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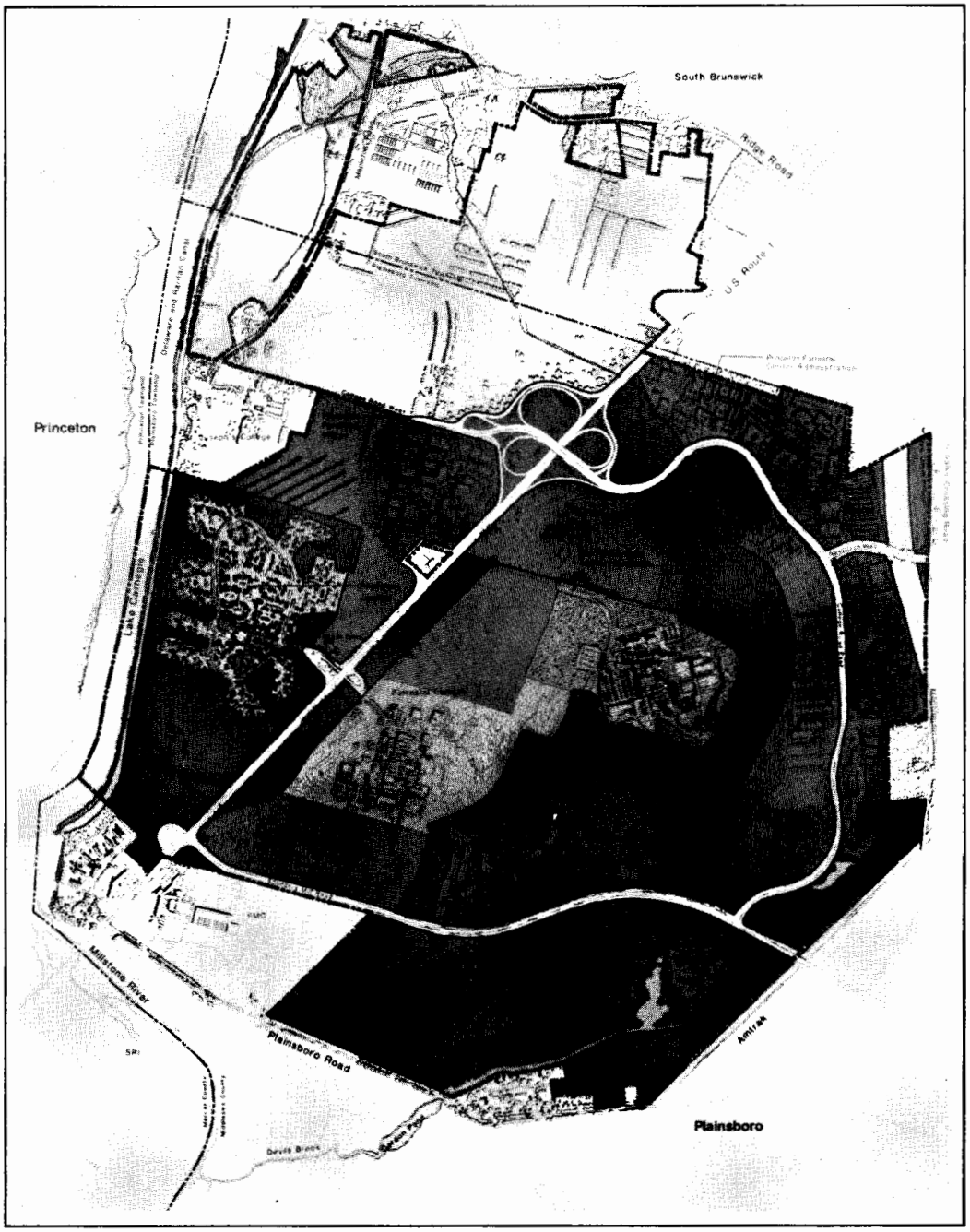
The Impact of Various Land Use Strategies on Suburban Mobility



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16. Abstract

This is a report on a study of the interaction between suburban land use trends and regional traffic conditions. Three different models of high density, mixed-use centers designed to fit in the Middlesex Somerset Mercer Region of New Jersey were developed. The three models examined -- transit construct, short drive construct, and walking construct -- placed residents' homes closer to their working and shopping destinations. The models incorporated residential and employment growth expected in the region by 2010, but reshaped the growth into different land use configurations. The projected growth was located in the cities and in a small number of newly created suburban centers instead of in low density developments spread throughout the region. Based on the study it is concluded that concentrating new suburban development into higher density, mixed-use centers will slow the growth of regional vehicular use.

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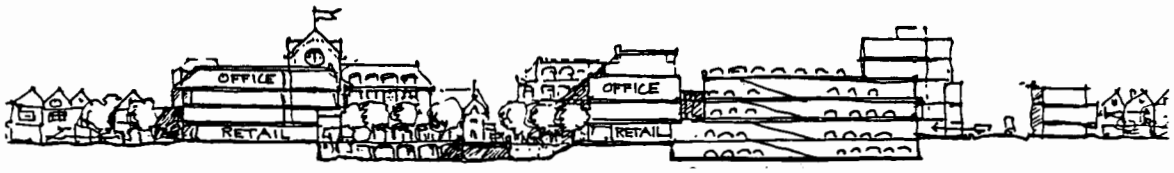
THE IMPACT OF VARIOUS LAND USE STRATEGIES ON SUBURBAN MOBILITY

Final Report



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NOTICE:

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MSM is an independent, non-profit civic planning and research organization. Established in 1968, MSM concentrates on land use, transportation, housing, environmental conservation, and related issues in the 500-square-mile central New Jersey region situated between the Delaware and Raritan Rivers. MSM's research and advocacy programs are supported primarily by individual and corporate members who share a concern for the future of their region. MSM receives funding from foundations and the state and federal governments to carry out special projects.

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The contents of this report reflect the views of the MSM staff and their consultants, who are responsible for the facts and accuracy of the information presented herein. The contents do not necessarily reflect the views of any of the above funding sources.

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The **Steering Committee** included the following individuals:

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Hon. Carolyn Bronson, Freeholder, Mercer County
Jack Claffey, Delaware Valley Regional Planning Commission
Hon. David B. Crabiel, Freeholder, Middlesex County
Robert Dunphy, Urban Land Institute
Carl Hintz, AICP, ASLA, Hintz Associates, Inc.
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THE IMPACT OF FUTURE LAND USE SCENARIOS ON SUBURBAN MOBILITY

EXECUTIVE SUMMARY

MSM Regional Council and its team of technical consultants have completed an 18-month study on the interaction between suburban land use trends and regional traffic conditions. The results of the study verify what had previously been only a theoretical viewpoint: that concentrating new suburban development into higher density, mixed-use centers will slow the growth of regional vehicular use.

The study tested the traffic impact of locating the region's new employees in Trenton and New Brunswick, as well as in tightly clustered suburban employment centers. Under scenarios proposed in the study, new residents would work and shop closer to their homes. Their living environment would be conducive to walking and reduced auto use. Those who still commute longer distances would have transit and ridesharing opportunities available to them, and a significant number would take advantage of these choices because of incentives provided by regional demand management policies. The study demonstrated that this approach to land use would create a significant reduction in the growth in traffic.

Background:

MSM began this study in the summer of 1989 by reviewing the published data on the relationship between suburban development and transportation, as well as by evaluating various analytic tools for the study. A consultant team joined MSM in February 1990, and a steering committee and peer review panel comprised of transportation and land use professionals (listed in Acknowledgments) provided oversight for the project.

Constructs of Higher Density, Mixed-Use Centers:

The study team developed and tested three models -- or "constructs" -- of higher density, mixed-use centers designed to fit within the suburban setting of the MSM region. These constructs incorporated residential and employment growth expected in the region by 2010 -- a 30 percent increase in population (187,905 new residents) and a dramatic 54 percent increase in employment (182,581 new jobs) -- but reshaped that growth into different land use configurations. The new growth was located in the cities and in a small number of newly created suburban centers instead of in low density developments spread throughout the region.

Three construct types were used: a **Transit Construct**, a dense development that could house a minimum of 12,000 people and employ over 13,000, while maximizing transit, ridesharing and walking access; a **Short Drive Construct**, a somewhat less dense area of at least 6,700 residents and 9,500 employees, with ridesharing and walking as the main travel alternatives to the single occupant vehicle (SOV); and a **Walking Construct**, a dense, pedestrian-oriented residential village of about 4,500 persons with only minimal service and retail employment opportunities.

Developing a Transportation Modeling Procedure:

A transportation modeling package called TransCAD was used for its capacity to incorporate important land use elements in a Geographical Information System (GIS). This allowed the project team to utilize transportation models similar to those used in prior regional studies (e.g., Route 1 Corridor Study, NJDOT, 1986) in combination with land use/demographic data bases and models that will have long-range applications for MSM, the counties, and the municipalities.

A key part of the modeling process was to determine quantitatively how much less auto travel could be expected from the constructs. Using case study data, the study team determined that Transit Constructs would create 28 percent fewer vehicle trips than the same amount of development dispersed in less dense, single-use configurations. For Short Drive and Walking Constructs, the corresponding numbers were 24 percent and 18 percent fewer vehicle trips, respectively.

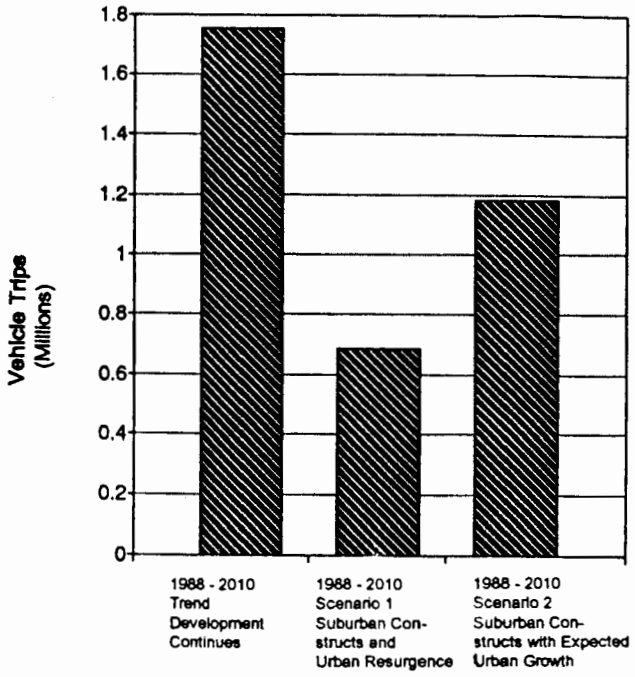
Scenarios and Results

Two scenarios were developed. Scenario 1 assumed that all new regional development between the year 1988 and 2010 would be distributed in two ways. First, much of it would be absorbed into suburban constructs located throughout the region. Second, a major resurgence of growth would occur in Trenton and New Brunswick. In Scenario 2, no major resurgence of the region's cities was assumed. Instead, all growth would be absorbed into the suburban constructs, making them larger than those in Scenario 1.

The results for two key criteria are described and displayed in the discussion below.

Vehicle Trips

The figure on the right examines the growth rate of vehicle trips occurring in the suburban portion of the MSM region between 1988 and 2010. Under "non-construct," trend conditions, new daily vehicle trips in the suburban area would be expected to grow by nearly 1.8 million. In Scenario 1, the combination of constructs and strong urban growth reduces that suburban growth to under 700,000 daily trips. In Scenario 2, where there is no significant new urban growth, new suburban vehicle tripmaking still declines to about 1.2 million daily trips.



When adding the large number of existing trips to these varying levels of new trip growth, the results for 2010 are as follows:

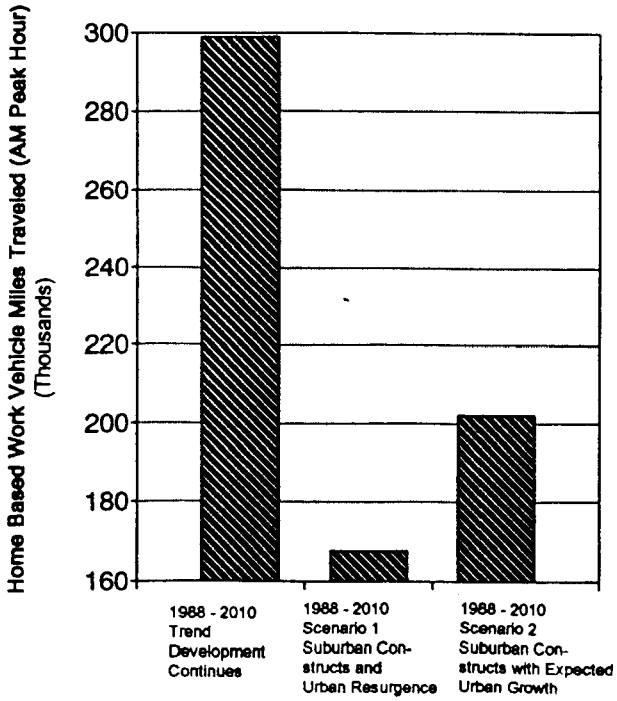
- There would be 18 percent fewer total daily suburban vehicle trips in Scenario 1, compared to the trend;
- and 10 percent fewer total daily suburban vehicle trips in Scenario 2, compared to trend.

Vehicle Miles Traveled

As seen at right, the growth of new vehicle miles traveled (VMT) on the suburban regional highway network declines in the alternative scenarios. Under trend conditions, VMT grows by about 300,000 miles during the morning peak hour trip to work. Under Scenario 1, the growth of AM peak hour VMT is under 170,000 miles. In Scenario 2, the growth is slightly more than 200,000 miles.

When the existing VMT are added to these varying levels of new VMT growth, the results are as follows:

- o In the year 2010, there would be 12 percent less total VMT in the morning peak under Scenario 1, compared to the trend;
- o and 9 percent less total VMT in Scenario 2, compared to the trend.



Conclusions

Four basic conclusions can be drawn from the analyses performed in this study:

1. Mixed-use centers can produce significant regional transportation benefits.
2. Mixed-use centers are a viable concept for suburban settings.
3. Mixed-use centers, through design and function, can have tangible transportation benefits at the site.
4. Promoting strong urban growth along with suburban mixed-use centers gives the best regional transportation results.

Note: These dramatic results are based on the assumption that **all** new development locates in cities or in higher density, mixed-use constructs. Only to the extent that we can change our current land use patterns, will we approach these results. Success within the next twenty years is unlikely because of the number of new developments in the region that already have planning permits for traditional, low density, single-use patterns. Success in the future will be achieved by carefully planning uncommitted lands and by redeveloping existing sites over a much longer period of time.

Next Steps:

In this study, the project team has worked to see whether higher density, mixed-use suburban development can achieve traffic impact reduction on a regional level. The conclusion is that indeed it can. During the next phase of our Land Use/Transportation Study, once again funded by the Urban Mass Transportation Administration, MSM will present this evidence to local officials, employers, developers, and residents and relate it to their efforts to achieve the goals and objectives of the New Jersey State Development and Redevelopment Plan and the federal Clean Air Act. Phase Two is expected to be completed by December, 1992.

Financial and time constraints on the first phase of the study forced the project team to ignore several key technical issues. Our regionwide trip generating formulas concentrated on suburban practices and do not provide a good reflection of urban tripmaking conditions. During the next phase of study, in order to understand better the full regional and subregional consequences of constructs and strong urban growth, new formulas will be developed and urban area vehicle trip reduction factors devised. In addition, a more detailed network and zone structure for the urban areas will be built to better distribute tripmaking within and around the periphery of the cities.

THE IMPACT OF FUTURE LAND USE SCENARIOS ON SUBURBAN MOBILITY

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CHAPTER I:
INTRODUCTION

A. Impetus for the Study

The continued growth of the nation's suburban areas as residential and employment centers places a strain on the transportation infrastructure and services available in these areas. As the 1989 report by the Institute of Transportation Engineers entitled A Toolbox for Alleviating Traffic Congestion pointed out, the growing trend of suburban congestion is due to 1) more people traveling in metropolitan areas (with most of that growth occurring in suburban settings); 2) more people traveling by car (and, overwhelmingly, in single occupant vehicles); 3) more people traveling to dispersed locations; and 4) more people traveling where necessary highway capacity has not been provided.

The strain that this creates is manifested by added energy use and regional air pollution, added congestion and delay; and the increasing conflict between preserving suburban/rural lifestyles and the need for more highway capacity and traffic controls.

Suburban growth represents a 40-year trend, and there is no expectation of any significant reversal leading to reconcentrated urban areas. In that light, the focus among planners has turned to determining how to redistribute and redesign suburban development to conserve open lands, preserve the unique local character of villages and towns, and reduce growth in traffic congestion, while continuing to serve the diverse needs of residents and employees.

In its April, 1989 report to the Urban Land Institute entitled Suburban Mobility and Growth Management: Initiatives in Central New Jersey, Middlesex Somerset Mercer (MSM) Regional Council concluded that "concentrating growth in higher density, mixed-use centers" would be "expected to reduce the growth in vehicular traffic" in this suburban New Jersey setting. The report pointed out that concentrating growth would create other related advantages:

- The reduction of highway congestion by internalizing trips within mixed-use areas;
- making transit or paratransit more feasible; and
- reducing the length of necessary trips.

The report acknowledged that "the real impact of these centers on traffic reduction has yet to be tested." The MSM Land Use/Transportation Project provides the evidence to document the transportation advantages of centers.

B. The Study Area

The MSM region served as the study area for the Land Use/Transportation Project. It is a 523-square-mile area, consisting of 32 municipalities covering all of Mercer County and the southern portions of Middlesex and Somerset Counties in central New Jersey (see Figure 1 on page 3). Virtually halfway between New York City and Philadelphia, the MSM region is largely suburban, although its northeast and southwest borders are anchored by the cities of New Brunswick (about 40,000 people) and Trenton (about 90,000 people), respectively. The Borough of Princeton (about 12,000 people) is at the center of the MSM region.

The MSM region is bisected -- northeast to southwest -- by Route 1, a four-lane regional commuter highway characterized by some strip development, stop lights, shopping centers and office parks. New Jersey's Department of Transportation has a long-term plan to improve Route 1 to six lanes and to replace most of the lights with grade-separated intersections. The Northeast Corridor Rail Line, used both by New Jersey Transit commuter trains and AMTRAK intercity lines, parallels Route 1.

In 1988 -- the year used in this report as the base year because of data availability -- it was estimated that the region included more than 617,000 residents and nearly 338,000 jobs (source: New Jersey Department of Labor). Growth by the year 2010, as projected in the 1989 New Jersey Preliminary State Development and Redevelopment Plan, is dramatic -- 187,905 new residents (a 30% increase), and 182,581 new jobs (a 54% increase).

C. Goals and Objectives of the Study

The goal of the MSM Land Use/Transportation Study was to rigorously test the concept of higher density, mixed-use centers in the suburban setting, in order to assess the type and level of transportation benefits that might occur.

The specific questions that this study addressed are as follows:

- Can higher density, mixed-use centers produce noticeable, beneficial effects on the regional highway network, when compared to the effects of typical single purpose suburban development as characterized by current trends?
- What intensities of development and mixes of land use patterns can realistically be developed that reduce vehicular trips made to, from and within the centers?
- Can higher density, mixed-use centers be located realistically in the MSM region, given expected growth in employment and population levels?

D. Methodology

1. Study Participants

The study was conducted in a collaborative effort by MSM Regional Council, its consultant team, and staff members of the Bureau of Local Transportation Planning of the New Jersey Department of Transportation (see Acknowledgments).

A steering committee was created early in the study and was convened four times during the course of the study (November 27, 1990; June 13, 1990; January 23, 1991; and April 10, 1991). The committee had the opportunity to review and comment on interim products, as well as to ask questions of and make comments to the project team at the committee's meetings.

Figure 1


THE MSM REGION
Bound Brook
Manville
Hillsborough
Millstone
New Brunswick
SOMERSET
Franklin
Milltown
North Brunswick
South River
Montgomery
East Brunswick
South Brunswick
Spotswood
Rocky Hill
Helmetta
Hopewell Boro
MIDDLESEX
Princeton
Jamesburg
Hopewell
Princeton Boro
Plainsboro
Pennington
Cranbury
Monroe
MERCER
West Windsor
Lawrence
Hightstown
Ewing
East Windsor
Hamilton
Trenton
Washington
N
County Lines
Municipal Lines
Cities
Boroughs
0
miles
5

In addition, a peer review process was built into the study at two important junctures of the project. First, on May 14-15, 1990, a meeting was held between the project team and a peer review panel. At this meeting, the overall methodological direction of the study was discussed, highlighting the following key issues (discussed in detail later in this report):

- o The TransCAD software used for modeling transportation impacts;
- o The "constructs" and "scenario" approach for testing land use patterns;
- o Site planning to reduce vehicular use; and
- o Travel demand management policies and effectiveness.

At the second juncture -- during November and December of 1990 -- a key interim document describing the capabilities of constructs to reduce single occupant auto tripmaking was circulated for comment among peer reviewers (Appendix A).

The comments of the peer review panel, as well as steering committee members, were a valuable resource to the project team during the course of the study.

2. Study Process

The study consisted of five major tasks, which are briefly described below and described in more detail later in this report.

a. Suburban Mixed-Use Centers and Transportation: Current Research. (Appendix G)

To test the hypothesis that concentrating growth in mixed-use centers would yield regional transportation benefits, the project team began by exploring published research for evidence of interaction between land use and transportation in general, and more specifically, the travel behavior associated with different facets of existing suburban mixed-use centers. Documented parameters for mixed-use centers, such as proper density, scale, design and mix of activities, were gathered as an empirical foundation for the analysis.

In addition, effective demand management techniques were examined to determine the extent to which the benefits of changing land use might be enhanced by implementing transportation management programs (a reciprocal enhancement was expected).

