns and energy consumption, particularly as it relates to transportation energy consumption. One goal of the study is to be able to provide decision makers with an assessment of the energy impacts of development which they may wish to consider in making future land use decisions.

As part of the study, we would like to obtain information regarding local officials' current perceptions of the relationship between land use and transportation energy use. We would also like to determine if there is interest on the part of local officials for having such energy information available and if so, the most appropriate means of reporting the information.

To help us with the study we are asking a sampling of local officials in the county to complete this questionnaire. It should take only a few minutes to do and will provide us with important information for our study. Thank you in advance for your cooperation.

CM:JC:mml

Surveys returned- 88
Surveys tabulated- 87

Numbers in parenthesis are raw numbers.
Others are percentages

Part A

An objective of the RPC Transportation Energy Conservation Project is to develop simple factors on energy consumption per dwelling unit for differing residential land use densities and locations in the county. Please answer the first portion of this questionnaire based upon your current understanding of the average annual travel of the households described in each question.

1. On the average, how do you think the overall miles traveled annually of persons residing in single family homes compares to persons residing in apartments, townhouses, etc.?

(48) 55 More (13) 15 Less (26) 30 Same

2. How many miles per year do you think households located in the small cities and villages would travel annually compared to households in the rural towns?

(20) 23 More (45) 52 Less (22) 25 Same

3. How many miles per year does a household located in the immediate Madison urban area travel compared to a household located in the rural areas of the county?

(15) 17 More (63) 73 Less (7) 8 Same (2) 2 No Answer

4. How much fuel is consumed annually for transportation by households located in the immediate Madison urban area compared to households located in the rural areas of the county?

(18) 21 More (60) 69 Less (7) 8 Same (1) 1 No Answer

Part B

Another objective of this project is to report energy consumption factors developed in a manner such that local officials could easily use this information when making local land use decisions. Please answer the remaining questions based on your role as a local official.

5. Do you consider the potential transportation energy use of new residences when reviewing rezoning and/or subdivision applications?

(21) 24 Yes, usually
(10) 11.5 Yes, occasionally
(27) 31 No, energy information is not available
(21) 24 No, not considered an important factor
(10) 11.5 No answer/not applicable

(OVER)

6. Would you find information on potential transportation energy use for differing types of new residential development to be of interest?

(70) 80 Yes (11) 13 No (6) 7 No answer

7. What type of energy/transportation data would you find useful? (Mark more than one answer, if appropriate.)

(52) 60 Energy use per household (for dwellings at different densities and locations)
(52) 60 Annual travel per household (for dwellings at different densities and locations)
(49) 56 Average miles per trip per household (for dwellings at different densities and locations)
(49) 56 Average daily number of trips per household (for dwellings at different densities and locations)
(11) 13 Other, please specify _____
(9) 10 No answer

8. Which of the following methods of data reporting would you find most helpful? (Mark more than one answer, if appropriate.)

(51) 59 Special report on this study
(33) 38 RPC newsletter article(s)
(19) 22 RPC Regional Trends report (published annually)
(33) 38 Special quarterly reports on building activity in the county
(2) 2 Other, please specify _____
(6) 7 No answer

Part C

This questionnaire is being sent to a cross section of city, village, town and county officials. To give us an idea of how views on this issue may differ among officials, please indicate:

9. Name (optional) _____
Area represented, (i.e., village of, etc.) _____

10. Are you directly involved in local land use decision making through any of the following activities?

(59) 59 Local plans
(48) 55 Rezoning actions
(34) 39 Subdivision regulations
(17) 20 Building permit review
(15) 17 Other, please specify _____
(11) 13 No answer/Not applicable

Part D

We anticipate the initial data reporting on the RPC Transportation Energy Conservation Project will occur during the early fall. Toward the end of the year a follow-up to this survey will be mailed to you to assess your reactions to the data and methods of reporting.

If you have questions or comments about this project, please use the space below or call the RPC offices at 266-4137.

Twelve surveys were returned with comments. Several comments were opinions on the value of the study ranging from the project not being useful to comments saying the project was extremely interesting and should be fully developed. Other comments included requests for more information. Several people commented that personal habits would greatly affect energy consumption and rural people, while making longer work trips, tended to plan other trips more and stay at home more in off-hours than urban residents.

Thank you very much for completing this questionnaire. Please return the survey form by July 15 to:

Dane County Regional Planning Commission
Room 114, City-County Building
210 Monona Avenue
Madison, Wisconsin 53709

Dane County Regional Planning Commission
Room 114 City-County Bldg. Madison, Wisconsin 53709 Tel. 608 266-4137

To: Sample of Local Officials in Dane County

From: Charles Montemayor, Executive Director

RE: Transportation Energy Conservation Project
Questionnaire to be Returned

Date: January 20, 1983

The Dane County Regional Planning Commission has undertaken a study to examine the relationship of land use patterns and transportation related energy consumption. One objective of the study was to be able to provide decision makers with an assessment of the energy impacts of development which they may wish to consider in making future land use decisions.

As an element of the study, we included two surveys of local officials in the county. The first survey was designed to assess the initial perceptions of officials concerning land use/energy consumption relationships and the interest on the part of officials for such energy information. You may recall receiving that questionnaire last summer. The second survey has been designed as a follow-up survey of the same sample of local officials to help us determine the effectiveness of our preliminary information dissemination and the further interest for more detailed information.