Although the literature search did not uncover any hard and fast rules, a number of case studies emerged which served as the basis for crafting the prototype mixed-use centers.

b. Building Basic Constructs of Mixed-Use Centers. (Chapter II)

The theoretical concept of a higher density, mixed-use center was formalized into a set of land use models, or "constructs." These constructs were meant to be ambitious, yet realistic representations of suburban centers which include good planning and design features, especially a pedestrian environment, while meeting the region's needs for residential and employment growth.

Three types of constructs were formulated:

- **The Transit Construct**: A high density, mixed-use center with a high concentration of employment. It is designed to maximize the use of transit services and provide significant pedestrian amenities.

- **The Short-Drive Construct**: A high density, mixed-use center, somewhat lower in density than the transit construct, but also with a high concentration of employment. Although there are minimal transit services, there are significant pedestrian amenities in this construct as well.

- **The Walking Construct**: A tightly clustered, mixed-use village or town, with a high level of residential development and only minimal employment opportunities.

c. Modeling the New Land Use/Transportation Relationships (Chapter III)

A regional transportation model was developed for the purpose of testing the effects of the constructs on travel in the MSM region. The typical modeling system has four steps: 1.) **trip generation:** uses formulas to generate total trips; 2) **distribution:** distributes trips throughout the region; 3) **mode split:** defines the proportion of trips using different forms of transportation; and 4) **assignment:** it assigns vehicle trips to appropriate routes for traveling from place to place.

The modeling system used in this study is the TransCAD software package which combines a geographic information system (GIS) with a traditional four-step transportation planning model. This GIS capability has a number of benefits. It provides numerous procedures for processing land use data, constructing and subdividing traffic zones, calculating the precise location and adjustment of transportation network links, and summarizing traffic characteristics by geographic area. It is also capable of storing present and future land use and demographic data at the parcel, census block and municipality level, a feature which is attractive to the long-term planning efforts of MSM.

The modeling system was further adjusted by consideration of some key tripmaking characteristics of the constructs, as distinct from the other subareas of the region. For the region as a whole, auto trip generation rates were developed using formulas developed by previous NJDOT studies in and around the MSM region. But these rates were adjusted for the different construct types -- based on case studies and the team's planning judgment to develop "trip reduction factors" -- to reflect the enhancing effect of density, demand management, mixed uses and transit services on reducing regional auto use to and from these constructs.

d. Forecasting Development Scenarios (Chapter IV)

A 1988 baseline of employment and population conditions in the MSM region was established. A forecast year of 2010 was selected for evaluation and a "2010 Trend Scenario" was developed, projecting conditions similar to those in the base year to the year 2010. These forecasts represent the trend of what is likely to occur in land use and transportation conditions without any change in policy direction.

In addition, two alternative land use scenarios were developed for the year 2010 to compare with the trend:

Scenario 1: a combination of suburban development in constructs and increased employment and population growth in the region's major cities;

Scenario 2: the replacement of all trend suburban development with development in suburban constructs, and only trend growth in the cities.

The two scenarios differ by the amount of growth which is allocated to urban vs. suburban areas.

e. Analyzing the Transportation Impacts of Construct Scenarios (Chapter V)

The impact of construct vs. trend development was analyzed, focusing on four key indices of transportation conditions at the regional and subregional level:

- o The number of vehicle trips;
- o The level of vehicle miles traveled (VMT);
- o The level of delay experienced; and
- o The average speed.

These measures were then assessed in aggregate terms -- what happens in the suburban portion of the region overall -- and in disaggregate terms, for their effects on suburban municipalities.

CHAPTER II:
BUILDING BASIC CONSTRUCTS OF MIXED-USE CENTERS

A. Suburban Development Trends and Alternatives

1. The Constructs as Alternatives to Present Development Trends

The constructs were devised as a means for exploring and illustrating alternative development patterns for central New Jersey. The dominant features of recent growth are large, single-use private developments: office parks, shopping centers and subdivisions. These developments are planned only within their property boundaries, and are related to each other only by existing road connections, and are almost entirely limited to automobile access.

The basic premise of the study is that integrated, multi-use and better planned development can significantly reduce auto travel needs. Underlying this premise are basic convictions that more integrated land use planning and design is both desirable in terms of aesthetic, social and environmental goals, and marketable to developers and consumers.

2. The Problems With Existing Development Patterns

The rapid growth of the 1980's tended to create large-size single purpose developments on assembled tracts of previously rural land. These suburban developments -- office parks over 6 million square feet, shopping centers approaching 1 million square feet, residential complexes over 3,000 units -- are much larger in scale than the existing fabric of small towns in the area. They lack an effective integration of uses and have no community framework to support them.

This land use pattern forces total dependence on automobile travel. By maximizing the need for cars and parking spaces at each destination, this pattern causes each facility to be surrounded and isolated by roads and parking lots, thereby reducing accessibility by walking, transit or bicycle. These single function private developments, although the size of small towns, lack a town's public institutions such as schools and government facilities. The resulting absence of public spaces and foot traffic not only aggravates transportation problems, but prevents the evolution of community life.

3. The Princeton Forrestal Center Area: An Attempt to Achieve Mixed-Use Center Objectives

The Princeton Forrestal Center is a major multi-use center owned by Princeton University that, in 1975, set the standard for development along the Route 1 Corridor. The center was selected by the project team to illustrate some key design issues for this study. The center is known for its ecologically sensitive site planning, as well as its excellent examples of architectural design. It contains all three of the major land use functions -- office, retail and residential -- and has the potential for creating a more integrated community environment, such as that presented in the constructs.

Forrestal Village, a retail and office development within Forrestal Center, offers a concrete illustration of how the comparative advantages of mixed-use constructs can be evaluated against the best efforts of single function development. In addition, Forrestal Village represents a movement toward a mixed-use and town center type environment, and, although it does not fully incorporate the concepts of integrated land use proposed in the constructs, it can provide some useful lessons.

The plan of the Forrestal Center area contains three basic elements (as shown in Figure 2):

- The Forrestal Center office park, with 4.9 million square feet of space already completed, and an eventual 8.6 million square feet at build-out;
- Princeton Landing and several other residential clusters (the latter not part of the development, but physically proximate) totaling about 1,200 dwelling units;
- Forrestal Village, a regional shopping center with upper-floor offices and a hotel, totaling about 1.5 million square feet, of which 822,000 square feet has been built, with the remainder designated as office space.

The office buildings are driving oriented. The housing complexes are exclusively residential, with only minimal community recreation facilities, and are only accessible at a minimal number of points. Even though the distances among the various facilities are not great (many under a mile), there are no local connections other than a very few regional roads.

Forrestal Village embraces some of the ideas of mixed-use developments and traditional pedestrian- oriented town centers. It contains a "Main Street," a "Village Square" and a "Market Plaza." Its environment fairly convincingly recreates the environment of traditional town centers. In appearance the town center and main street in one of the constructs might be very similar.

An aerial view of Forrestal Village (Figure 3), however, reveals a very different place. It is isolated in a sea of parking lots and, although it is located on a huge overpass of Route 1, it is virtually inaccessible from anywhere else. The "Main Street" and "Village Boulevard" terminate in parking lots within a block of the center. Although an attempt was made to provide walkways and bikepaths, it is inconvenient to walk or bike to the office park or the residential neighborhood. There is no school or city hall nearby. Forrestal Village is revealed from this view as simply a regional shopping center with the marketing theme of a "village" without the urban design and land use connections to make it real.

4. Why Propose Alternative Development Patterns?

The causes of the development trend favoring large single function compounds are easy to trace. Land use regulations, created a century ago to protect residential property from noxious industry, generally favor single purpose zoning. In addition, developers and the financing institutions they depend upon tend to develop their business expertise in one functional area (i.e., housing, office parks or shopping centers) and for the most part do not welcome the complexities of mixed-use town development.

New regulatory measures have been enacted in towns in the region to reduce the impact of these large developments on their environment and infrastructure. But there has been little effort to change the underlying zoning to encourage new developments to enhance the existing community or to become a complete community in their own right.

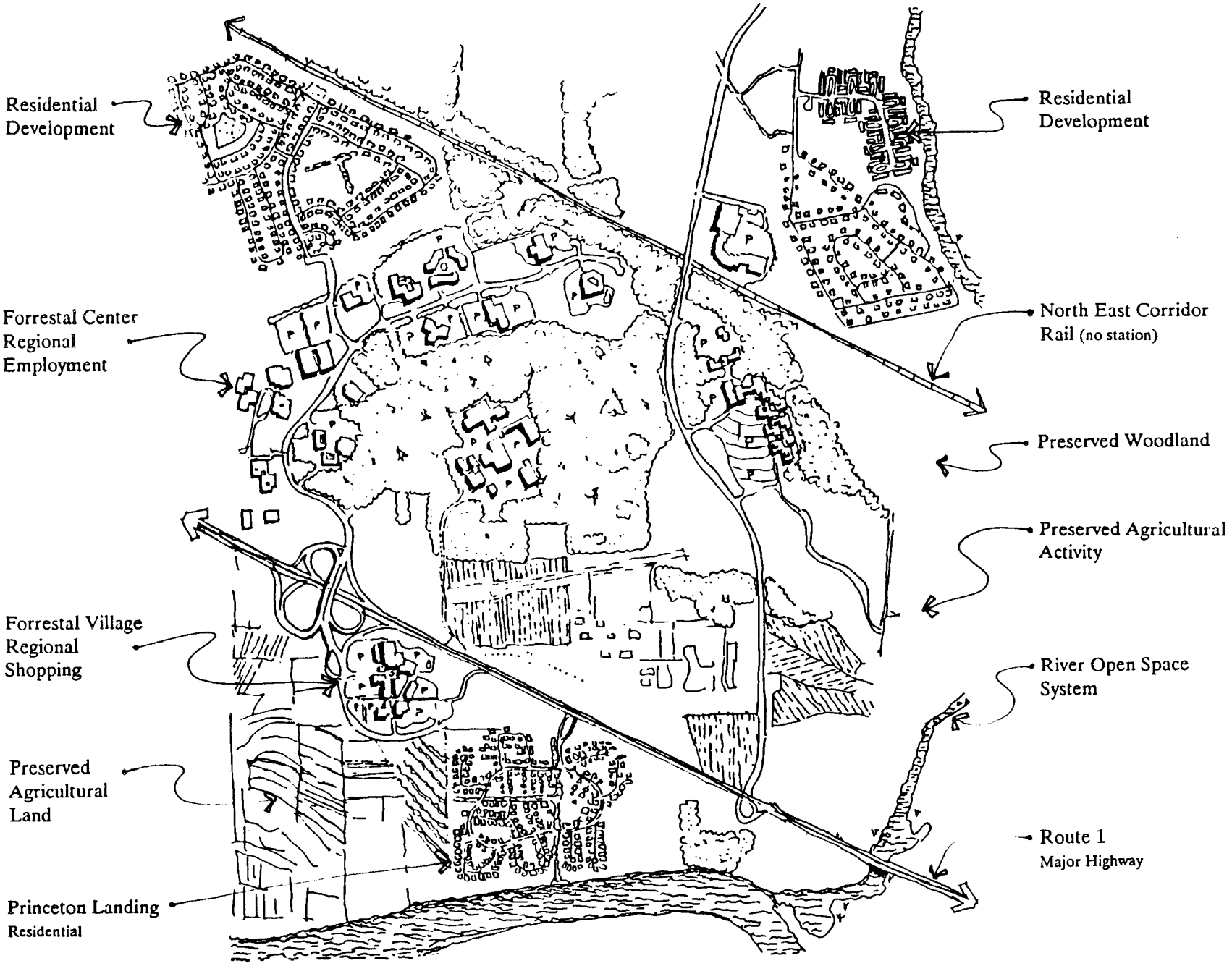

Figure 2: REPRESENTATIVE RECENT DEVELOPMENT - FORRESTAL CENTER

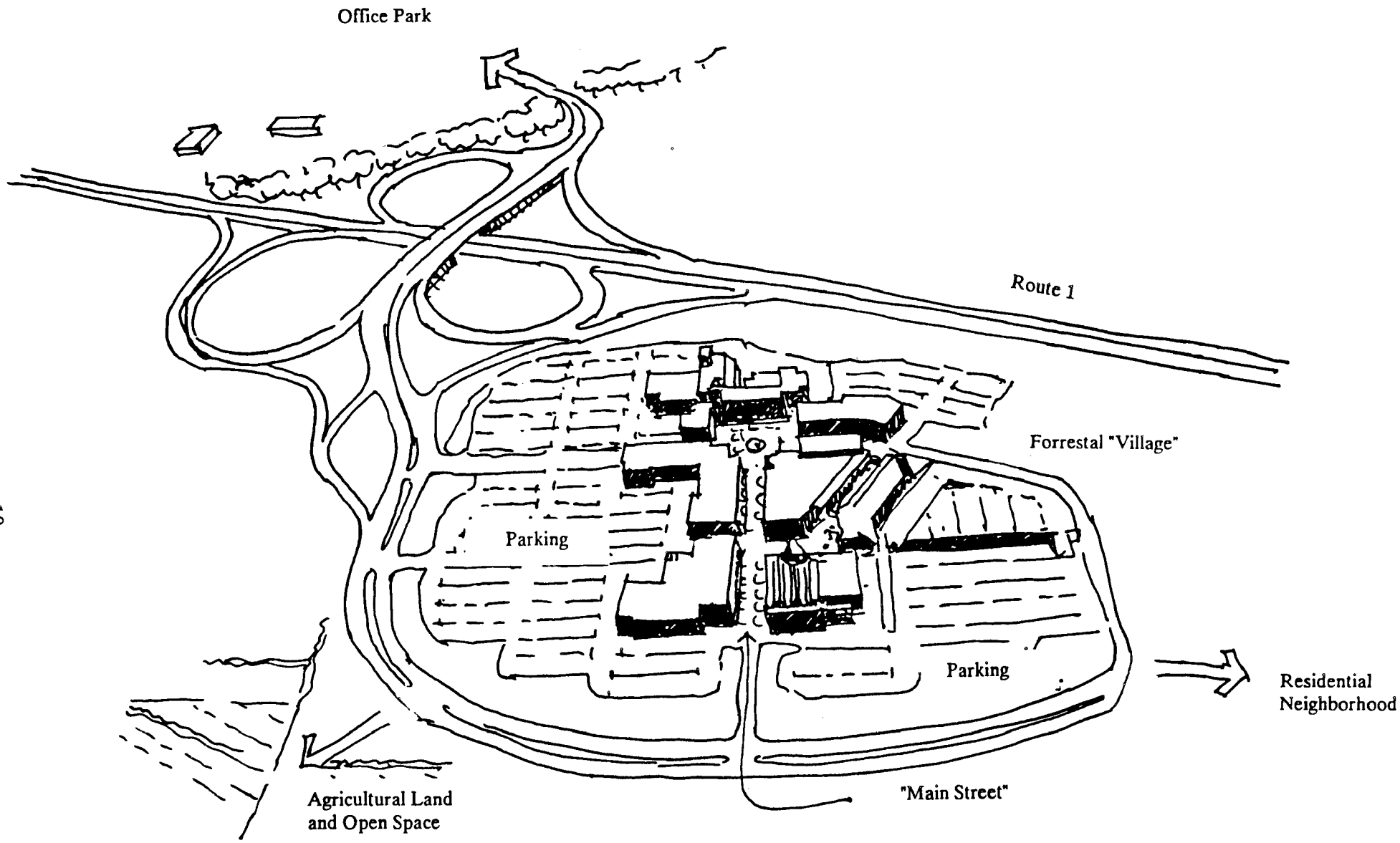

Figure 3: FORRESTAL VILLAGE - EXISTING DEVELOPMENT

"VILLAGE CENTER" - ISOLATED BY DISTANCE AND PARKING LOTS FROM HOUSING, EMPLOYMENT AND OPEN SPACE PRESERVES

As shown through the analyses and reports produced for the emerging New Jersey State Development and Redevelopment Plan, and the 1987 MSM REGIONAL FORUM, such large, single function development patterns consume enormous amounts of land, tax the transportation infrastructure through their auto dependence, force up the cost of housing, and degrade the environment and community character of the region. Both planning documents call for a regional approach to growth management and the creation of regional mixed-use centers as an alternative development pattern.

The professional planning community is now promoting many of these changes under the banner of "neo-traditional" planning techniques. However, the federal Clean Air Act, with its powerful mandate to **reduce** vehicle miles traveled (VMT), as well as auto emissions, will force New Jersey regulators -- under threat of losing major federal funding -- to use land use plans to help achieve these targets. Demand management techniques, largely an effort to mitigate the damage that auto-dependent land use patterns have created, will not be successful enough on their own. The underlying land use patterns must change as well.

B. Defining Alternative Development Patterns: The Construct Approach

1. Three Basic Construct Types

In this study, the construct approach was adopted to show that, as an alternative to current land use trends, reasonable models of higher density, mixed-use centers could fit within the geographical and socioeconomic settings of the suburban MSM region. The constructs take into account that there is a continuing demand for residential and employment opportunities within the region, albeit at a slower pace than in the 1980's. They also take into account some basic transportation assumptions of the region, namely:

- The automobile will remain the dominant mode of travel for employees and residents.
- Because of the proximity of the NJ Transit/AMTRAK rail line and the relative proximity of New York City and Philadelphia, employees and residents have some receptivity to transit services.
- There is a basic familiarity with ridesharing, particularly for commuting purposes.
- Polls have demonstrated that people like the pedestrian amenities and opportunities that "small town" aesthetics offer.

These attributes were accepted by both the steering committee and the peer review panel.

Three basic construct types were identified to represent three transportation environments: the **Transit Construct**, the **Short Drive Construct**, and the **Walking Construct**. These are further defined below.

a. The Transit Construct

This construct represents the largest, densest and most complex of the three construct types. It is anchored between a transit hub (e.g., a rail station or convenient bus route) and a major highway. (See Figure 4.) Commercial and residential land uses are mixed to provide a jobs/dwelling unit ratio of at least 2.18.

The Transit Construct shows a high density concentration of employment and transportation services near a rail station, and a second high density of employment and retail activity at the highway connection point. The Main Street of the Transit Construct and its access roads connect the two transportation nodes and create a pedestrian and transit focused spine. Transit facilities may include shuttles along Main Street and regional and local collector bus service providing service from the residential areas to the employment facilities and the Transit Hub.

The focal point of the Transit Construct is the Town Square, which is near the construct's geographic center and houses its primary local institutions and civic facilities.

As found in the other two constructs, the Transit Construct, as do the other two constructs, has strong public and private sector demand management policies in place. It has restricted, preferential parking and a transportation coordinator on site.

b. The Short Drive Construct

The Short Drive Construct has a structure similar to the Transit Construct, but is somewhat less dense and lacks direct access to a transit hub as a second transportation anchor (see Figure 5). Main Street still acts as an important spine, but now it is shorter and only connects the Regional Shopping and Market Square area of the Town Center.

Since the Short Drive Construct is not well served by convenient public transit, the denser residential areas are clustered near enough to the center to permit access on foot. The less dense parts are spread somewhat further and require a short drive to shopping and employment opportunities either by private auto or shuttle buses. The jobs/housing ratio here is 3.39.

In comparison to an ordinary office park, a reduction in trips in the Short Drive Construct is produced by having more housing and retail services near the employment site and by the use of strong demand management policies. There is restricted and preferential parking, and a transportation coordinator on site.

c. The Walking Construct

The Walking Construct is basically a higher density residential village, with minimal employment opportunities, located off the main highway network. It is sufficiently compact to permit access on foot to the center from most of the residential areas (see Figure 6). The cluster pattern of the neighborhoods facilitates vanpools and ridesharing to regional employment centers.

The Town Square is the focus of this more limited mixed-use area and is almost completely locally oriented. If the Primary Connecting Road is not overwhelmed by high speed traffic and can bring some additional clientele from surrounding communities, the Town Square may develop into a kind of Main Street. Many of the existing village centers could evolve into this pattern. While there is some commercial employment within the walking construct, its jobs/housing ratio is only 0.14.

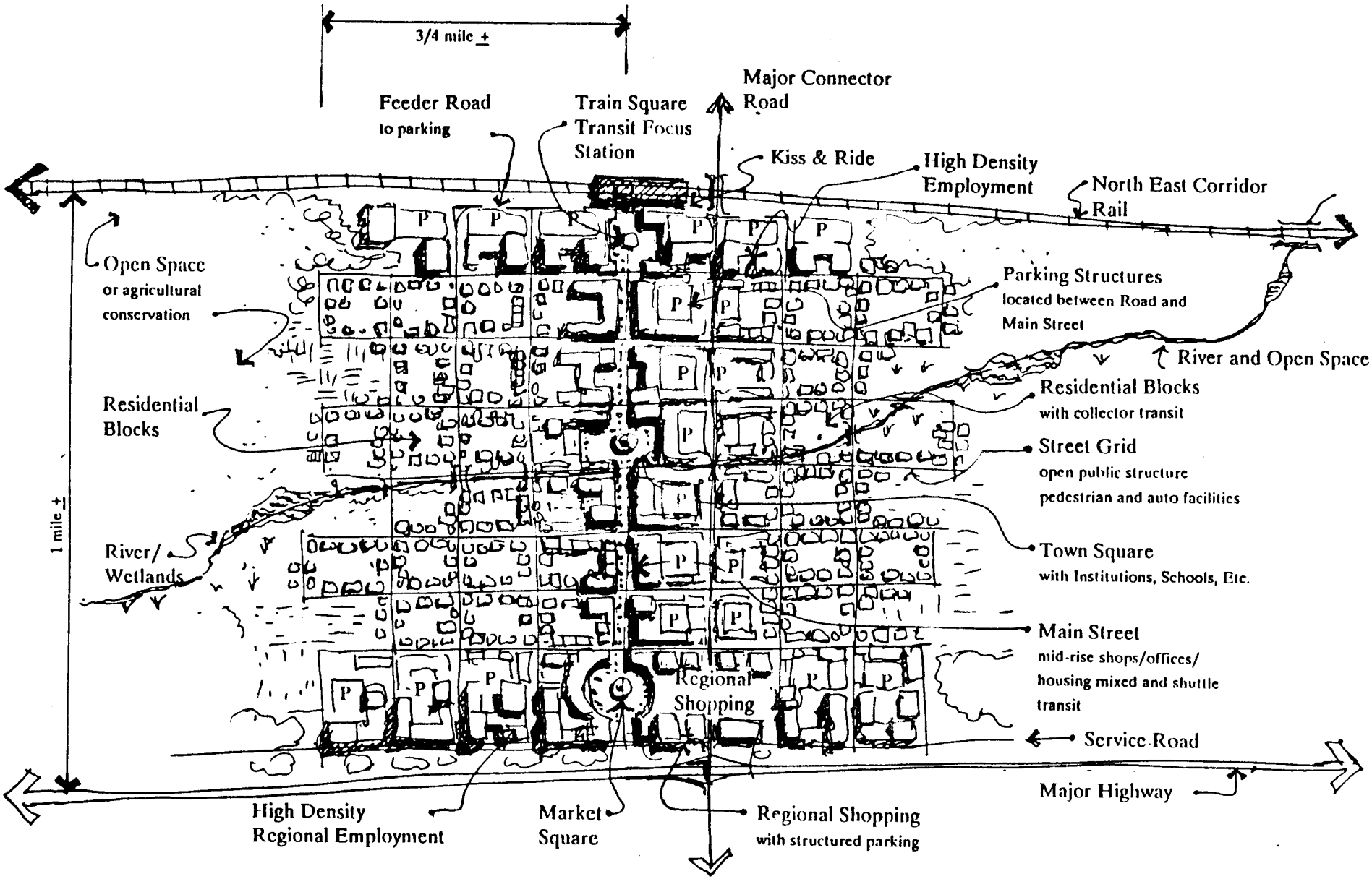

Figure 4: TRANSIT CONSTRUCT CITY DIAGRAM

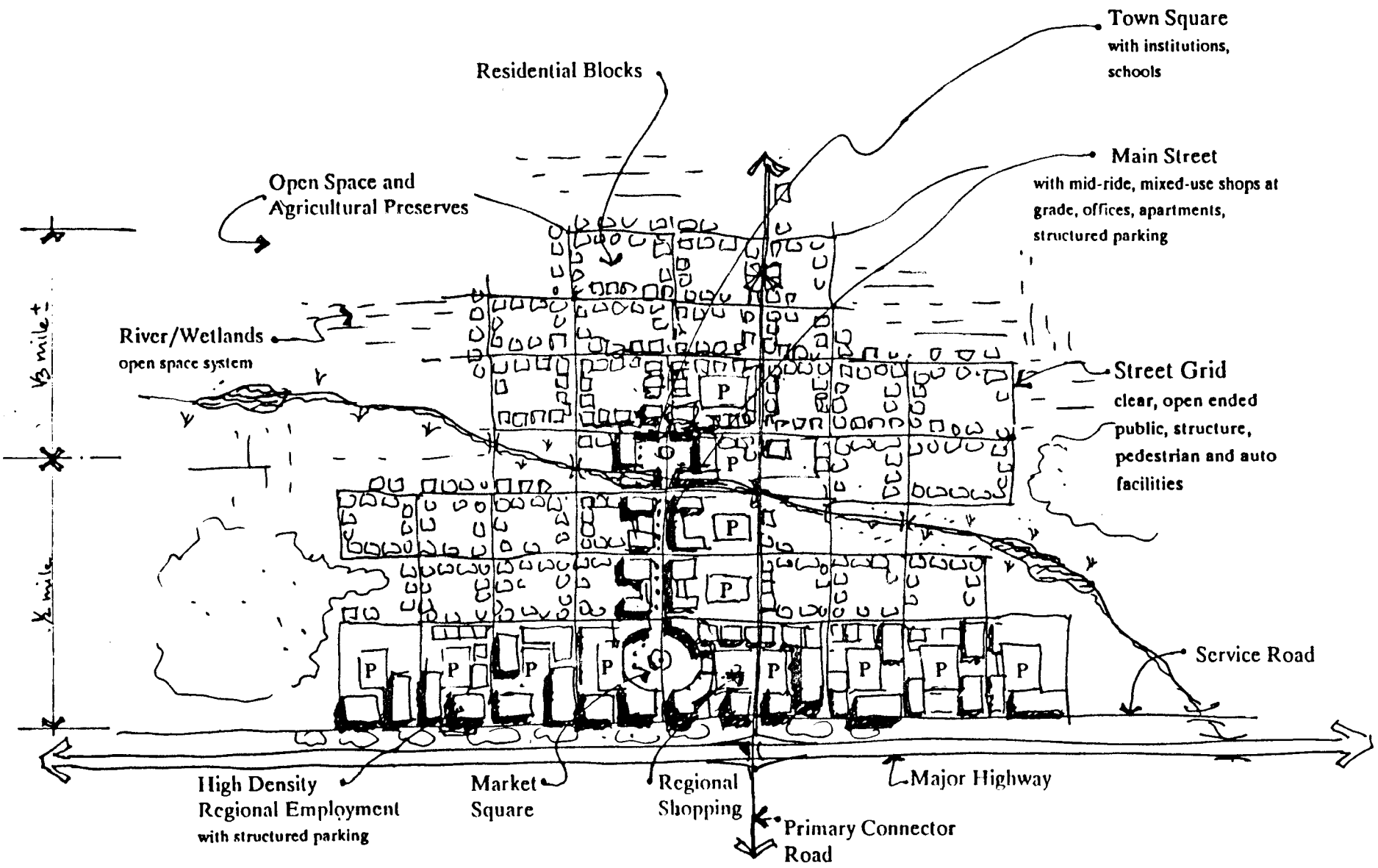

Figure 5: SHORT DRIVE CONSTRUCT CITY DIAGRAM

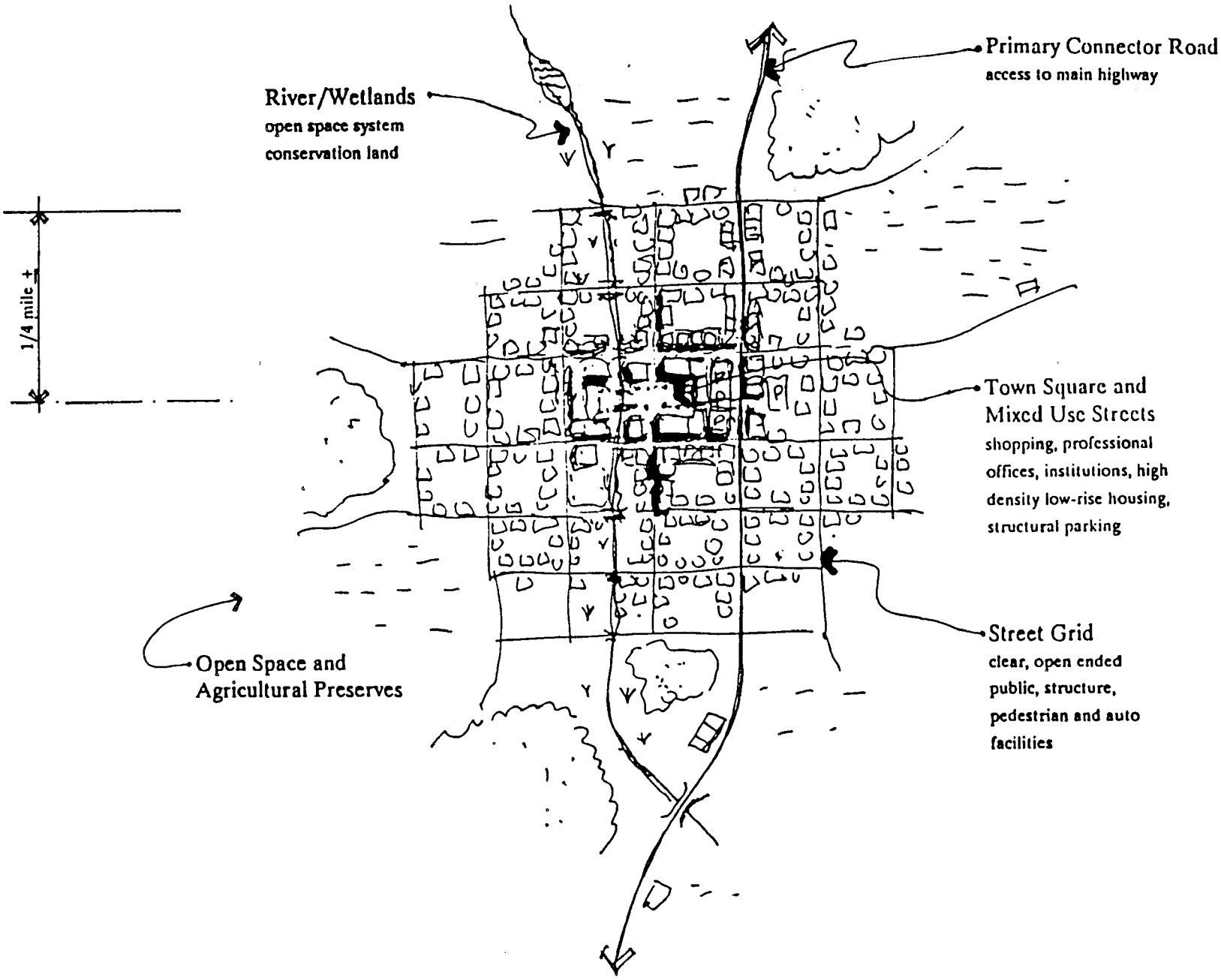

Figure 6: WALKING CONSTRUCT VILLAGE DIAGRAM

2. Urban Design Components of the Three Constructs

The Transit Construct, the Short Drive Construct and the Walking Construct show basic differences of size, scale, organization, focus and pattern. On the other hand, all three represent a major departure from prevailing patterns of development and are made up of similar components of successful urban design for viable towns with a full complement of community functions. These components are in most ways traditional prototypes drawn from successful cities and towns of the past, updated to accommodate today's functional requirements.

The visual imagery of these components can vary. The key to success is that the basic density and functional layout requirements needed for a sound transportation and land use plan are accompanied by massing, zoning, and street environment concepts that support a pedestrian environment and the community life of the town. Thus, we illustrate general scale, proximity and massing relationships on the plan and cross section diagrams (Figures 7-10), but avoid advocating particular architectural vocabularies.

The following are some of the key design components. Refer to the plan and cross section diagrams for their illustration.

- **Streets:** To function properly, streets must be committed to full-time civic use. By contrast, malls, drives, cul-de-sacs, and other contemporary devices tend to serve single, semi-private purposes and restrict the public life of a town. The best streets allow for some mix of livable and interesting uses, such as cars, pedestrians, service vehicles, bicycles, baby carriages, etc.

  The use of the street and adjacent relationships of private properties should be regulated by public code. Grids of streets serve multiple functions and civic purposes by creating an open-ended, continuously connected system with enough redundancy to be adaptable and flexible.

  The actual shape of the open grid can vary with topography, density, and design intent, but its basic integrity should be consistently maintained. Older, traditional towns have many examples of successful streets.

- **Main Streets:** The traditional center of American cities and towns is "Main Street," characterized by a mix of uses and transportation modes and a high level of pedestrian activity and interaction. Dense, mid-rise buildings (3-5 story) with retail uses on the ground floor, and small offices, workshops and apartments on the upper floors usually create the right mix.

  The scale and density of the "Main Street" at Forrestal Village would be quite appropriate for the constructs. However, unlike the one at Forrestal Village, Main Street needs to be connected to and become the focal point of the street grid in order to attract pedestrians from surrounding neighborhoods. Vehicles should be allowed on Main Streets, but their volume and speed controlled to maintain a pedestrian orientation.

  Main Street should connect to the principal squares of the town and should be within walking distance from most residential blocks. In the Transit Construct, shuttle transit should run along the length of Main Street.

- **Squares:** Squares are special spaces in the street network where functional, civic, recreational, and ceremonial activities of the city or town can be focused. In the larger constructs, the functions can be split -- i.e., one square devoted primarily to

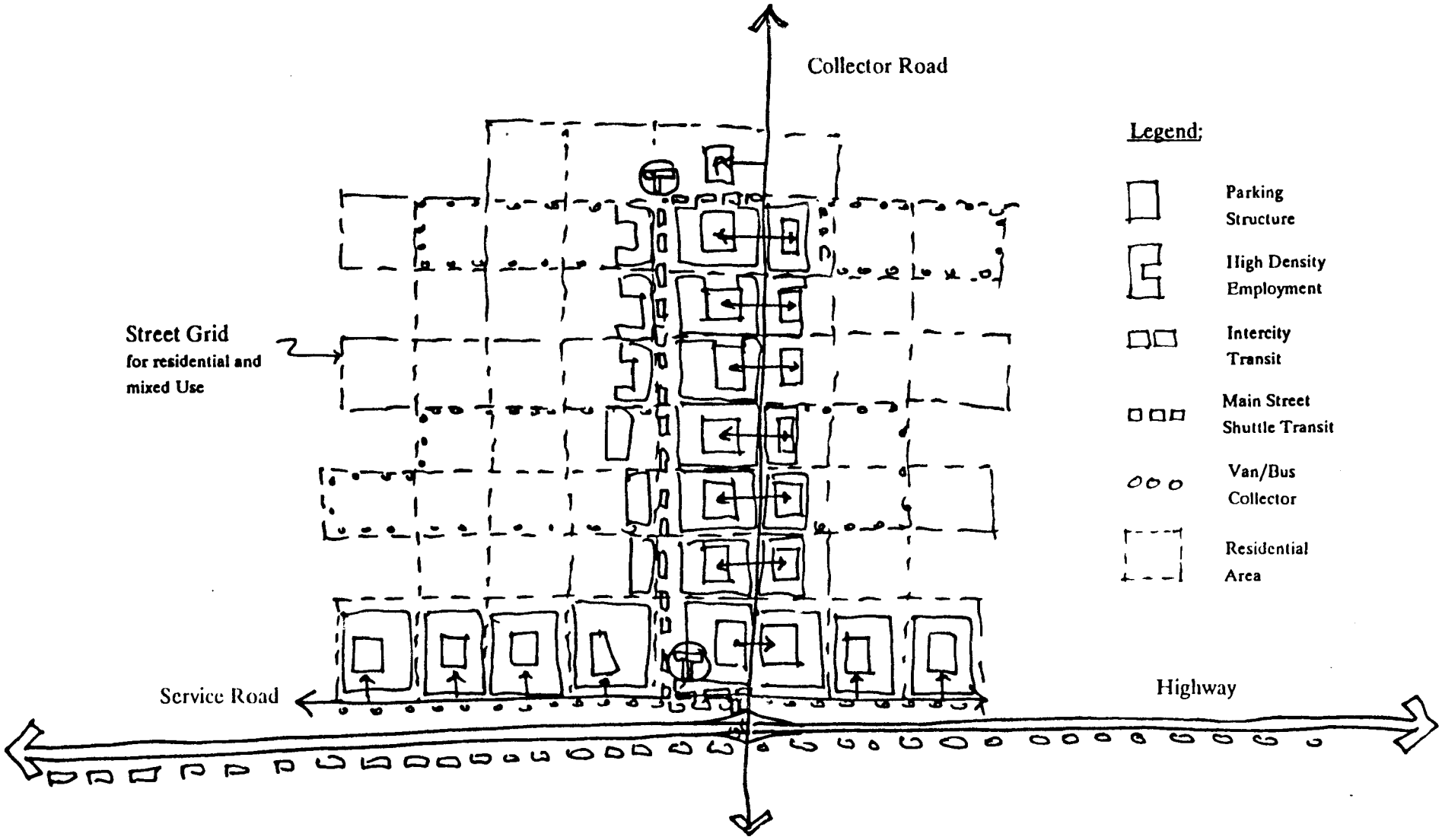

Figure 7: TRANSPORTATION COMPONENTS OF CONSTRUCTS - GENERALIZED

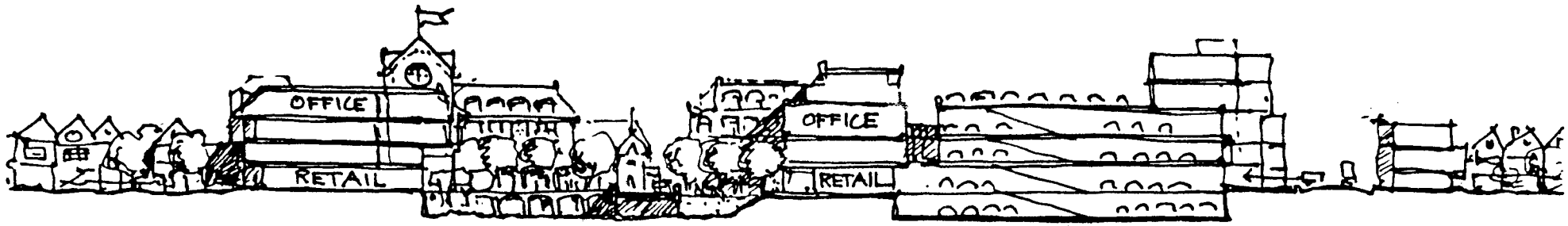

Figure 8: DIAGRAMMATIC CROSS SECTION - TOWN CENTER

Main Street
typical mixed use block - pedestrian arcade with retail, transit shuttle

Transit and Kiss & Ride Street

Train Square
mixed use buildings, pedestrian arcades with retail, high density employment beyond, structured parking beyond

Railroad Station

Figure 9: DIAGRAMMATIC CROSS SECTION AT RAILROAD STATION AND MAIN STREET

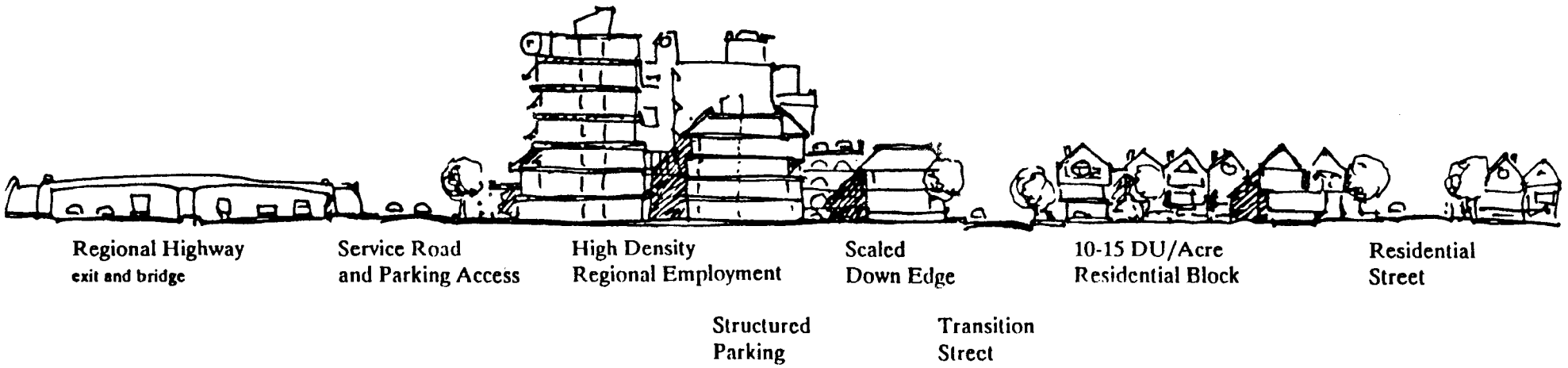

Figure 10: DIAGRAMMATIC CROSS SECTION - HIGHWAY EDGE

institutions, another to markets, a third to transportation -- but these definitely need to be in close relationship to each other. Pedestrian emphasis and connection among the squares is essential.

- **Major Connector and Service Roads:** The size and density of settlements considered for the constructs creates a great deal of auto traffic bound for highly concentrated employment, retail, and transit centers. For this reason, roads should be designated in the grid to handle primary traffic and give access to the main parking garage concentrations. In the two larger constructs, these connector roads should be separate from Main Street and not have major pedestrian or retail concentrations at street level.

  Generally, at the scale of these settlements, traffic signal timing and other management techniques, rather than grade separation, should be used to insure adequate flow along these roads. The plan diagrams and Town Center cross section illustrate the relationship of these roads to the other elements of the grid, land uses, and parking areas.

- **Parking Design:** The large amount of area required for parking in these towns where employment and retail are concentrated (roughly a 1:1 ratio of space devoted to parking and all other uses), necessitates a very careful design approach to parking.

  It is assumed for the constructs that in order to create the density and continuity required for mixed-use centers, most of the parking for employment and Main Street related activity will be in multi-level structures. This will be an economic burden for the developers, but recent developments -- such as Forrestal Village, Carnegie Center in West Windsor and the proposed Metroplex office park in South Brunswick -- have set the precedent by including multi-level parking garages.

  The key design principle is to make these parking structures easily accessible from the main connector and service roads, but to prevent them from dominating the streetscape of Main Street, the Squares, or the residential streets. Ideally, garages should be located at the center of commercial blocks, faced with stores at the ground level and other uses above.

  Parking for the residential areas should generally be absorbed in driveways, garages, or carports on a small scale directly adjacent to the units, as shown in the site diagrams and Town Center cross section. But controlled street parking should not be prohibited.

- **Residential Neighborhoods and Streets:** Neighborhoods need a greater level of privacy and protection from heavy traffic than other, more public uses. Residential streets can be designed to enhance, but not dominate the neighborhood, and still remain connected to the public street grid that ties the town or city together.

  Traffic management should insure that these streets carry primarily local traffic at low speeds. Front doors and parking and front doors should generally occur at or near the street to keep an active community character. Density, proposed in the 10 to 15 dwelling units per acre range (on average), should be highest near Main Street and diminish toward the edges. These densities are equivalent to traditional single-family neighborhoods, and recent townhouse and apartment complexes in the region.

- o **Institutions:** Government buildings, schools, colleges, day care centers, and public recreation facilities need to be provided in prominent public locations, easily accessible on foot and by all other modes of transport. Schools and recreation facilities need to be directly connected to the city's open space system.