In the past week you should have received a copy of a summary of the preliminary findings of the study. Following completion of the full study report, more detailed information will be available. To help us complete the study, we would like to again ask you to complete the attached questionnaire. It should take only a few minutes and will help us complete the final portion of the study. Thank you for your cooperation throughout the study. If you have any questions, please call Bob McDonald (266-4518) or Joan Callan (266-9119) of the RPC staff. Please return the attached questionnaire to the RPC office by February 4.

Charles Montemayor

CM:JC:mml
Attachment

Survey Totals

Transportation Energy Use Questionnaire 1/83

Part A

One objective of the RPC Transportation Energy Conservation Project has been to develop simple factors on energy consumption per dwelling unit for differing residential land use densities and locations in the county. Please answer the following questions based on your understanding of the average annual travel of the households described in each question.

1. On the average, how do you think the overall miles traveled annually of persons residing in single family homes compares to persons residing in apartments, townhouses, etc.?

63%(44) More 11.5%(8) Less 21.5%(15) Same 4%(3) No answer

2. How many miles per year do you think households located in the small cities and villages would travel annually compared to households in the rural towns?

11.5%(8) More 67%(47) Less 17%(12) Same 4%(3) No answer

3. How many miles per year does a household located in the immediate Madison urban area travel compared to a household located in the rural areas of the county?

8%(6) More 83%(58) Less 6%(4) Same 3%(2) No answer

4. How much fuel is consumed annually for transportation by households located in the immediate Madison urban area compared to households located in the rural areas of the county?

28.5%(20) More 58.5%(41) Less 10%(7) Same 3%(2) No answer

Part B

Another objective of this project is to report energy consumption factors developed in a manner such that local officials could easily use this information when making local land use decisions. Please answer the remaining questions based on your role as a local official.

5. Did you find the preliminary information on potential transportation energy use for differing types of new residential development to be of interest?

77%(54) Yes 17%(12) No 6%(4) No answer

6. Which of the following methods of data reporting would you find most helpful? (Mark more than one answer, if appropriate.)

39%(27) Special report on this study
53%(37) RPC newsletter article(s)
30%(21) RPC Regional Trends report (published annually)
14%(10) Other, please specify _____
7%(5) No answer

(over)

This questionnaire is being sent to a cross section of city, village, town and county officials. To give us an idea of how views on this issue may differ among officials, please indicate:

7. Name (optional) _____

   Area represented, (i.e., village of, etc.) _____

8. Are you directly involved in local land use decision-making through any of the following activities?

29% (41) Local plans
24% (34) Rezoning actions
18% (26) Subdivision regulations
9% (13) Building permit review
13% (18) Other, please specify _____
7% (10) No Answer

9. If you have questions or comments about this project, please use the space below or call the RPC offices at 266-4137.

Fourteen surveys were returned with comments. The comments were similar to those received on initial survey. Many comments expressed opinions on the value of the survey. The single most recurring comment raised the issue of the difference between rural and urban residents in both the type and frequency of trips made (i.e., rural residents make fewer but longer trips related to work, urban residents make several short trips).

Thank you very much for completing this questionnaire. Please return the survey form by February 4 to:

Dane County Regional Planning Commission
Room 114, City-County Building
210 Monona Avenue
Madison, WI 53709

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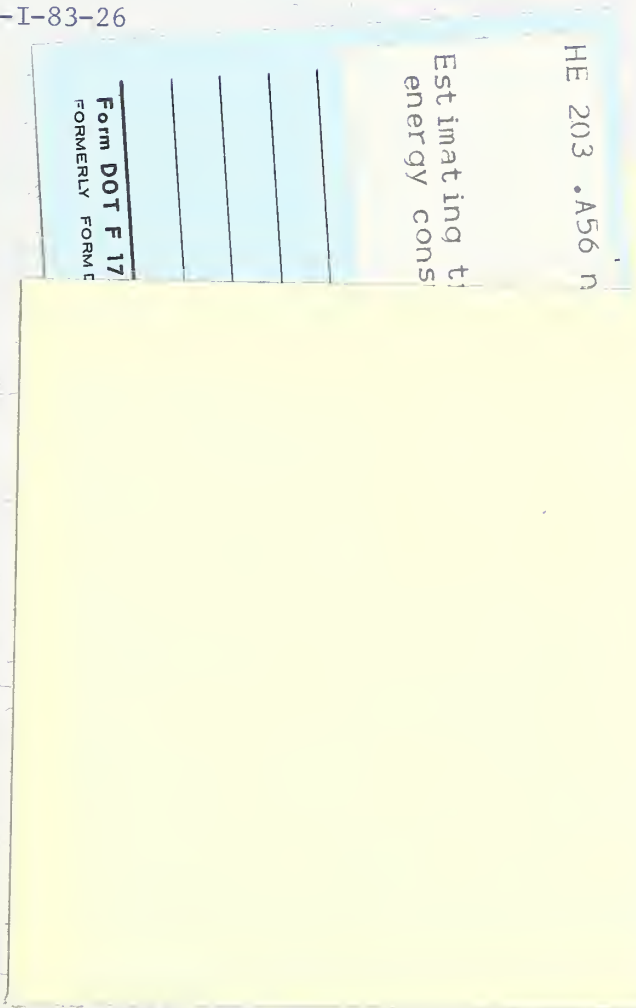

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