- o **Open Space Networks:** Streets, provided with sidewalks that are scaled to the amount of pedestrian activity, are the most used part of the public open space network, and should be landscaped with trees and enhanced with other planting on the adjacent private properties.

  Walkways other than sidewalks are needed primarily in the densest commercial areas, where arcades and through block passages are a welcome and valuable enrichment, and in the undeveloped periphery, where public walkways should give access to natural attractions.

3. Key Characteristics of the Constructs

Specific characteristics of the three constructs were developed by the project team and were reviewed and revised by the initial peer group and the steering committee. The density and size of the Transit Construct were designed to maximize the use of transit and paratransit services while maintaining the suburban fabric of the development. However, for the Short Drive and Walking Constructs, the characteristics were based on standards put forth for "regional centers" and "towns and neighborhoods" as defined by MSM's REGIONAL FORUM in 1985-87 and followed by the Preliminary State Development and Redevelopment Plan.

The FORUM convened regional public and private sector leaders, as well as interested citizens, to address ways to better manage growth in the region. This consensus-building effort developed a set of recommendations for efficiently concentrating growth into mixed-use centers. (See An Action Agenda for Managing Growth, Final Report of the MSM Regional Forum, 1987.)

Table 1 shows the key characteristics used in the Land Use/Transportation Study for all three constructs. **These are presented as minimum thresholds rather than absolute dimensions of the constructs. (The estimates in Table 1 were used for Scenario 1. Scenario 2's estimates were larger in order to accommodate more suburban growth.)** A summary of major points follows:

a. Population

The number of residents ranges from 12,000 in the Transit Construct to 6,700 in the Short Drive Construct, to 4,500 in the Walking Construct. Residential density ranges from 15 dwelling units per net residential acre (average) for the Transit Construct, to 10 dwelling units per net residential acre (average) for both the Short Drive Construct and the Walking Construct.

b. Employment

Employment opportunities are significant in the Transit Construct (13,100 jobs) and the Short Drive Construct (9,500 jobs), but negligible for the Walking Construct (230 jobs). The commercial land use floor area ratio is 2.0 in the Transit Construct, 1.1 in the Short Drive Construct and 0.4 in the Walking Construct.

Both the Transit Construct and the Short Drive Construct have regional retail anchors, while the retail component of the Walking Construct is assumed to be a neighborhood center.

Table 1

MSM LAND USE CONSTRUCT COMPARISON

Characteristic	Transit Construct "TC"	Short Drive Construct "SD"	Walking Construct "W"
COMMERCIAL COMPONENTS:			
Comm. Floor Area(SF)	4,000,000	3,000,000	10,000
Comm. Employment	12,000	9,000	30
Commercial FAR	2.0	1.1	0.4
Comm.Net Acres	45.9	62.6	0.6
RETAIL COMPONENTS:			
Retail Floor Area(SF)	550,000	250,000	50,000
Retail Employment	1,100	500	200
Retail FAR	1.00	0.40	0.23
Retail Net Acres	12.6	14.3	5.0
NON-RESIDENTIAL TOTALS:			
Total Employment	13,100	9,500	230
Total Net Non-Res. Acres	58.5	77.0	5.6
RESIDENTIAL COMPONENTS:			
Population	12,000	6,700	4,500
People per D.U.	2.0	2.4	2.8
Dwelling Units	6,000	2,800	1,600
D.U. per Net Res. Acre	15	10	10
Net Residential Acres	400.0	280.0	160.0
TOTAL CONSTRUCT FACTORS:			
Jobs per D.U.	2.18	3.39	0.14
Workers per D.U.	1.0	1.5	1.5
RESERVE AREAS:			
Open Space	15%	15%	15%
Roads/Utilities	25%	28%	28%
Public Buildings, etc.	10%	10%	10%
GROSS DIMENSIONS:			
Area in Acres	917	759	352
Area in Sq. Mi.	1.43	1.19	0.55
Radius if Circular (FT.)	3,566	3,245	2,210

c. Jobs to Dwelling Units Ratio

This ratio reflects the mixed-use elements of the Transit Construct (2.18) and the Short Drive Construct (3.39), while indicating that the Walking Construct (0.14) is simply a residential center.

d. Gross Dimensions

In order to accentuate the potential for walking trips among land uses, an attempt was made to concentrate each construct into a relatively compact area. As a result, the Transit Construct represents an area of over 900 acres, the Short Drive Construct represents an area of over 750 acres, and the Walking Construct represents an area of over 350 acres. This includes not only the residential, commercial and retail land uses, but open space, roads, utilities and public buildings as well.

C. The Role of Constructs in Reducing Vehicle Traffic: Local Level Analysis

Each of the three constructs was designed to reflect a "package" of land use mix, density, transportation, and demand management attributes which in combination reduce automobile usage. In this step of the study, the effects of each construct on reducing auto travel were quantified by the type of development in each construct for **peak hours, off-peak hours and daily trips**. The analysis was designed both to identify the specific traffic reduction benefits of constructs at the local level, and to show the overall effects on the regional network. The regional analysis discussed in Chapters III & IV was conducted only for the more general measure of **daily travel**.

1. Assumptions

The analysis was based on a number of assumptions about the trip types considered and their trip rates, and the effects of the different constructs on tripmaking, as follows:

- As the target of the study was the reduction of automobile trips, the trip generation dealt with **vehicle trips**. The effect of changes in modal shifts to transit, carpools or walking was thus expressed as an estimated change in vehicle trips.

- The product of the trip generation was vehicle trips with an origin or destination **external** to the construct, as intra-construct trips do not impact the area roadways to any significant extent. Traffic zones in the model were not smaller than a construct.

- Tripmaking generated by each construct was accounted for in three categories:

    - **commercial** (represented mainly by office rates),
    - **retail**; and
    - **residential** uses.

- The time periods considered were:

    - **AM Peak Hour**
    - **PM Peak Hour**
    - **Off-Peak periods**
    - **Average Weekday (ADT)**

Travel behavior description and analyses for the constructs required inclusion of all such periods. For determination of off-peak period trip rates, twice the sum of the AM and PM peak hour rates (to determine the peak period) was subtracted from the ADT rate.

2. Methodology

Construct-level analysis was based on the premise that the constructs chosen reduce (external) vehicle trips. These **vehicle trip reduction factors** were developed for each construct, trip type and time period compared to basic trip rates. Comparison among the constructs is possible by looking at the differences in construct-to-trend ratios. (See Appendix A.)

3. Construct Land Use and Transportation Relationships

A review of the literature in land use/transportation relationships, transportation demand management, and of case studies of suburban activity centers indicated that the general effects in terms of land use and travel relationships can be summarized in five areas, as follows:

a. Internal Vehicle Trips increased by:

- Greater employment opportunities for residents. (Jobs/Housing ratio more balanced within zone.)
- More retail/services for residents or employees. (Mixed-use enhanced.)

b. Internal Walking Trips increased by:

- Combination of jobs, retail/services and residences in close proximity with one another. (Density and mixed-used enhanced.)
- Pedestrian oriented site planning and design.

c. Internal Transit Trips increased by:

- Presence of local transit service, i.e., shuttle/feeder buses. (Density enhanced.)
- Greater variety of trip purposes served. (Mixed-use enhanced.)
- Transit oriented site planning and design.

d. External Trip Shift to Transit increased by:

- Good transit available to serve remote residents working in construct and construct residents working in remote job centers. (Density and mixed-use enhanced.)
- Transit incentives, such as transit pass subsidy by employers, etc. (Demand management enhanced.)

e. External Trip Shift to Carpools increased by:

- Greater carpool matching potential, i.e., convenience of association at both ends of trip. (Density and mixed-use enhanced.)

- Carpooling incentive through parking management and pricing at destination. (Demand management enhanced.)

Of course, each one of the features listed above has a varying influence on the reduction of vehicle trip making, and, in most cases, the features' interaction with each other complicate estimating. In addition, similar end results can be caused by the varying interaction of different factors in different constructs.

4. Determination of Vehicle Trip Reduction Factors

Once basic land use and transit relationships were established, specific vehicle trip reduction factors for each construct were determined through the steps below. The project team developed the factors and had them reviewed by the peer group. All land use based reduction factors were applied to Institute of Transportation Engineers average vehicle trip rates for the AM peak hour, PM peak hour, off-peak period and the average daily traffic (ADT) conditions, while the values for the regional analysis were limited to daily (ADT) vehicle trips.

a. The Factors Influencing Trip Reduction

The vehicle trip reductions from the constructs result from a combination of factors:

- overall office/retail/housing mix;
- jobs/housing ratio;
- total employment;
- design integration;
- proximity to rail transit;
- presence of radial bus service;
- presence of internal bus service;
- constrained, and in the case of the Transit Construct, priced parking supply for commercial uses; and
- increased residential density.

b. How the Factors Operate on Travel Behavior

As discussed above, these factors in various combinations can bring about varying degrees of reduction of single occupant vehicles, due to:

- internalization of vehicle trips, whether by vehicle, transit, or walking; and/or

- reduction of external vehicle trips by shifts to transit or rideshare modes.

c. Using NCHRP #323

In looking for case study data to use in measuring the vehicle trip reduction effects of these characteristics, one of the best sources, containing the largest, most recent and most consistent data set is NCHRP #323, Travel Characteristics at Large-Scale Suburban Activity

Centers (October, 1989) by Kevin Hooper[1]. As shown in his report and in other studies such as Cervero's,[2] existing "suburban activity centers" or "suburban employment centers" typically exhibit some of the above characteristics, but not all. Existing centers exhibit some land use mixing (particularly office/retail), but generally, with the possible exception of Bellevue, Washington, do not have the level of residential development, the parking restraints, the clustering, rail service, internal transit service, or pedestrian amenities included in our constructs.

The literature indicates that many of the suburban activity centers are actually more like "trend" development than the constructs. Individual cases where higher transit use or walking rates have been achieved are those, like Bellevue, where there is transit, more housing units, better integrated design, or pedestrian walkways, etc.

Beyond the NCHRP #323 report, other case studies are useful insofar as they measure effects of transportation demand management measures, individual land use or transit service characteristics. These others do not consider the land use mixing.

d. Basic Trip Reduction

Thus, a decision was made to use the average values from NCHRP #323 as a **base indicator of trip reductions which can be achieved through a limited amount of mixing land uses and increasing density in suburban activity centers which would otherwise be dispersed in a "trend" (sprawl) pattern.** The case study data provided the benchmark values and empirical evidence which were used as the starting point for the regional testing.

It should be noted that the base trip reductions are fairly substantial in themselves. Their impact, regionally, could be fairly significant without full construct development.

e. Enhanced Trip Reduction Factors in Constructs

Then, for each land use under each construct, additional case studies and the experience of observed behavior were used to estimate **added** reductions which could be attributed to the particular features assumed for our constructs. Some of these reductions are tied to the Hooper data for Bellevue and other case study data of developments which are most like our constructs.

Others are estimates, based on work/non-work trip percentages, ratios of employment to housing, etc. For some trip types there are no further trip reductions beyond those indicated in the Hooper cases. (As noted in Appendix A.)

The exception is the walking construct, which is not really a "suburban activity center" as currently defined, and for which there is the least case study data. The most comparable data, if available, would probably be from new towns such as Reston or the new "neo-traditional suburbs." In this case, the project team reached a decision that the base

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1. Hooper, Kevin G. Travel Characteristics at Large-Scale Suburban Activity Centers, National Cooperative Highway Research Program Report 323, (October, 1989).

2. Cervero, Dr. Robert. America's Suburban Centers: A Study of the Land Use/Transportation Link, Prepared for Office of Policy and Budget, Urban Mass Transportation Administration, Report No. DOT-T-88-14, Washington, D.C. (January, 1988).

case trip type values could not be achieved in all cases, since the walking construct had the least similarity to the mixed-use centers studied, notably its lack of employment opportunities. Therefore, in the case of the walking construct, smaller base reductions were made for some trip types through negative adjustments.

f. Factoring to Avoid Double Counting

The resulting trip reductions were then combined for each construct through factoring. In this way the values for the individual components were combined as the product of sub-factors for each percentage. This was done to avoid double counting. For example, transit users produced by construct conditions are not available for carpools, and vice versa. If individual trip reductions of 15 percent and 10 percent might be estimated for transit mode shift and carpooling, respectively, the reduction factor would be 0.765 (0.85 x 0.90), implying a lesser reduction of 1 - 0.765 = 0.235 or 23.5 percent.

Table 2 on page 30 summarizes the total vehicle trip reductions by construct. The table shows that compared to the trend vehicle trip generation rate, the number of vehicle trips generated and attracted to that construct will be reduced by that factor. (See **Section 5** on the following page, for example. Detailed tables showing calculations of vehicle trip reductions for each construct are included in **Appendix D.**)

It is difficult to substantiate every factor as applied to every trip type. However, it is possible to see how each construct compares to the current suburban activity centers for each type of trip. Looking at the literature, the values chosen for use in the analysis are within ranges which have been measured in other case studies such as those presented in the ITE 1987 Trip Generation Manual[1] and the Stover and Koepke text Transportation and Land Development.[2]

Similarly, the February, 1990 FHWA report, Evaluation of Travel Demand Management Measures to Relieve Congestion[3], states that by instituting programs of Transportation Demand Management (TDM) measures, "trip reductions in the range of 20% to 40% can be the norm, rather than the exception." Although our study purposely does not attempt to isolate TDM program effects from land use factors, TDM programs such as constrained and priced parking, TMA activity, rideshare incentives, and staggered work hours are considered part of each construct "package" along with the land use mix, density, and design features which are the focus of this analysis.

Land use based vehicle trip reduction factors were later converted to Home Based-Work, Home Based-Other, and Non-Home Based categories in the AM peak hour, as required by the network model used in the TransCAD package. Figure 11 shows the travel reduction factor for each construct type for the four key time periods, compared to the same land use developed under trend conditions. The model was run for 1988 conditions, the 2010 "trend" scenario, and two construct scenarios (ADT), as explained in Chapter IV.

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1. Institute of Transportation Engineers. Trip Generation, 4th Edition (1987) pp.17-21.

2. Stover, Virgil G. and Frank J. Koepke, Transportation and Land Development, Institute of Transportation Engineers, Englewood Cliffs, New Jersey (1988) pp. 47-48.

3. Kuzmyak, J. Richard, Eric N. Schreffler, and Harold Katz, et al. Evaluation of Travel Demand Management (TDM) Measures to Relieve Congestion, Report No. FHWA-SA-90-005, prepared for Federal Highway Administration, Washington, D.C. (February, 1990), p. 28.

5. Producing a Vehicle Trip Reduction Factor: An Example

An example of how this method is applied, related to office trips, follows. The numbers correspond to those shown in Table 2 on the next page.

- For office use in the AM peak hour, NCHRP #323 shows that for "smaller centers," (those most similar in size to the constructs), an average of 10 percent of employees make a stop within the activity center. Mode shift data from NCHRP for the non-Bellevue suburban centers[1] show that, on average, 1 percent use transit, walk or bike, and 7 percent carpool. These values were put into the matrix as base case study values. It was assumed that these reductions would be achieved as a minimum vehicle trip decrease from the trend values in any of the constructs. **Result:** 0.90 x 0.99 x 0.93 = 0.83 net vehicle trip reduction factor.

- Then, for the transit construct, an additional 2 percent internal trip reduction was estimated, due to the internal transit system and improved walking conditions. An additional 12 percent transit use was estimated, based on Bellevue's 10 percent transit mode share (with radial bus system), plus an estimated 2 percent reduction due to the rail access. Reductions due to ridesharing were not increased over the case study value. **Result:** 0.83 (from base case, above) x 0.98 x 0.88 = .71 net vehicle trip reduction factor.

- For the short drive construct, reductions due to increased internal walking were increased by 1 percent, and carpooling was increased 8 percent over the base values, based on Cervero's findings of 15 percent carpool rates for large and medium mixed use centers. **Result:** 0.83 (from base case, above) x .99 x .92 = .75 net vehicle trip reduction factor.

- For the walking construct, office trips represent a much smaller proportion of total travel, but, due to their location, they attract a large proportion of employees and visitors from within the construct. Thus, the 10 percent internal trip reduction from the base case was deemed valid for office uses in this construct. However, no external transit use or carpooling increases were predicted for the walking construct, due to the absence of new regional services and the low proportion of use in commercial space, which would not justify adding local bus service. Thus, these values were listed as negative values (translated into factors greater than one) in the table. **Result:** 0.83 x 1.01 x 1.07 = 0.90 net vehicle trip reduction factor.

Vehicle trip reduction factors were then applied to vehicle trip generation numbers that the basic model produces. By this method, the special vehicle trip reduction characteristics of constructs as opposed to land uses in the region were taken into account.

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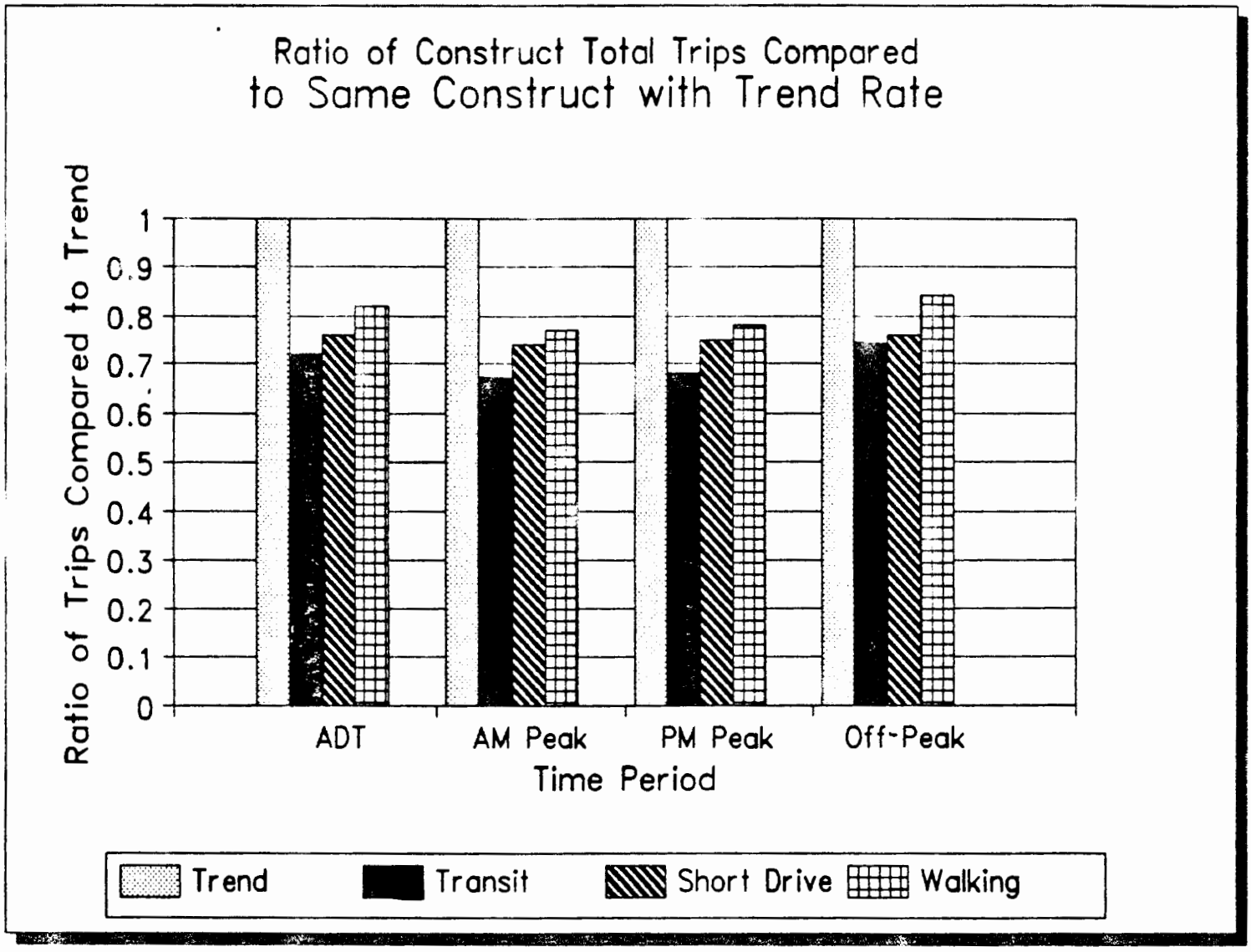
1. For the transit use value, Bellevue is excluded from the base case value due to its atypical, higher level of transit service which would raise the base value too high to be used in all cases.

Table 2
Summary of Vehicle Trip Reduction Factors

Trip Type	Land Use Construct Factor			
	Trend	**Transit**	**Short Drive**	**Walking**
COMMERCIAL:				
Average Daily	1.00	0.69	0.73	0.81
AM Peak Hour	1.00	0.71	0.75	0.90
PM Peak Hour	1.00	0.71	0.75	0.90
Off-Peak Periods	1.00	0.67	0.71	0.75
RETAIL/RESTAURANT:				
Average Daily	1.00	0.73	0.76	0.81
AM Peak Hour	1.00	0.83	0.85	0.86
PM Peak Hour	1.00	0.83	0.85	0.86
Off-Peak Periods	1.00	0.67	0.70	0.77
RESIDENTIAL:				
Average Daily	1.00	0.73	0.78	0.82
AM Peak Hour	1.00	0.59	0.69	0.77
PM Peak Hour	1.00	0.59	0.69	0.77
Off-Peak Periods	1.00	0.82	0.84	0.86

Note: Compared to the development pattern expected to occur in the MSM region by the year 2010 (if Trend conditions continue), constructs would produce fewer vehicle trips on the regional highway network. As this chart shows, if the Trend represents the expected level of vehicle tripmaking, then the constructs produce daily trip levels between 0.59 and 0.90 of what would be expected to occur, depending upon trip types and construct types.

Figure 11


Ratio of Construct Total Trips Compared
to Same Construct with Trend Rate
Ratio of Trips Compared to Trend
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
ADT
AM Peak
PM Peak
Off-Peak
Time Period
Trend
Transit
Short Drive
Walking

CHAPTER III:
DEVELOPING THE REGIONAL TRANSPORTATION MODEL

A. Basic Components of the Regional Transportation Model

In MSM's Land Use/Transportation Project, a regional transportation model was developed to provide a platform for evaluating the traffic impacts of alternative land use forms in the MSM study area. In particular, it was designed as a means for testing the hypothesis that placing future development in constructs would have a positive impact on traffic in central New Jersey.

The modeling procedure involved three methodologies of particular interest:

- o Building the MSM network with reliance on previous efforts;
- o Using the GIS-based TransCAD package; and
- o Accounting for the traffic reduction effects of construct development in the regional model.

These are briefly described below and more extensively in the remainder of this chapter. More detailed descriptions and tables are included in Appendix B.

1. Building the MSM Network with Reliance on Previous Efforts

The MSM area presented a particularly intriguing modeling challenge. The region lies at the edge of two regional planning agency boundaries: Philadelphia to the south and New York City/Northern New Jersey to the north. Although parts of the three counties were included in previous transportation modeling projects, there was no uniform network and no calibrated model covering the four standard transportation planning steps (trip generation, trip distribution, modal choice, and network assignment) for all three counties. Thus, the project team was faced with piecing together data and information from other studies and regional planning efforts.

2. Using the GIS-Based TransCAD Package

The demands placed on the regional transportation model were similar for this study to those for any regional study, but with the added desire to control and manipulate land use and demographic data more easily. Because of this goal, enhanced capabilities compared to typical transportation packages were needed.

The TransCAD package, which combines the normal battery of transportation models with a Geographic Information System (GIS), provides these capabilities and thus was used in this study.

3. Accounting for Traffic Reduction Effects of Construct Development in the Regional Model

Another challenge for this project was the fact that the typical four-step travel demand models used throughout the nation generally are not capable of reflecting land use variables related to density/cluster development attributes or accessibility by walking and other non-motorized means. The regional transportation model used in this study was geared toward a more typical urban/suburban setting, and it dealt exclusively with vehicle trips.

As a result, a two-step process for defining and accounting for the traffic reduction features of the constructs was undertaken, as illustrated in Figure 12. The first step, distinct from the TransCAD package and described in Chapter II, was undertaken by the project team with input from the peer review panel and the steering committee.

As discussed, and because the regional models dealt only with vehicle trips, this process first analyzed the specific effects of each construct's land use density, mix, and design and its transit service availability on mode choice, trip length, and auto occupancy for each individual construct. This provided the detailed zone-level analysis of specific construct impacts for various time periods.

Then, to enable input into the regional model, these effects were translated into vehicle "trip reduction factors," which could be input directly into the regional model by traffic zone at the vehicle trip generation stage to modify construct tripmaking relative to "trend." In regional aggregation, this provided the means to compare each construct scenario to the "trend" scenario development trips.

It should be noted that the basic vehicle trip reduction factors used to adjust trend rates for each construct were initially formulated on the basis of ITE Trip Generation rates on a land use basis, as described in Chapter II. For application to the trip generation categories of the regional model, it was necessary to convert the basic factors to apply to the model categories of separate productions and attractions by varying purpose definitions. This will be discussed further in Section D below.

B. Building the MSM Network with Reliance on Previous Efforts

1. Building the 1988 Network

To conduct the travel demand portion of this study, it was necessary to assemble a data base reflecting the highway and demographic conditions of the study area. The highway portion of the data base was used to simulate traffic flows for a given year. In this study, a calibration year of 1988 and a future year of 2010 were used. The demographic data used as inputs to the traffic models were also estimates for the years 1988 and 2010.

Data sources for the highway data base consisted of four networks supplied by the New Jersey Department of Transportation (NJDOT) from studies it had completed. The networks supplied were from the North Jersey Regional Transportation Model Development Project and the Route 1, Route 130 and Route 571 studies. Three of the four networks (Routes 1, 130 and 571) consisted of existing and future links, although not representing the same years. The North Jersey network supplied only the links for 1988 because the future network for that study was still in development. These four networks were used because they covered the majority of the MSM study area with the exception of Hopewell

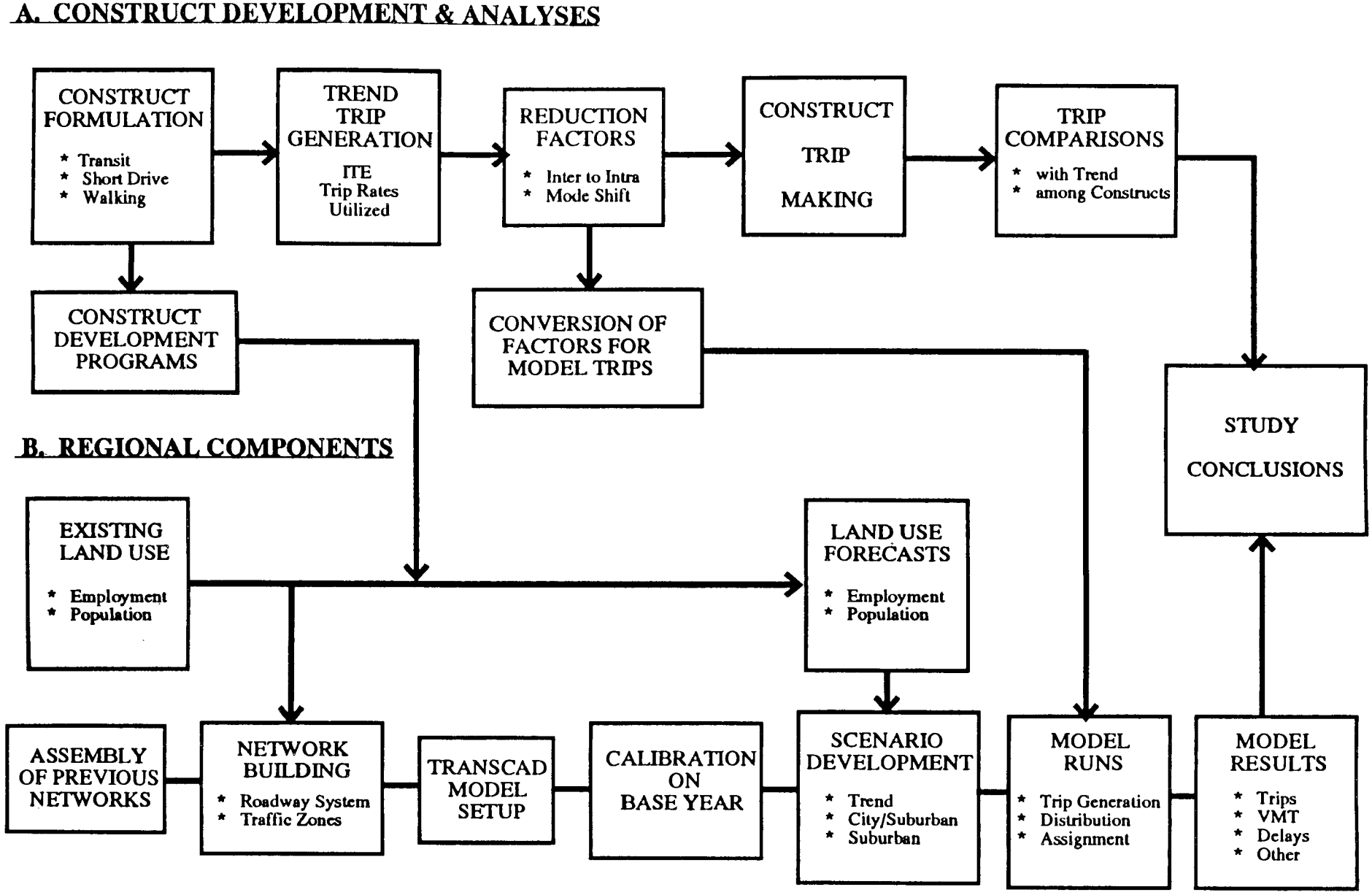


Figure 12: CHART OF STUDY PROCESS

and a portion of Ewing Township. No individual network provided complete coverage of the study area, so the four networks were "stitched" together. (**NOTE:** Although Trenton and New Brunswick were covered, the network was not fine-grained enough to accurately describe urban travel behavior. Because of time and financial constraints, refinements of the cities' network and zone system were not attempted in this study, and the results are therefore limited to suburban analyses.)

To simplify this process, all four networks were loaded over a common base map in TransCAD. By doing this, the consultant team was able to eliminate any portion of a given network that was covered by another. By first establishing the Route 1 network as the base to build from, the other three networks were reduced by deleting where they overlapped the Route 1 network.

The link detail, zone size and coarseness of the Route 130 network closely matched that of the Route 1 network, so it was retained and the Route 571 network was dropped. In addition, although much of the Route 130 network was dropped because of duplicate coverage with Route 1, its network was used to complete the eastern portion of Mercer County and fill in areas of sparse coverage on the eastern fringe of the Route 1 network.

The North Jersey network supplied coverage for the southern halves of Somerset and Middlesex counties. This was the southern-most extent of the North Jersey network and was stitched to the northern limits of the Route 1 network. Each of the older networks had somewhat different attribute conventions since the Route 1 study used UTPS, the Route 130 study used a MINUTP network and the North Jersey network was developed using Tranplan. For the MSM network, the consultant team needed to transfer the number of lanes, initial speeds and per lane capacity (facility and type) from the parent network. This was done by using the TransCAD package, which has superior capabilities for defining link length and location with greater accuracy than the parent systems.

The project team developed new networks and a zone system for Hopewell and Ewing Townships. Speed and capacity classifications for these new links were defined using the facility and area classification table from the Route 1 Corridor Study Report.

2. Building the 2010 Network

The calibration network was used as a base from which the future network, used in the Trend and Scenarios 1 and 2, was constructed. Both the Route 1 and Route 130 Studies contained future networks. The differences between the calibration and future networks of these two studies represent the proposed projects in the MSM Region. Since the completion of the Route 1 and Route 130 Studies and since the start of this study, a number of highway projects assumed to be constructed are either under further study or lack funding to implement. These projects include Route 92 through Middlesex County and the widening of Routes 27 and 130. Therefore, they were not included in this study.

Discussions with NJDOT revealed four highway facility changes to the MSM calibration network that could be completed by 2010: 1) extension of Route 29 from the Trenton Freeway to the I-195/295 Trenton Complex in western Washington Township, Trenton and Hamilton Township; 2) extension of I-295 from the Trenton Complex into Bucks County, Pennsylvania (this extension functions as an external connector in the network); 3) the Hightstown Bypass; and 4) the widening of the New Jersey Turnpike by two lanes from Cranbury Road to State Highway 18.

These changes were incorporated into the existing (calibration) 1988 network to form the 2010 network used for this analysis. It should be stressed, however, that these projects are not necessarily included in NJDOT's committed capital programs.

3. Building Traffic Zones

The MSM region was divided into nearly 200 geographic zones, within which population, employment and other relevant land use/demographic data was stored. Trips originating from or destined to each zone link up to the regional network from each zone centroid via a centroid connector to the highway links. Zones were built as an amalgam of census blocks, a process expedited by TransCAD's GIS capabilities. There is some correspondence between the zones built for this effort and those used in the other modeling efforts described earlier. (Appendix B shows the zonal layout for the MSM region.)

Constructs for the year 2010 were assigned either to an existing traffic zone or to a new zone created from segments of one or more existing zones. Placing a construct in an existing zone(s) meant that any existing development in the zone (as of 1988) would be absorbed in and take on the behavior pattern of the construct development. This implies that the existing development served as a foothold upon which the construct was built. All but four of the constructs created in this study were assumed to be developed in this so-called "piggyback" fashion. In the four new zones, the travel behavior is characterized by the construct factors, but the persons in the surrounding zones with trend-type development would **not** change as a result of proximity to the construct development.

4. External Trips

The model accommodates external trips. There are two types of such trips: first, trips that pass through the MSM region without origins or destinations in the area; and second, trips that either originate from or are destined to the region, but with destinations or origins outside the region. The Route 1 model had to be adjusted to account specifically for the trip generation of zones that the original model treated as external points, but which were now contained within the larger MSM network.

C. Using the GIS-Based TransCAD Package

The GIS-based TransCAD package contains a gravity model and an equilibrium traffic assignment model among its battery of procedures. It also provides numerous procedures for processing land use data, constructing/subdividing traffic zones, calculating the precise location and adjustment of transportation links, and summarizing traffic phenomena by geographic area. Thus, it provided most of the models necessary for the current study, and allowed for direct entry and manipulation of the land use database by the MSM professional staff. A spreadsheet model calculated the daily person trip ends. A complex combination of case study results provided the modal choice (reduction) percentages for each type of construct. Constructs were easily accommodated by creating new zones or altering zone boundaries.

D. Accounting for Traffic Reduction Effects of Construct Development in the Regional Model

Because they were based on vehicle trip generation rates by individual land use, the traffic reduction effects of the constructs were taken into account in the Trip Generation step of the standard four-step transportation modeling process. To be used in the model, however, the rates had to be converted from land use based rates (i.e. vehicle trips per 1,000 square feet of floor space) to rates which could be applied to the different trip categories used in the model. This procedure is discussed below.

This study used a simplified set of vehicle trip generation equations in order to reduce the need for detailed zone level land use forecasts. The relationships in the parent studies required estimates of housing units by type (single family, low-rise multi-family, high-rise), or household size and income. It should be noted that the North Jersey study, which used income and household size, did not forecast dwelling unit levels for any future year.

This study developed a simplified set of vehicle trip generation rates from the Route 1 Study rates, as shown in Appendix C. Where land uses combined (e.g., single family and multi-family dwelling units), the new rates were calculated as the weighted averages of the rates from the parent study. Thus, they contained an implicit assumption that the relative mix of dwelling types would remain the same in the future for the basic trip generation equations. In a similar fashion, new factors for trip attractions were weighted functions of various employment categories which have been aggregated into retail and non-retail categories.

The trip generation formulas used generated **vehicle trips** for three basic trip types:

- Home-based-work trips, meaning trips made from home to work or work to home;
- Home-based-other trips, meaning trips made to or from home, to or from another, non-work destination; and
- Non-home-based trips, meaning a trip not made either to or from home.

The formulas generated these vehicle trips for four different land use types (reduced from the 16 land use types used in the Route 1 Study) namely:

- one residential type, combining various density types;
- two employment types, one being retail and the other non-retail, which includes office, industrial, hospital, etc.; and
- one for university students.

All vehicle trips **to** (i.e., trip attractions) and **from** (i.e., trip productions) zones were generated. A **daily vehicle trip rate** represents the sum of attraction and productions for three trip types and four land use types.

The vehicle trip generation formulas developed were applied to all scenarios studied. The trip modification effects of the special land use constructs were incorporated by applying construct trip reduction factors (ITE/land use derived) as described in Chapter II, converted to the model trip categories described on the previous page, and applied to traffic zones where constructs are located.

The factor conversion or adaptation was done by analogy or combination. Among the assumptions made were those that peak hour travel, particularly AM, is home-based and work oriented, and that off-peak non-retail commercial trips are dominantly non-home-based. For example, the factor for residential AM peak hour trips is appropriate for home-based-work productions, as virtually all of such trips leave home and are destined principally to work. Similarly, the off-peak commercial (non-retail) trip factor is appropriate for application to non-home-based productions or attractions, as such trips are unlikely to be going to or from home.

Once the vehicle trip reduction factors were converted to the model categories, they were input into the model to reduce average daily vehicle trips going to or from each construct zone in each of the two scenarios analyzed. The results of the trend analysis, and the analyses of the two alternative construct development scenarios are discussed in the following chapters.

CHAPTER IV:
FORECASTING DEVELOPMENT SCENARIOS

A key element in testing the effectiveness of constructs of higher density, mixed-use centers is to develop a forecast of future land use patterns in the MSM region. In fact, multiple forecasts must be developed: one representing the best estimate of current land use development patterns without any shift to construct-type development; and one or more forecasts representing the presence of construct centers in the MSM region. A 2010 forecast year was used, representing the latest year in which reasonable estimates of regionwide development can be projected and the earliest year in which to expect constructs to become a significant presence in the region.

Prior to developing these forecasts, however, it is important to build a consistent set of baseline conditions, using the most recent estimate of current land use and demographic characteristics in the region. The year 1988 was designated as the latest year in which existing conditions can be determined with any reasonable accuracy.

A. Developing 1988 Baseline Conditions

MSM staff developed 1988 conditions for the following key indices:

- Total number of households;
- Total retail employment;
- Total non-retail employment; and
- Total university student population.

The 1988 estimates were based on 1980 census data, more recent estimates from the various municipalities in the region, and knowledge of recent site specific developments from MSM's annual Current Development Survey (MSM Regional Data Book). The 1988 levels were estimated for each of the nearly 200 traffic zones. Table 3 shows the various estimates aggregated at the municipal level.

B. Year 2010 Trend Conditions

The total growth increment from 1988 to the year 2010 for the MSM region was based on county projections prepared for New Jersey's Cross-Acceptance Process. This process required counties to help develop the New Jersey State Development and Redevelopment Plan, by soliciting input from municipal officials, interest groups and community leaders. The expected growth levels in the MSM region for the year 2010 as published in the 1988 Preliminary Plan are:

Table 3

1988 Baseline Conditions for MSM Region Communities

Municipality	Non-Retail Employment	Retail Employment	Households
East Windsor	7,615	848	8,666
Ewing	26,152	2,508	12,541
Hamilton	22,302	5,623	31,336
Hightstown	2,055	800	1,818
Hopewell Township & Borough	3,299	168	4,673
Lawrence	14,684	6,617	8,616
Pennington	1,596	40	872
Princeton Township & Borough	20,615	1,647	8,804
Trenton	51,442	3,405	33,952
Washington	1,601	500	2,250
West Windsor	11,112	1,050	4,436
Mercer County	162,473	23,206	117,964
Franklin	21,855	2,087	13,502
Hillsborough	3,309	1,071	9,165
Manville	996	283	3,868
Millstone	35	19	180
Montgomery & Rocky Hill	7,385	595	3,290
South Bound Brook	426	69	1,502
Somerset County (part)	34,006	4,124	31,507
Cranbury	6,653	50	913
East Brunswick	17,315	8,004	13,555
Helmetta	154	11	439
Jamesburg	1,649	433	1,688
Milltown	2,415	242	2,412
Monroe	1,946	0	8,640
New Brunswick	32,395	2,857	12,682
North Brunswick	13,606	2,169	10,730
Plainsboro	5,847	1,152	6,833
South Brunswick	11,906	780	8,341
South River	1,814	423	4,823
Spotswood	1,720	454	2,904
Middlesex County (part)	97,420	16,575	73,960
MSM Region Total	**293,899**	**43,905**	**223,431**

- o A growth of 182,581 new jobs, of which 14,292 are expected to be retail jobs and 168,287 are expected to be non-retail jobs; and

- o A growth of 187,905 new residents, or 92,016 new households.

Once again, year 2010 estimates at the zonal level are based on projections of municipalities, knowledge of "pipeline" projects and judgment of likely growth areas. Table 4 shows the various estimates for the year 2010 aggregated at the municipality level.

C. Alternative Development Scenarios

The basis for alternatives to the expected trend development was the substitution of construct centers for typical suburban land use development. Chapter II introduced the three construct types: the Transit Construct, the Short Drive Construct, and the Walking Construct. All three are projected to be utilized in the MSM region under alternative scenarios. In fact, this study assumes in its alternative growth scenarios that **all** suburban growth will take the form of constructs.

A major undertaking was to assign the appropriate number of constructs to the region in particular geographic locations. The purpose of this effort should be carefully understood: Placing constructs in actual sites is done to indicate that such development could reasonably fit within the region. **However, the sites selected are not meant to be actual recommendations for construct development, but merely representative locations. The project team has not performed any of the necessary detailed planning, environmental or design analyses that would be required to recommend particular development sites.**

Two alternative scenarios of construct development were used in this analysis. Scenario 1 tests the effects of channeling some of the growth which would occur in suburban areas under trend conditions into the urban areas of New Brunswick and Trenton, on the hypothesis that placing more development in the urban areas with higher land use densities and more transit services would help reduce auto travel. It is also a policy goal of the emerging New Jersey State Development and Redevelopment Plan.

Scenario 2 assumes that the cities will grow only at their expected trend rates, with suburban constructs absorbing all the remaining growth. Both scenarios take as given the regional projections of employment and household growth. Therefore, the total growth projected for the year 2010 in the Trend, Scenario 1 and Scenario 2 are all the same. It is the disaggregate distribution of development that differs among the Trend and two scenarios. (**NOTE:** The analysis of the data published in this report does not include the cities. See Chapter V, Defining the Study Area).

1. Scenario 1: Constructs and Major Urban Growth

a. The Urban Growth Component

Preceding the assignment of constructs, it was necessary to make some assumptions about the major urban centers in the region, New Brunswick and Trenton. Their projected growth rates

Table 4
2010 Trend Conditions for MSM Region Communities

Municipality	Non-Retail Employment	Retail Employment	Households
East Windsor	12,097	1,403	13,562
Ewing	30,949	2,791	14,512
Hamilton	27,722	6,568	40,394
Hightstown	3,680	1,000	1,819
Hopewell Township & Borough	4,426	394	7,231
Lawrence	22,170	7,180	11,235
Pennington	3,510	40	1,113
Princeton Township & Borough	28,263	1,837	13,295
Trenton	65,644	4,256	39,619
Washington	3,340	600	4,159
West Windsor	23,392	2,128	9,327
Mercer County	225,193	28,197	156,266
Franklin	24,221	2,389	23,293
Hillsborough	9,311	1,339	14,249
Manville	3,347	283	4,133
Millstone	191	19	187
Montgomery & Rocky Hill	9,961	1,149	5,548
South Bound Brook	1,011	69	1,669
Somerset County (part)	48,042	5,248	49,079
Cranbury	7,360	316	2,165
East Brunswick	22,211	10,551	17,768
Helmetta	214	11	986
Jamesburg	2,270	433	2,215
Milltown	2,615	242	3,000
Monroe	9,913	2,391	14,215
New Brunswick	34,002	3,013	16,461
North Brunswick	30,665	3,667	15,223
Plainsboro	32,097	1,452	13,566
South Brunswick	42,262	1,801	15,645
South River	2,829	423	5,504
Spotswood	2,508	454	3,354
Middlesex County (part)	188,946	24,754	110,102
MSM Region Total	**462,181**	**58,199**	**315,447**

for the year 2010 are shown in Table 4, and are taken from the State Plan's prediction (not policy) of little growth in those areas. These became our 2010 Trend levels for the cities.

MSM's REGIONAL FORUM, discussed in Chapter II, developed a growth policy scenario which placed much higher employment and population in these two cities than did the trend estimates. These became our Scenario 1 levels for the cities.

The remaining regional growth was distributed among constructs.

b. The Construct Component

The assignment of constructs was performed by the project team, with input from the steering committee. As a first step, three Transit Constructs were found to be a reasonable number for the region. Two were located on the Northeast Corridor rail line (at Princeton Junction in West Windsor and the projected station for Monmouth Junction in South Brunswick), and one was positioned near Exit 8 of the New Jersey Turnpike, where there is convenient bus service to New York City.

Next, eight Short Drive Constructs were assigned, absorbing virtually all the remaining regional employment growth not picked up by the cities and the Transit Constructs. Short Drive Constructs were placed where employment centers are already emerging, and/or there is some major highway access.

Finally, the remaining population growth (and a small amount of employment growth) was distributed into eight Walking Constructs. Figure 13 shows a map of the locations of these constructs, while the municipalities in which they are located are listed in Table 5.

2. Scenario 2: Constructs with Trend Urban Growth

In Scenario 2, the year 2010 Trend growth assumptions for New Brunswick and Trenton were assumed to prevail, meaning that the Regional FORUM's goal for a major resurgence of the cities is not met. Instead, the same level of suburban growth as projected in the Trend is expected in this scenario, and all of the 1988-2010 growth increment (except for the small amount predicted for the cities) is absorbed by the constructs. Figure 14 shows how employment and population levels in Trenton and New Brunswick differ among the Baseline 1988, the 2010 Trend, and Scenarios 1 and 2.

It was assumed that the same number of constructs would be sited in the region in Scenario 2 as in Scenario 1, at the same locations. But in order to absorb the larger amount of suburban growth, a number of the constructs have been increased in size. It should be noted, however, that although the land area was increased, the land use density (i.e. average dwelling units per acre) was maintained.

Finally, Tables 6 and 7 show the differences in the total level of employment and households among the Baseline 1988, the year 2010 Trend, Scenario 1 and Scenario 2, aggregated at the municipal level. Detailed descriptions of these forecasts by traffic zone are included in Appendices D and E.

Figure 13

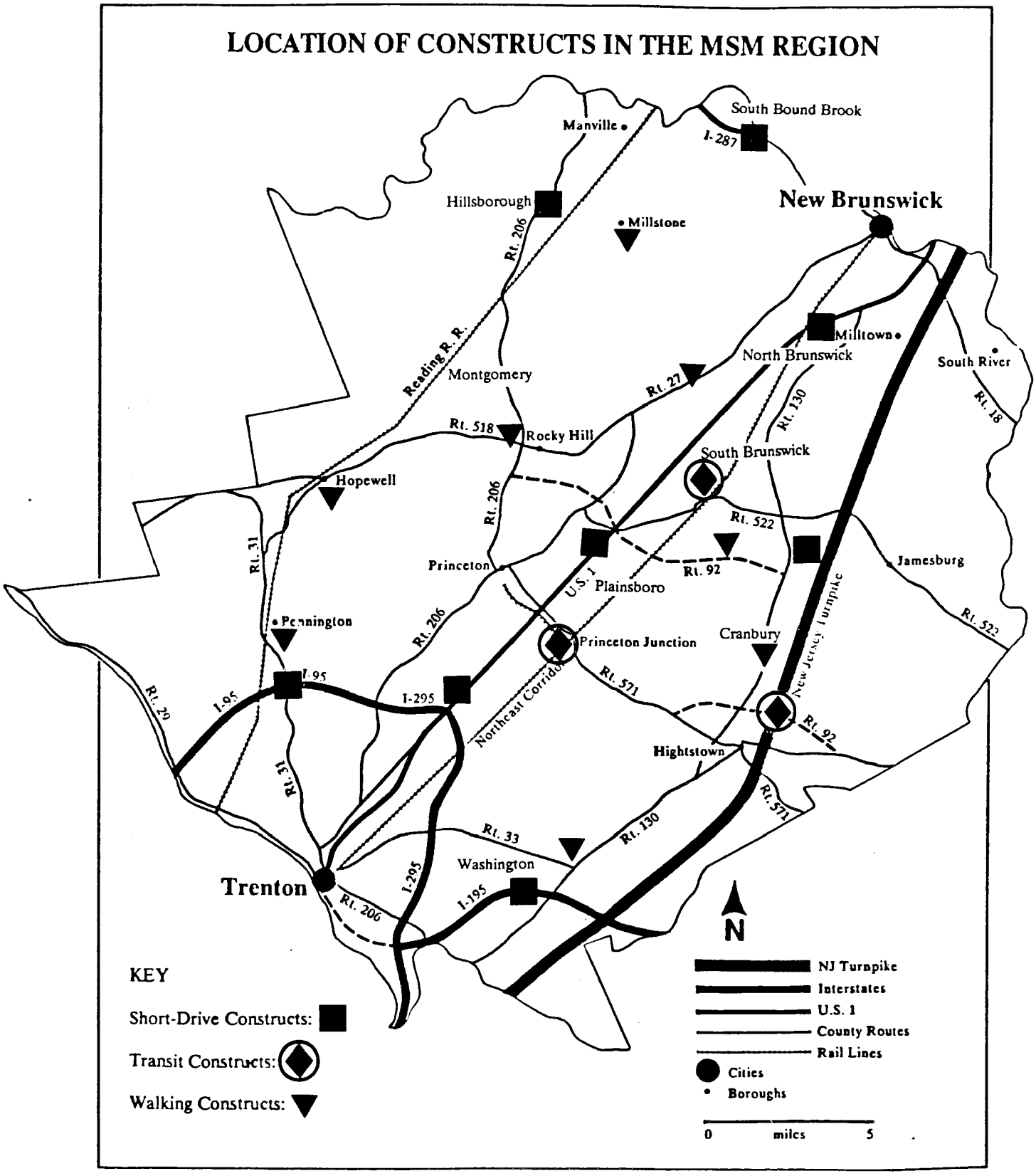

LOCATION OF CONSTRUCTS IN THE MSM REGION
South Bound Brook
Manville
I-287
Hillsborough
New Brunswick
Millstone
Rt. 206
Milltown
North Brunswick
South River
Reading R. R.
Montgomery
Rt. 27
Rt. 130
Rt. 18
Rt. 518
Rocky Hill
South Brunswick
Hopewell
Rt. 206
Rt. 522
Rt. 31
Princeton
U.S. 1
Rt. 92
Jamesburg
Plainsboro
Pennington
Rt. 206
Princeton Junction
Cranbury
New Jersey Turnpike
Rt. 522
I-95
I-295
Northeast Corridor
Rt. 571
Rt. 29
I-95
Rt. 92
Hightstown
Rt. 31
Rt. 571
Rt. 33
Rt. 130
Washington
Trenton
I-295
I-195
Rt. 206
N
KEY
Short-Drive Constructs:
Transit Constructs:
Walking Constructs:
NJ Turnpike
Interstates
U.S. 1
County Routes
Rail Lines
Cities
Boroughs
0
miles
5

Table 5

Location of Constructs in Both Scenarios 1 and 2

	Number of Constructs in Each Municipality of this Type:		
Municipality	**Transit Construct**	**Short-Drive Construct**	**Walking Construct**
East Windsor	1 (bus)	-	-
Hopewell Township	-	1	2
Lawrence	-	1	-
Washington	-	1	1
West Windsor	1 (rail)	-	-
Franklin	-	1	1
Hillsborough	-	1	-
Montgomery	-	-	2
Cranbury	-	-	1
North Brunswick	-	1	-
Plainsboro	-	1	-
South Brunswick	1 (rail)	1	1

NOTE: The sites selected are not meant to be actual recommendations for construct development, merely representative locations. The project team has not performed any of the necessary detailed planning, environmental or design analyses that would be required to recommend particular development sites.

Figure 14

Employment and Household Projections for Trenton and New Brunswick for the Year 2010 Under Scenarios 1 and 2

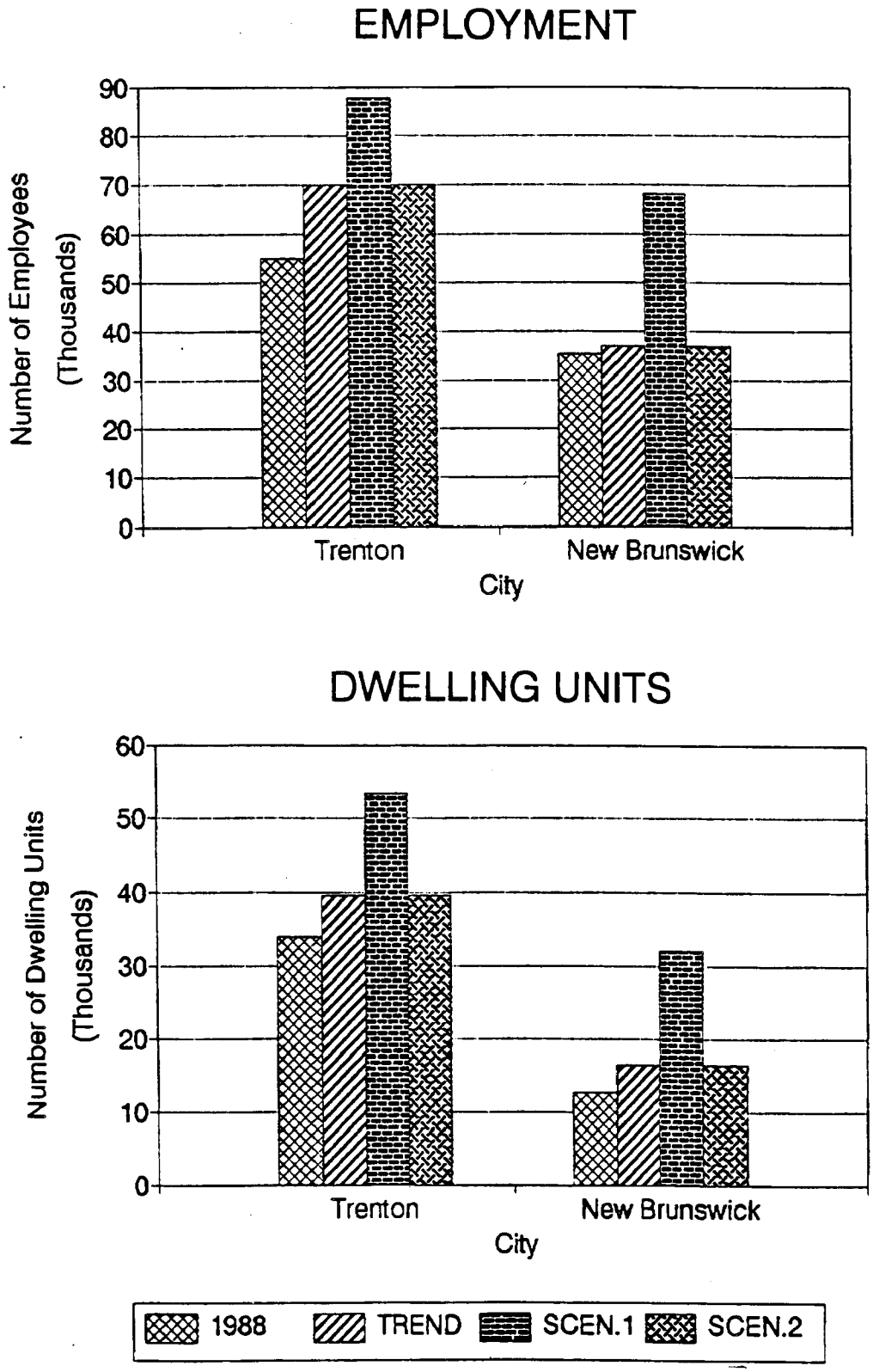


Table 6
Current and Projected Employment Under Different Scenarios

Municipality	Construct Types	Total Employment: 1988	2010 Trend	2010 Scen. 1	2010 Scen. 2
East Windsor	T	8,463	13,500	21,563	27,031
Ewing		28,660	33,740	28,660	28,660
Hamilton		27,925	34,290	27,925	27,925
Hightstown		2,855	4,680	2,855	2,855
Hopewell Twnshp/Boro	D,2W	3,467	4,820	13,427	17,656
Lawrence	D	21,301	29,350	30,301	34,006
Pennington		1,636	3,550	1,636	1,636
Princeton Twnshp/Boro		22,262	30,100	22,262	22,262
Trenton		54,847	69,900	87,817	69,900
Washington	D,W	2,101	3,940	11,830	15,959
West Windsor	T	12,162	25,520	25,262	30,731
Mercer County		**185,679**	**253,390**	**273,538**	**278,621**
Franklin	D,W	23,942	26,610	33,672	37,801
Hillsborough	D	4,380	10,650	13,880	17,899
Manville		1,279	3,630	1,279	1,279
Millstone		54	210	54	54
Montgomery/Rocky Hill	2W	7,980	11,110	8,440	8,660
South Bound Brook		495	1,080	495	495
Somerset County (part)		**38,130**	**53,290**	**57,820**	**66,188**
Cranbury	W	6,703	7,676	6,933	7,043
East Brunswick		25,319	32,762	25,319	25,319
Helmetta		165	225	165	165
Jamesburg		2,082	2,703	2,082	2,082
Milltown	W	2,657	2,857	2,657	2,657
Monroe		1,946	12,304	1,942	1,942
New Brunswick		35,252	37,015	68,223	37,015
North Brunswick	D	15,775	34,332	25,275	26,311
Plainsboro	D	6,999	33,549	16,499	20,518
South Brunswick	T	12,686	44,063	35,516	45,115
South River		2,237	3,252	2,237	2,237
Spotswood		2,174	2,962	2,174	2,174
Middlesex County (part)		**113,995**	**213,700**	**189,022**	**175,561**
MSM Region Total		**337,804**	**520,380**	**520,380**	**520,380**

T = transit construct, W = walking construct, D = short-drive construct

Table 7

Current and Projected Households Under Different Scenarios

Municipality	Construct Types	Total Households: 1988	2010 Trend	2010 Scen. 1	2010 Scen. 2
East Windsor	T	8,666	13,562	14,666	17,994
Ewing		12,541	14,512	12,541	12,541
Hamilton		31,336	40,394	31,336	31,336
Hightstown		1,818	1,819	1,818	1,818
Hopewell Twnshp/Boro	D,2W	4,673	7,231	10,673	13,976
Lawrence	D	8,616	11,235	11,416	12,958
Pennington		872	1,113	872	872
Princeton Twnshp/Boro		8,804	13,295	8,804	8,804
Trenton		33,952	39,619	53,359	39,619
Washington	D,W	2,250	4,159	6,650	9,073
West Windsor	T	4,436	9,327	10,436	13,764
Mercer County		**117,964**	**156,266**	**162,571**	**162,755**
Franklin	D,W	13,502	23,293	17,902	20,325
Hillsborough	D	9,165	14,249	11,965	13,507
Manville		3,868	4,133	3,868	3,868
Millstone		180	187	180	180
Montgomery/Rocky Hill	2W	3,290	5,548	6,490	8,253
South Bound Brook		1,502	1,669	1,502	1,502
Somerset County (part)		**31,507**	**49,079**	**41,907**	**47,635**
Cranbury	W	913	2,165	2,513	3,394
East Brunswick		13,555	17,768	13,555	13,555
Helmetta		439	986	439	439
Jamesburg		1,688	2,215	1,688	1,688
Milltown	W	2,412	3,000	2,412	2,412
Monroe		8,640	14,215	8,640	8,640
New Brunswick		12,682	16,461	32,090	16,462
North Brunswick	D	10,730	15,223	13,530	15,072
Plainsboro	D	6,833	13,566	9,633	11,175
South Brunswick	T	8,341	15,645	18,741	24,493
South River		4,823	5,504	4,823	4,823
Spotswood		2,904	3,354	2,904	2,904
Middlesex County (part)		**73,960**	**110,102**	**110,968**	**105,057**
MSM Region Total		**223,431**	**315,447**	**315,447**	**315,447**

T = transit construct, W = walking construct, D = short-drive construct

CHAPTER V:
ANALYZING THE TRANSPORTATION IMPACTS OF CONSTRUCT SCENARIOS

A. Defining the Study Area

In analyzing the results of the constructs, a somewhat smaller study area was selected from the MSM region. For technical reasons, the cities of New Brunswick and Trenton are excluded. The reasons for examining this smaller, non-urban study area are twofold:

- First, the study was funded to analyze suburban land use trends and alternatives. Although a key assumption is made in Scenario 1 regarding the growth of the cities, it was not within the scope of this analysis to assess the specific impacts of that growth.

- Second, the vehicle trip generation rates used in the analysis represent the suburban qualities of the region, not its two urban centers. As a result, the transportation model within the TransCAD package over-predicts auto trips in both New Brunswick and Trenton by a considerable amount (since auto trip rates are significantly higher in suburban vs. urban areas). The results showed worse auto congestion in the cities, neither the intent nor a realistic outcome of the planning goals for the cities.

In order to adequately include New Brunswick and Trenton in future analyses, either of two future methodological steps should be taken:

1) Fine tune the network to allow for a greater number of zones within the two urban areas; and

2) Develop specific urban area vehicle trip generation formulas, or urban area vehicle trip reduction factors, similar to those developed for the constructs.

Neither of these steps was within the purview of this study.

The study area, excluding the cities of New Brunswick and Trenton, is referred to as the MSM Construct Study Area.

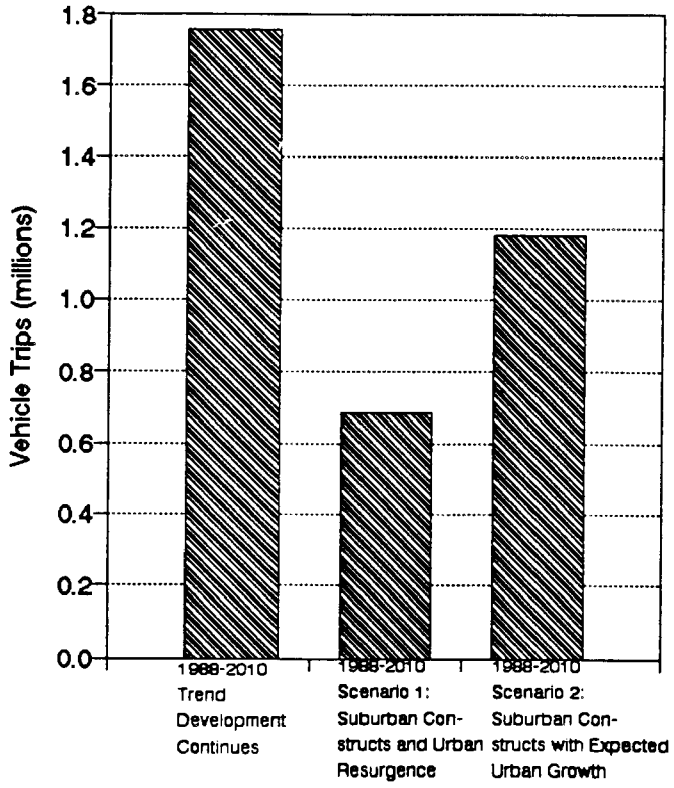
B. Regional Impacts of the Scenarios

1. Total Vehicle Trips on the Regional Network

Figure 15 shows the effect of constructs on the growth of vehicle trips in the MSM Construct Study Area. The Trend represents a growth of 1.74 million daily vehicle trips from the 1988 baseline, or an increase of 43 percent. In Scenario 1, the growth is just under 687,000 daily

Figure 15

Growth in Daily Trip Ends: 1988 - 2010 MSM Construct Study Area: Trend Versus Alternative Development Scenarios



trips, growth of 17 percent from the 1988 baseline. In Scenario 2, the growth is 1.18 million daily trips, an increase of 29 percent from the 1988 baseline.

Table 8 shows the total number of vehicular trips (existing, plus growth related) on the network in 1988, Year 2010 Trend, Scenario 1 and Scenario 2, disaggregated by jurisdiction. For this table (and in subsequent Tables 9-11), some of the smaller municipalities have been grouped together with larger ones to create a set of 17 jurisdictions (MCD's) as mapped in Appendix F. This was done because the limited size of smaller jurisdictions did not allow for substantial network building within them, producing skewed estimates of vehicle miles traveled, speeds and travel time. (However, the full breakout of vehicle trips for all municipalities and zones can be found in Appendix E.) The combined jurisdictions are as follows:

- Hopewell includes Pennington
- East Windsor includes Hightstown
- East Brunswick includes Milltown, South River and Spotswood
- Monroe includes Helmetta and Jamesburg
- Hillsborough includes Manville and Millstone
- Franklin includes South Bound Brook

In addition, as previously discussed, the cities of New Brunswick and Trenton are not shown in the tables or reflected in the accompanying figures.

Table 8 indicates that **Scenario 1 produces an 18 percent reduction in total Year 2010 vehicle trips on the regional network, while Scenario 2 produces nearly a 10 percent reduction in total vehicle trips.** The higher impact of Scenario 1 is due to the **combined** effects of channeling more growth into the two urban areas (where higher overall densities and better transit service lead to lower vehicle trip generation), and channeling the remaining suburban growth into constructs. Scenario 2, on the other hand, keeps all trend growth (except a nominal level in the cities) in the suburban areas.

2. Total Vehicle Miles on the Regional Network

Figure 16 shows the effect of constructs on the growth of vehicle miles traveled (VMT) during the AM peak hour on the regional highway network in the MSM Construct Study Area. The trend represents a growth of 299,000 VMT from the 1988 baseline, or a growth of 38 percent. (Baseline VMT in the AM Peak is just over 918,000.) In Scenario 1, the growth is just under 168,000 VMT, or an increase of 21 percent from the 1988 baseline. In Scenario 2, the growth is 202,000 VMT, an increase of 26 percent.

Table 9 shows total AM Peak hour VMT on the network in 1988, Year 2010 Trend, Scenario 1 and Scenario 2, disaggregated by jurisdiction. **Scenario 1 causes a 12 percent reduction in the level of year 2010 VMT on the regional network, while Scenario 2 produces nearly a 9 percent reduction.**

Table 8

Vehicle Trips in the MSM Construct Study Area

Jurisdiction	Daily Vehicle Trip Ends (Total In and Out): 1988 Base	2010 Trend	2010 Scen. 1	2010 Scen. 2	Percentage Difference From 2010 Trend for: Scen. 1	Scen. 2
Washington	46,697	74,273	127,177	169,591	71.2%	128.3%
Ewing	339,907	378,957	328,756	328,756	-13.2%	-13.2%
Lawrence	372,560	434,553	375,431	400,411	-13.6%	-7.9%
Hopewell	87,780	132,168	183,871	235,956	39.1%	78.5%
Princeton	257,165	335,439	249,691	249,691	-25.6%	-25.6%
West Windsor	130,647	263,981	216,928	271,722	-17.8%	2.9%
Hamilton	608,927	721,057	578,606	578,606	-19.8%	-19.8%
East Windsor	206,673	296,117	303,654	358,426	2.5%	21.0%
Cranbury	41,837	65,079	57,003	66,956	-12.4%	2.9%
Plainsboro	135,014	326,649	183,302	215,762	-43.9%	-33.9%
South Brunswick	167,383	404,977	348,622	445,840	-13.9%	10.1%
North Brunswick	243,498	410,384	278,127	310,587	-32.2%	-24.3%
East Brunswick	640,491	776,287	610,623	610,623	-21.3%	-21.3%
Monroe	145,211	313,060	136,739	136,739	-56.3%	-56.3%
Montgomery	87,275	135,090	120,435	140,350	-10.8%	3.9%
Hillsborough	199,948	288,157	246,814	279,274	-14.3%	-3.1%
Franklin	331,006	439,748	383,140	425,554	-12.9%	-3.2%
MSM Construct Study Area	**4,042,019**	**5,795,976**	**4,728,919**	**5,224,844**	**-18.4%**	**-9.9%**

Figure 16

Growth in AM Peak Hour Vehicle Miles of Travel 1988 to 2010
MSM Construct Study Area: Trend Versus Alternative Development Scenarios

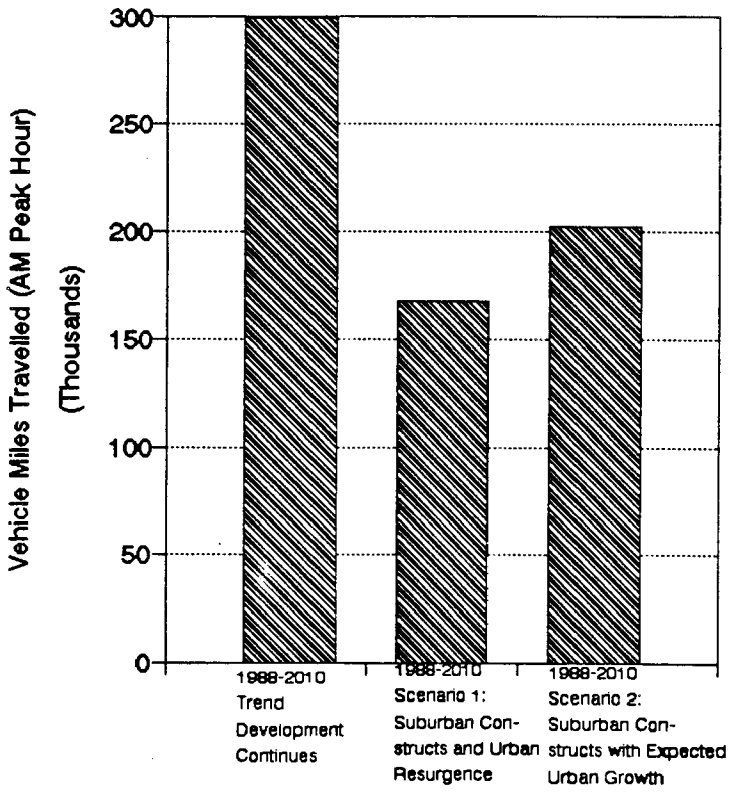


Table 9

AM Peak Hour Vehicle Miles Traveled (VMT)
in the MSM Construct Study Area

Jurisdiction	Peak Hour VMT: 1988 Base	2010 Trend	2010 Scen. 1	2010 Scen. 2	Percentage Difference From 2010 Trend for: Scen. 1	Scen. 2
Washington	91,926	109,419	106,211	102,221	-2.9%	-6.6%
Ewing	51,551	55,055	57,756	50,929	4.9%	-7.5%
Lawrence	74,568	96,545	102,519	99,980	6.2%	3.6%
Hopewell	25,494	32,276	33,776	37,927	4.6%	17.5%
Princeton	39,966	56,184	42,922	43,845	-23.5%	-22.0%
West Windsor	45,731	72,124	59,708	65,460	-17.2%	-9.2%
Hamilton	34,764	45,624	47,844	51,608	4.9%	13.1%
East Windsor	25,986	36,666	35,761	41,203	-2.5%	12.4%
Cranbury	40,201	53,285	45,217	48,301	-15.1%	-9.4%
Plainsboro	19,634	37,605	21,786	24,772	-42.1%	-34.1%
South Brunswick	71,936	134,703	104,437	118,289	-22.5%	-12.2%
North Brunswick	35,178	54,081	50,225	48,668	-7.1%	-10.0%
East Brunswick	77,835	88,530	77,480	76,117	-12.5%	-14.0%
Monroe	31,246	50,256	32,738	33,026	-34.9%	-34.3%
Montgomery	27,441	39,015	30,887	34,152	-20.8%	-12.5%
Hillsborough	32,948	46,970	37,555	40,980	-20.0%	-12.8%
Franklin	56,065	72,939	63,207	67,221	-13.3%	-7.8%
MSM Construct Study Area	**782,019**	**1,081,277**	**950,099**	**984,699**	**-12.1%**	**-8.9%**

3. Travel Speeds

As a result of Trend growth between the years 1988 and 2010, speeds on a number of the region's highway links deteriorate. As Table 10 shows, average regionwide AM Peak speeds on the network (which represents only a subset of the region's key highway links), would fall by 4 miles per hour, or a 16 percent decline. Under Scenario 1, there would be virtually no change in speed from 1988 levels. Under Scenario 2, average speed would decline by less than 2 miles per hour, or a 7 percent decline. In both cases, therefore, construct development has a key beneficial effect upon travel speeds, relative to trend development patterns.

Table 10

AM Peak Hour Average Vehicle Speeds in the MSM Construct Study Area

	AM Peak Hour Average Vehicle Speeds (miles per hour):				Percentage Difference From 2010 Trend for:	
Jurisdiction	1988 Base	2010 Trend	2010 Scen. 1	2010 Scen. 2	Scen. 1	Scen. 2
Washington	29.4	30.6	32.9	31.8	7.7%	4.2%
Ewing	12.2	11.0	13.1	15.1	19.3%	37.4%
Lawrence	35.6	31.2	33.1	35.6	6.0%	13.9%
Hopewell	34.0	32.6	31.5	29.9	-3.2%	-8.3%
Princeton	14.5	14.2	14.9	13.8	4.7%	-3.1%
West Windsor	32.2	17.9	30.3	27.6	69.0%	53.8%
Hamilton	47.4	44.7	45.5	44.7	1.7%	-0.2%
East Windsor	29.4	28.7	27.2	25.1	-5.1%	-12.3%
Cranbury	44.3	42.0	44.8	44.7	6.6%	6.3%
Plainsboro	29.2	19.1	27.6	23.5	44.4%	22.7%
South Brunswick	33.4	21.2	28.9	22.1	36.2%	4.2%
North Brunswick	28.6	23.8	27.8	24.8	16.8%	4.0%
East Brunswick	21.6	19.8	21.5	21.5	9.0%	8.9%
Monroe	24.5	22.5	24.7	25.0	9.8%	11.2%
Montgomery	32.3	26.4	31.3	30.5	18.5%	15.5%
Hillsborough	15.8	8.8	15.3	8.8	75.2%	0.8%
Franklin	18.8	17.5	18.5	16.9	5.7%	-3.1%
MSM Construct Study Area	**24.6**	**20.6**	**25.0**	**22.9**	**21.4%**	**11.1%**

4. Travel Time

Figure 17 shows the effect of constructs on vehicle travel time in the AM peak hour. This represents an increase in the total number of minutes required to traverse the highway network as a result of additional tripmaking in the year 2010. The total new minutes of delay experienced in the trend would mean a growth of more than 65 percent. In Scenario 1, the growth in minutes of delay is only 20 percent from the 1988 base year. In Scenario 2, the growth in minutes of delay is 36 percent.

Table 11 shows total vehicle travel time during the AM peak hour on the network in 1988, Year 2010 Trend, Scenario 1 and Scenario 2, disaggregated by jurisdiction. It indicates that Scenario 1 produces a 28 percent reduction in the level of year 2010 travel time on the regional network, while Scenario 2 produces an 18 percent reduction.

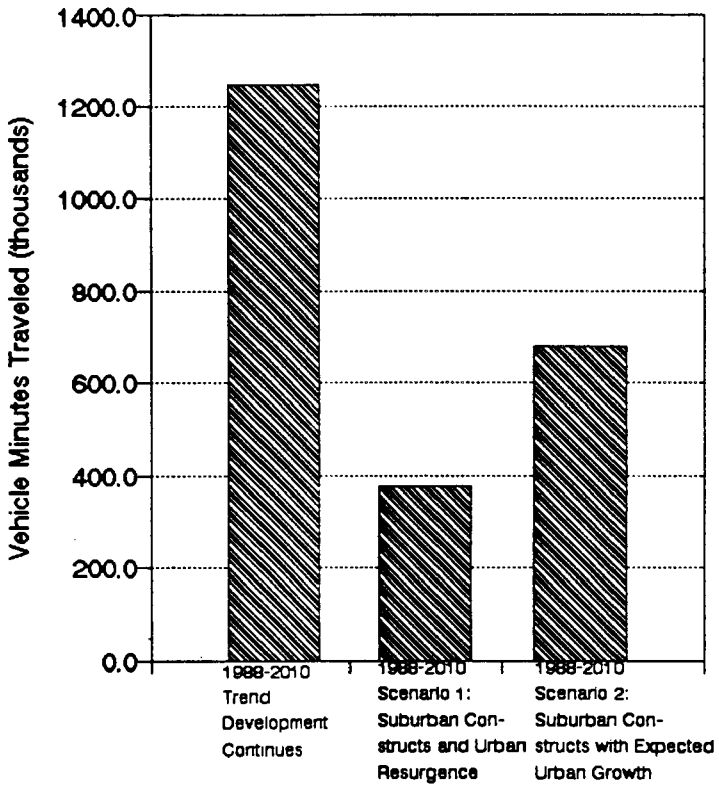
Table 11

AM Peak Hour Vehicle Travel Minutes in the MSM Construct Study Area

	AM Peak Hour Vehicle Travel Minutes:				Percentage Difference From 2010 Trend for:	
Jurisdiction	1988 Base	2010 Trend	2010 Scen. 1	2010 Scen. 2	Scen. 1	Scen. 2
Washington	187,404	214,849	193,563	192,672	-9.9%	-10.3%
Ewing	253,058	301,650	265,206	203,020	-12.1%	-32.7%
Lawrence	125,680	185,458	185,864	168,561	0.2%	-9.1%
Hopewell	44,966	59,492	64,337	76,233	8.1%	28.1%
Princeton	165,878	236,602	172,901	190,643	-26.9%	-19.4%
West Windsor	85,344	241,125	118,129	142,297	-51.0%	-41.0%
Hamilton	43,983	61,178	63,073	69,337	3.1%	13.3%
East Windsor	53,100	76,750	78,907	98,322	2.8%	28.1%
Cranbury	54,467	76,032	60,521	64,811	-20.4%	-14.8%
Plainsboro	40,351	118,028	47,364	63,374	-59.9%	-46.3%
South Brunswick	129,393	381,204	216,929	321,286	-43.1%	-15.7%
North Brunswick	73,928	136,191	108,273	117,800	-20.5%	13.5%
East Brunswick	216,182	268,745	215,810	212,109	-19.7%	-21.1%
Monroe	76,501	133,951	79,485	79,150	-40.7%	40.9%
Montgomery	50,962	88,626	59,201	67,154	-33.2%	-24.2%
Hillsborough	125,204	321,775	146,884	278,466	-54.4%	-13.5%
Franklin	179,020	250,563	205,342	238,193	-18.0%	-4.9%
MSM Construct Study Area	**1,905,421**	**3,152,219**	**2,281,789**	**2,583,448**	**-27.6%**	**-18.0%**

Figure 17

Growth in Travel Time (Vehicle Minutes of Travel) 1988 to 2010
MSM Construct Study Area: Trend Versus Alternative Development Scenarios



CHAPTER VI:
CONCLUSIONS AND NEXT STEPS

A. Conclusions

The questions that were asked as the impetus of the study, as outlined in Chapter I, have now been addressed. We have examined the suburban character of higher density, mixed-use centers and measured the potential results that can be achieved by changing our current practice of creating low-density, single-use development.

The extent to which these results can be achieved in the MSM region will depend on our ability to implement construct-like development. Although the total implementation of these constructs is ambitious, several current initiatives are pushing practice in the construct direction: the concept of "communities of place" in the emerging New Jersey State Development and Redevelopment Plan; the federal Clean Air Act mandating significant reductions in vehicle miles traveled (VMT), as well as in emissions in New Jersey; and the struggle in which many towns are engaged to reduce the impact of recent growth on their character and infrastructure.

Four main conclusions can be drawn from this study, and these are discussed below.

1. Mixed-Use Centers Can Produce Significant Regional Transportation Benefits

The results of the previous chapter are clear: Constructs can have significant effects on **slowing the growth of trips, VMT, and the deterioration of highway speeds normally associated with growing suburban areas.** In the year 2010, construct scenarios have the following effect, relative to the trend:

- o 10-18 percent reduction in total projected regional automobile trips -- and a 30-60 percent reduction in the incremental impacts of forecasted growth;
- o 9-12 percent reduction in total projected regional vehicle miles traveled (VMT) -- and a 33-45 percent reduction in the incremental impacts of growth;
- o little, if any, change in regional speeds; and
- o 18-28 percent reduction in added travel time.

All of these regional network impacts have far-reaching consequences in many areas:

- o The continued deterioration of air quality is retarded;
- o Energy utilization growth rates are lessened;

- o Increasing traffic delays for passenger and commercial vehicles are reduced;
- o The rapid pace of degradation of highway surface and capacity conditions is curtailed, with consequent cost savings implications for funding agencies;
- o Less land is required for new roads and parking areas to accommodate the automobile; and
- o The overall amenities of suburban life can be better preserved for all the region's inhabitants, while still accommodating the demand for further growth.

NOTE: The scenarios outlined in this study place the entire 1988 to 2010 growth increment either into a city or a higher density, mixed-use, carefully planned construct. **No** sprawling, dispersed suburban development was projected. Achieving this level of success in planning and implementing new development patterns by the year 2010 is unlikely because of the number of new developments that already have planning permits for traditional, low density, single-use patterns. Success in the future will be achieved by working with uncommitted lands and by redesigning existing development over a much longer time frame. The extent to which we can achieve these goals will depend on the extent to which we can change current land use practices.

2. Mixed-Use Centers Are A Viable Concept For Suburban Centers

As conceived in this study, constructs of higher-density, suburban mixed-use centers assume continued reliance on automobiles for most forms of travel. At the same time, their design is based upon familiarity with and general acceptance of transit and ridesharing alternatives. Further, they incorporate the types of pedestrian amenities and interaction that are often lacking in suburban settings. Finally, the construct design assumes that, given the opportunity to work and shop near home, and encouraged to take advantage of this opportunity by demand management policies, a number of suburban dwellers will opt to do so.

With this understanding as background, it is possible to define constructs that are clearly suburban in nature, but which draw on the efficiencies of density and variety to make them active and successful places to live and work. Constructs can take advantage of nearby rail stations or regional highway links as a way of supporting their higher densities (i.e., 10-15 dwelling units per acre; commercial floor area ratios of 1.1 to 2.0), while reducing (but by no means eliminating) the typical suburban dependence upon the automobile. Walking constructs can offer residential amenities that help support other nearby constructs which have higher densities and significantly more employment opportunities.

Constructs of limited size (i.e., from 350 to 900 acres) can be sited in a suburban area and expected to absorb development pressures for employment and residential growth without converting the suburban setting into an urban one. They can incorporate some of the better features of current suburban single-use centers and make them work to better advantage for residents and employees.

3. Mixed-Use Centers, Through Design and Function, Can Have Tangible Local Transportation Benefits

The nature of higher density, mixed-use centers around the nation has made them more efficient places to travel from, to and within. Constructs encourage more internal tripmaking -- where the trip never reaches the regional highway network -- because of greater employment opportunities for residents and more retail/services to attract residents and employees. Furthermore, a number of these internalized trips are not made by automobile, since 1) pedestrian-oriented site planning and design, as well as density itself, encourages pedestrian tripmaking, and 2) densities allow greater reliance on internal transit shuttle systems.

External vehicular tripmaking is reduced as well, due to the availability of transit services and the encouragement of transit modes through the Travel Demand Management (TDM) policies and programs of employers and government. In addition, densities enhance ridesharing opportunities, while active TDM policies bring ridesharing into reality.

All these factors have the effect of reducing vehicular tripmaking during all periods of the day and in each type of construct, relative to typical suburban development patterns. During the peak commuting hour, the Transit Construct produces a 28 percent reduction in vehicles accessing the regional highway network for some trip types. In the Short Drive Construct, reductions on the order of 24 percent are likely, while even in Walking Constructs, reductions of up to 18 percent are likely. Off peak reductions are typically less, but can have an impact.

4. Promoting Strong Urban Growth Along With Suburban Mixed-Use Centers Gives the Best Regional Results

The type of strong urban resurgence that the Regional Forum set as a goal for New Brunswick and Trenton has beneficial effects on the region as a whole, particularly when combined with suburban constructs. As shown in Chapter V, major urban growth in employment and households, combined with the suburban constructs, **reduces the growth in total trips by nearly 20 percent.** Without that type of urban growth -- meaning that it must be absorbed into the suburban constructs -- the overall growth in regional trips is reduced by only 10 percent. Similar differences occur for the other impact criteria. This points out, as the Regional Forum previously indicated, that strong **urban** development policies must be in effect and that they can support suburban development.

B. Next Steps

Three areas are indicated for further analysis as a result of this study: making technical improvements to the first study, addressing more questions relevant to the relationship of land use and transportation; and developing a methodology to encourage land use change by those entities which control the development process.

1. Technical Improvements to the MSM Model and Regional Network

Technical issues that remain at the conclusion of this study include: 1) redoing an overall regional analysis to **include** the cities of New Brunswick and Trenton, and 2) further expanding of the TransCAD/construct modeling effort for use as a more refined planning tool by MSM and its constituents. These are briefly described below:

a. Improving the Modeling of the Cities

As discussed in Chapter V, regionwide trip generation formulas do not reflect urban tripmaking conditions well. In order to understand better the full regional -- urban and suburban -- and subregional consequences of constructs and strong urban growth, new formulas should be developed or urban area vehicle trip reduction factors devised. In addition, more detailed networks and traffic zones for the urban areas need to be built (e.g., Trenton is represented by only one zone in this model) to better distribute tripmaking within and around the periphery of the cities.

This type of modeling will also help urban areas to implement traffic and public transportation improvements which are responsive to the changing commuting patterns of the 1990's.

b. Expanded/Refined Use of the Study Methods

The construct vehicle trip reduction methodology, in combination with the TransCAD regional modeling package, is used here primarily as a tool for analyzing major, areawide development and transportation impacts. However, it can be readily refined to forecast discrete network impacts of site specific development types at the municipal and sub-municipal levels.

In particular, use of the spreadsheets offers analysis of vehicle trip reductions for peak hours and off-peak periods not analyzed by the regional model in this study. With this tool, MSM can assist the municipalities and counties in assessing land use decisions in conjunction with the status of the transportation network.

In order to accomplish this, a more detailed network for the MSM region should be built, including a peak hour version, as well as more refined traffic zones created to account for particular projects.

2. Quantifying the Public and Private Costs and Benefits of the Study Findings

The finding that the vehicle trip generation of projected new development in the region can be reduced by as much as 60 percent through changes in land use and development patterns is dramatic. Even the lesser reductions potentially achieved by these changed development policies are worth further consideration. The benefits of these reduced vehicle trips to the public and private sectors deserve further quantification. For example, if year 2010 travel demand was reduced by 20 percent from forecast levels, what savings in highway maintenance costs would result? What new highway links could be postponed or not constructed? What energy savings would result? And, what are the longer-term environmental savings in terms of such measures as improved air quality or preserved open land?

These questions are probably of most interest to public sector decision makers. However, the development community would be interested to know whether these "construct-style" projects could be built at less or at least the same cost as the current type of projects. Will they be marketable? Are there savings afforded by reduced parking requirements? Lower lot sizes? Lower roadway costs? Less impact fees? Specific case studies of construct patterns should be conducted to explore these questions, as MSM develops design guidelines and an implementation framework for the new options.

3. Seeking Public Support for Changing Regional Development Patterns

In this study, MSM Regional Council and the consultant team have worked together to see whether higher density, mixed-use suburban development can achieve traffic impact reduction on a regional level. The conclusion is that indeed it can. As MSM moves forward, this evidence needs to be supported by data from other subject areas, including that outlined in Section 2 above, and presented to local officials, employers, developers, and residents.

MSM recognizes the institutional strength that is invested in current land use patterns. Besides changing the zoning ordinances and master plans specifying the preference for low density, single-use development, banks, developers, residents associations, and many planning professionals will need to be convinced that a new pattern of development will be worth the risk of making a change.

MSM is a unique private, non-profit planning organization, carrying out both research and advocacy activities in central New Jersey. As a non-governmental agency, MSM has no authority to implement its recommendations, but its twenty-three-year history in the region has given MSM considerable credibility among its constituents. MSM staff will widely disseminate the results of this study and will use their influence through private and public meetings and seminars to ensure that serious consideration is given to the recommendations.

Further, the concepts outlined here will be strengthened by the goals and objectives of the New Jersey State Development and Redevelopment Plan and the federal Clean Air Act, as communities seek to bring their local plans into conformity with state policies. These state initiatives will provide the needed incentive for county and local governments to change their land use decision-making process.

The Urban Mass Transportation Administration and the New Jersey Department of Transportation have agreed to sponsor some of the additional work outlined above. The results of this work will determine whether the benefits of land use change can be translated from the pages of this research report into the protection and enhancement of the quality of life in the region.

REFERENCES

1. Cervero, Dr. Robert. America's Suburban Centers: A Study of the Land Use- Transportation Link, prepared for the Office of Policy and Budget, Urban Mass Transportation Administration, Report NO. DOT-T-88-14, Washington, D.C. (January, 1988).

2. Hooper, Kevin G. Travel Characteristics at Large-Scale Suburban Activity Centers, National Cooperative Highway Research Program, Report 323 (October, 1989).

3. Institute of Transportation Engineers. A Toolbox for Alleviating Traffic Congestion (1989).

4. Institute of Transportation Engineers. Trip Generation, 4th Edition (1987).

5. Kuzmyak, J. Richard, Schreffler, Eric N., and Katz, Harold, et al. Evaluation of Travel Demand Management (TDM) Measures to Relieve Congestion, Report No. FHWA-SA-90-005, prepared for Federal Highway Administration, Washington, D.C. (February, 1990).

6. Middlesex Somerset Mercer Regional Council. Suburban Mobility and Growth Management: Initiatives in Central New Jersey (April, 1989).

7. Middlesex Somerset Mercer Regional Council. An Action Agenda for Managing Regional Growth (June, 1987).

8. New Jersey State Planning Commission. Communities of Place: A Legacy for the Next Generation, the Preliminary State Development and Redevelopment Plan for the State of New Jersey, two volumes (November, 1988).

9. Stover, Vergil G., and Koepke, Frank J. Transportation and Land Development, In stitute of Transportation Engineers, Englewood Cliffs, New Jersey (1988).

Appendix A

Calculation of Vehicle Trip Reduction Factors for Walking, Transit, and Short Drive Constructs

MEMORANDUM

TO: MSM Regional Council
FROM: Land Use/Transportation Study Consultant Team
DATE: October 26, 1990
SUBJECT: **Construct Trip Reduction Factors**

This memo is intended to serve as a working record of trip reduction expected from Land Use Constructs, for review and final comment from appropriate parties. The trip reduction factors have been prepared both from the perspective of land use and for direct use in the TransCAD network model.

Based on our prior memorandum of September 25, and our study team meeting of October 11, we have finalized our estimate of the vehicular trip reductions which can be attributed to the various land use mix and density characteristics of our three constructs. As you know, we have worked hard to tie the estimated reductions to documented case study data. This memo presents the estimated reductions for each construct on a land use basis, the methodology utilized for translating these to the categories required for the regional network model, along with the results of each analysis stage.

Attached are tables summarizing case study trip reduction data which are considered applicable to our constructs as base values, plus additional trip reduction increments which can be expected for the various land use types under each of the three constructs. These factors have been devised for use with vehicle trip rates based on land use, similar to standard ITE trip generation rates. As we discussed, they can also be applied to person trip rates, provided that the same vehicle occupancy rates are used in the basic trip generation for the trend and construct scenarios.

Reduction Factor Determination Method

The methodology for determining the trip reduction factors is summarized below. All land use based factors were estimated for the AM peak hour, PM peak hour, offpeak period and the average daily traffic (ADT) conditions, while the values for the network were focused on only the AM peak hour.

1) Define land use and transit characteristics of constructs.

2) Determine conditions which lead to reduction of network vehicle trips through the means of a) changing external trips to internal trips (either vehicle, transit, or walk) and b) shifting mode of external trips (from SOV's to either transit or rideshare modes).

3) Use data from actual case studies at existing Suburban Activity Centers to help determine the level of trip reductions that would be experienced in our constructs under the conditions established in 2).

4) Compare constructs to case study data conditions to see if case study reductions apply, or if additional trip reductions can be expected beyond the case study values due to more favorable construct conditions.

5) Sum trip reductions for each construct. The initial reduction estimates were expressed as individual percentages for each relevant condition, and presented as simple sums for "gross" reductions. For "net" reduction factors, the values for the individual component conditions were combined as the product of sub-factors for each percentage. This was done to avoid double counting, as the effects of one condition remove a portion of total trips that can be affected by other conditions. For example, transit users produced by construct conditions are not available for carpools and vice versa. Numerically, if individual trip reductions of 15% and 10% might be estimated for transit mode shift and carpooling, repectively, the gross reduction would be 25% (15+10), but the net reduction factor would be 0.765 (0.85 x 0.90), implying a lesser reduction of 1 - 0.765 = 0.235 or 23.5%.

6) As a basis for comparison of construct trip making with the same development program under "trend" conditions, the ITE trip generation rates for AM peak, PM peak and average daily vehicle trips (with offpeak trips as a byproduct) were applied to construct land use programs. Trip generation under construct conditions was calculated using ITE rates modified by the estimated reduction factors. For each construct, trips made with reduced rates were compared with trips produced with unmodified rates, yielding estimates of trip reduction performance compared with "trend" conditions. THIS STEP IS IMPORTANT FOR OVERALL ANALYSIS, BUT WAS NOT USED FOR ESTABLISHING CONSTRUCT TRIP MAKING IN THE NETWORK MODEL.

7) Convert construct land use based trip reduction factors to HBW (Home Based Work), HBO (Home Based Other), and NHB (Non Home Based) categories in the AM peak hour, as required by the TransCAD network model.

8) Run TransCAD model for "trend" scenario and first construct alternative (AM peak hour).

9) To supplement and expand on the "AM peak hour only" operations of TransCAD, analyze trip characteristics on a construct level versus the same land use programs on a trend basis for AM peak, PM peak, off-peak and ADT, as set forth in 6).

Application

In prior study phases, we have already identified the characteristics of the constructs. This memo summarizes the identification of the trip reduction factors to be applied to ITE rates for each land use. These steps are explained below.

1) The trip reductions from the constructs are due to a combination of factors. These include:

- overall office/retail/housing mix;
- jobs/housing ratio;
- total employment;
- design integration;
- proximity to rail transit;
- presence of radial bus service;
- presence of internal bus service;
- constrained (and in the case of the transit construct priced) parking supply for commercial uses; and
- increased residential density.

2) These factors in various combinations can result in varying degrees of reduction of single occupant vehicles, due to:

- internalization of external vehicle trips, whether by vehicle, transit, or walking; and/or
- reduction of external vehicle trips by mode shifts to transit or rideshare modes.

3) In looking for case study data to use in measuring the trip reduction effects of these characteristics, we found no comparable existing data for areas which combine all of the factors as our constructs are intended to do. Probably the largest, most recent, most consistent data set is that found in NCHRP 323, Travel Characteristics at Large-Scale Suburban Activity Centers (October, 1989) by Kevin Hooper of JHK[1], one of our "peer review group." As shown in his report and in other studies such as Cervero's[2], existing "suburban activity centers" or

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1. Hooper, Kevin G. Travel Characteristics at Large-Scale Suburban Activity Centers, National Cooperative Highway Research Program Report 323, (October, 1989).

"suburban employment centers" typically exhibit some of the above characteristics, but not all. With the possible exception of Bellevue, Washington, the existing suburban activity centers exhibit some land use mixing (particularly office/retail), but generally not the parking restraints, clustering, rail service, internal transit service, or pedestrian amenities which are included as assumptions in our constructs. And, many of the suburban activity centers are actually more like the "trend" development than the constructs. In fact, those individual cases where higher transit use or walking rates have been achieved are those like Bellevue which seem closer to our constructs in terms of adding transit, providing more housing units, better integrated design, pedestrian walkways, etc. Beyond the Hooper report, other case studies are useful in that they measure effects of transportation demand management measures, individual land use or transit service characteristics, but do not consider the land use mixing.

4) Thus, a decision was made to use the average values from NCHRP 323 as a **base indicator of trip reductions which can be achieved through mixing land uses and increasing density in activity centers which would otherwise be dispersed in the "trend" (sprawl) pattern. The case study averages provide the benchmark values, tied to reality, which can be the starting point for the regional testing.** Bear in mind that these trip reductions are fairly substantial in themselves. Their impact, when applied regionally, should be fairly significant.

5) Then, for each land use under each construct, additional references and "professional judgment" are used to estimate **added** reductions which can be attributed to the particular features we are assuming for our constructs. Some of these are tied to the Hooper data for Bellevue and other case study data of developments which are most like our constructs. Others are estimates, based on work/non-work trip percentages, ratios of employment to housing, etc. For some trip types there will be no further trip reductions beyond those indicated in the Hooper cases.

The exception is the walking construct, which is not really a "suburban activity center" as currently defined, and for which there is the least case study data. The most comparable data, if available, would probably be from new towns such as Reston or the new "neotraditional suburbs." In this case, the study team reached a decision that the base case trip type values could not be achieved in all cases, since the walking construct had the least similarity to the mixed use centers studied, notably in its lack of employment opportunities. Therefore, in the case of the walking construct, base reductions were made smaller for some trip types through negative adjustments, as shown in the tables.

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2. Cervero, Dr. Robert. America's Suburban Centers: A Study of the Land Use-Transportation Link, Prepared for Office of Policy and Budget, Urban Mass Transportation Administration, Report No. DOT-T-88-14, Washington, D.C. (January, 1988).

An example of how this method is applied, related to office trips, follows. The numbers correspond to those shown in Page 1 of the attached tables.

For office use in the AM peak hour, NCHRP 323 shows that for "smaller centers," (those most similar in size to our constructs), an average of 10% of employees make a stop within the activity center. Mode shift data from NCHRP for the non-Bellevue suburban centers[3] show that on average 1% use transit, walk or bike, and 7% carpool. These values are put into the matrix as base case study values. It is assumed that these reductions would be achieved as a minimum vehicle trip decrease from the trend values in any of the constructs. **Result:** 0.90 x 0.99 x 0.93 = 0.83 net trip reduction factor.

Then, for the transit construct, an additional 2% internal trip reduction is estimated, due to the internal transit system and improved walking conditions. An additional 12% transit use is estimated, based on Bellevue's 10% transit mode share (with radial bus system) plus an estimated 2% reduction due to the rail access. Reductions due to ridesharing are not increased over the case study value. **Result:** 0.83 (from base case, above) x 0.98 x 0.88 = .71 net trip reduction factor (as shown in page 1 of the Tables).

For the short drive construct, reductions due to increased internal walking are increased by 1%, and carpooling is increased 8% over the base values, based on Cervero's findings of 15% carpool rates for large and medium mixed use centers. **Result:** 0.83 (from base case, above) x .99 x .92 = .75 net trip reduction factor.

For the walking construct, office trips will be a much smaller proportion of total travel, but, due to their location they will attract a large proportion of employees and visitors from within the construct. Thus, the 10% internal trip reduction from the base case is deemed valid for office uses in this construct. However, no external transit use or carpooling increases are predicted for the walking construct, due to the absence of new regional services and the low proportion of use in commercial space, which would not justify adding local bus service. Thus, these values are listed as negative values (translated into factors greater than one) in the table. **Result:** 0.83 x 1.01 x 1.07 = 0.90 net trip reduction factor..

Pages 1, 2, and 3 of the attached tables list trip reductions by land use for each construct. Then, Page 4 of the tables summarizes the total trip reductions by construct.

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3. For the transit use value, Bellevue is excluded from the base case value due to its atypical, higher level of transit service which would raise the base value too high to be used in all cases.

As we have talked about before, it is difficult to substantiate every factor as applied to every trip type. However, it should be reasonable to predict, as we have done here, how each construct stacks up against the current suburban activity centers for each type of trip. Looking at the literature, the values we have calculated here seem within ranges which have been measured in other case studies such as those presented in the ITE 1987 Trip Generation manual[4] and the Stover and Koepke text Transportation and Land Development. [5]

Similarly, the February, 1990 FHWA report, Evaluation of Travel Demand Management Measures to Relieve Congestion[6], states that, for programs of Transportation Demand Management (TDM) measures in combination, "trip reductions in the range of 20% to 40% can be the norm, rather than the exception." Although our study purposely does not attempt to isolate TDM program effects, TDM programs such as constrained and priced parking, TMA activity, rideshare incentives, and staggered work hours are considered part of each construct "package" along with the land use mix, density and design features which are the focus of this analysis effort.

We welcome the comments of the "peer review group" in adding comparative data. Also, as the constructs become incorporated into existing town centers, shopping centers, etc., it may be possible to adapt the trip reduction factors to reflect actual conditions.

/Attachments: Tables, Charts

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4. Institute of Transportation Engineers, Trip Generation, 4th Edition, (1987), pp. 17-21.

5. Stover, Vergil G. and Koepke, Frank J. Transportation and Land Development, Institute of Transportation Engineers, Englewood Cliffs, New Jersey (1988), pp. 47-48.

6. Kuzmyak, J. Richard, Schreffler, Eric N. and Katz, Harold et al. Evaluation of Travel Demand Management (TDM) Measures to Relieve congestion Repot No. FHWA-SA-90-005, prepared for Federal Highway Administration, Washington D.C. (February, 1990), p 28.

MSM Trip Reduction Relationships: 10/20/90
Land Use Type: COMMERCIAL (OFFICE) TRIPS

	AM Peak Values	Refer.	PM Peak Values	Refer.	Off Peak Values	Refer.
CASE STUDIES: MIXED USE DEV'T/SUBURBAN ACTIVITY CENTERS						
Construct/Reduction Type:						
Base Reductions for All Constructs:						
Internal Trips: (All Modes)	10%	1	10%	11	25%	21
External-Transit	1%	2	1%	12	0%	
External-Carpool	7%	3	7%	13	0%	
Subtotal (Gross):	18%		18%		25%	
Additional Reductions/Totals by Construct:						
TRANSIT CONSTRUCT:						
Internal-Vehicle	0%		0%		0%	
Internal-Transit	1%	4	1%	14	1%	22
Internal-Walking	1%	5	1%	15	10%	23
External-Transit	12%	6	12%	16	0%	
External-Carpool	0%		0%		0%	
CONSTRUCT TOTAL (Gross):	32%		32%		36%	
* Net Ratios =	0.71		0.71		0.67	
SHORT DRIVE CONSTRUCT:						
Internal-Vehicle	0%		0%		0%	
Internal-Transit	0%		0%		0%	
Internal-Walking	1%	7	1%	17	5%	24
External-Transit	0%		0%		0%	
External-Carpool	8%	8	8%	18	0%	
CONSTRUCT TOTAL (Gross):	27%		27%		30%	
* Net Ratios =	0.75		0.75		0.71	
WALKING CONSTRUCT:						
Internal-Vehicle	0%	9	0%	19	0%	25
Internal-Transit	0%		0%		0%	
Internal-Walking	0%		0%		0%	
External-Transit	-1%	10	-1%	20	0%	
External-Carpool	-7%	10	-7%	20	0%	
CONSTRUCT TOTAL Gross):	10%		10%		25%	
* Net Ratios =	0.90		0.90		0.75	

* Ratios combine individual percentages as a product of corresponding reduction factors.

REFERENCES:

1,11 Hooper, p. 72, Table 17 Average for smaller centers, stop within SAC, 10%

2,12 Hooper, p. 68

3,13 Av. mode split for non-Bellevue sites: 92% auto, 7% carpool, 1% bus/walk/bike

4,14 H/SH estimate

5,15 H/SH estimate

6,16 H/SH estimate based on Bellevue 10% transit/bike/walk mode share with radial bus and 2% due to rail access

7,17 H/SH estimates: slightly higher walk commute due to more housing nearby

8,18 Cervero, America's Suburban Centers, p. 955 - increase due to density/land use mix

9,19 H/SH estimates: base reduction applicable to commercial trips because nature and location make office uses likely to attract local workers

10,20 H/SH estimates: reduced from base due to low proportion of office use in construct

21 Hooper, p. 72, Table 17 -- midday trips by office workers within SAC - smaller centers

22,23 H/SH estimates: marginal diversion to transit beyond case study value; large increase in walk trips due to density, design features

24 H/SH estimate: increase in walk trips due to more retail integration and design features, but less than that for transit construct due to greater distances

25 H/SH estimate: base rates apply for offpeak trips due to high ratio of commercial to office space, design features

MSM Trip Reduction Relationships: 10/20/90
Land Use Type: RETAIL TRIPS

	AM Peak Values	Refer.	PM Peak Values	Refer.	Off Peak Values	Refer.
CASE STUDIES: MIXED USE DEVELOPMENT/SUBURBAN ACTIVITY CENTERS						
Construct/Reduction Type:						
Base Reductions for All Constructs:						
Internal Trips:						
(all modes)	14%	1	14%	6	23%	11
External-Transit	0%		0%		1%	12
External-Carpool	0%		0%		1%	13
Subtotal (Gross):	14%		14%		25%	
Additional Reductions/Totals by Construct:						
TRANSIT CONSTRUCT:						
Internal-Vehicle	0%		0%		0%	
Internal-Transit	0%		0%		2%	14
Internal-Walking	1%	2	1%	7	10%	15
External-Transit	2%	3	2%	8	0%	
External-Carpool	0%		0%		0%	
CONSTRUCT TOTAL (Gross):	17%		17%		37%	
* Net Ratios=	0.83		0.83		0.67	
SHORT DRIVE CONSTRUCT:						
Internal-Vehicle	0%		0%		0%	
Internal-Transit	0%		0%		2%	16
Internal-Walking	1%	4	1%	9	5%	17
External-Transit	0%		0%		0%	
External-Carpool	0%		0%		0%	
CONSTRUCT TOTAL (Gross):	15%		15%		32%	
* Net Ratios =	0.85		0.85		0.70	
WALKING CONSTRUCT:						
Internal-Vehicle	0%	5	0%	10	0%	18
Internal-Transit	0%		0%		0%	
Internal-Walking	0%		0%		0%	
External-Transit	0%		0%		-1%	19
External-Carpool	0%		0%		-1%	20
CONSTRUCT TOTAL (Gross):	14%		14%		23%	
* Net Ratios =	0.86		0.86		0.77	

* Ratios combine individual percentages as a product of corresponding reduction factors.

REFERENCES:

1,6,11 Hooper, p. 89 -- average of smaller activity centers (Bellevue, South Coast Metro and Southdale)

12,13 Hooper, p. 89 -- average of smaller activity centers (Bellevue, South Coast Metro and Southdale)

2,3,7,8 Slightly higher retail commute trips by radial transit, walking (estimate)

4 Slightly higher retail commute trips by walking -- estimate

5,10 Base values hold for retail employment due to relatively low number of jobs to be filled by high number of households in construct

14,15 For transit construct, 12% increase in internal offpeak trips estimated over case study values - due to higher density, design, constrained parkinng

16,17 For short drive, moderate increase in retail offpeak internal trips due to better design, clusteering (estimate)

18 For walking construct, 1base values assumed to hold for offpeak due to large number of households to support neighborhood commercial center

19,20 Base values do not apply due to low square footage of retail -- not large enouugh center to attract carpool, transit offpeak trips

MSM Trip Reduction Relationships: 10/20/90
Land Use Type: RESIDENTIAL TRIPS

CASE STUDIES: MIXED USE DEV'T/SUBURBAN ACTIVITY CENTERS

Construct/Reduction Type:	AM Peak Values	Refer.	PM Peak Values	Refer.	Off Peak Values	Refer.
Base Reductions for Transit and Short Drive Constructs:						
Internal Trips:						
(All Modes)	27%	1	27%	13	7%	25
External-Transit	0%		0%		0%	
External-Carpool	0%	2	0%	14	0%	
Subtotal (Gross):	27%		27%		7%	
Additional Reductions/Totals by Construct:						
TRANSIT CONSTRUCT:						
Internal-Vehicle	1%	3	1%	15	3%	26
Internal-Transit	1%	4	1%	16	3%	27
Internal-Walking	4%	5	4%	17	4%	28
External-Transit	10%	6	10%	18	2%	29
External-Carpool	5%	7	5%	19	0%	
CONSTRUCT TOTAL (Gross):	48%		48%		19%	
* Net Ratios =	0.59		0.59		0.82	
SHORT DRIVE CONSTRUCT:						
Internal-Vehicle	0%	8	0%	20	4%	30
Internal-Transit	0%		0%		2%	31
Internal-Walking	0%	9	0%	21	4%	32
External-Transit	0%		0%		0%	
External-Carpool	5%	10	5%	22	0%	
CONSTRUCT TOTAL (Gross):	32%		32%		17%	
* Net Ratios =	0.69		0.69		0.84	
WALKING CONSTRUCT:						
Internal-Vehicle	0%		0%		3%	33
Internal-Transit	0%		0%		0%	
Internal-Walking	-17%	11	-17%	23	5%	34
External-Transit	0%		0%		0%	
External-Carpool	10%	12	10%	24	0%	
CONSTRUCT TOTAL (Gross):	20%		20%		15%	
* Net Ratios =	0.77		0.77		0.86	

* Ratios combine individual percentages as a product of corresponding reduction factors.

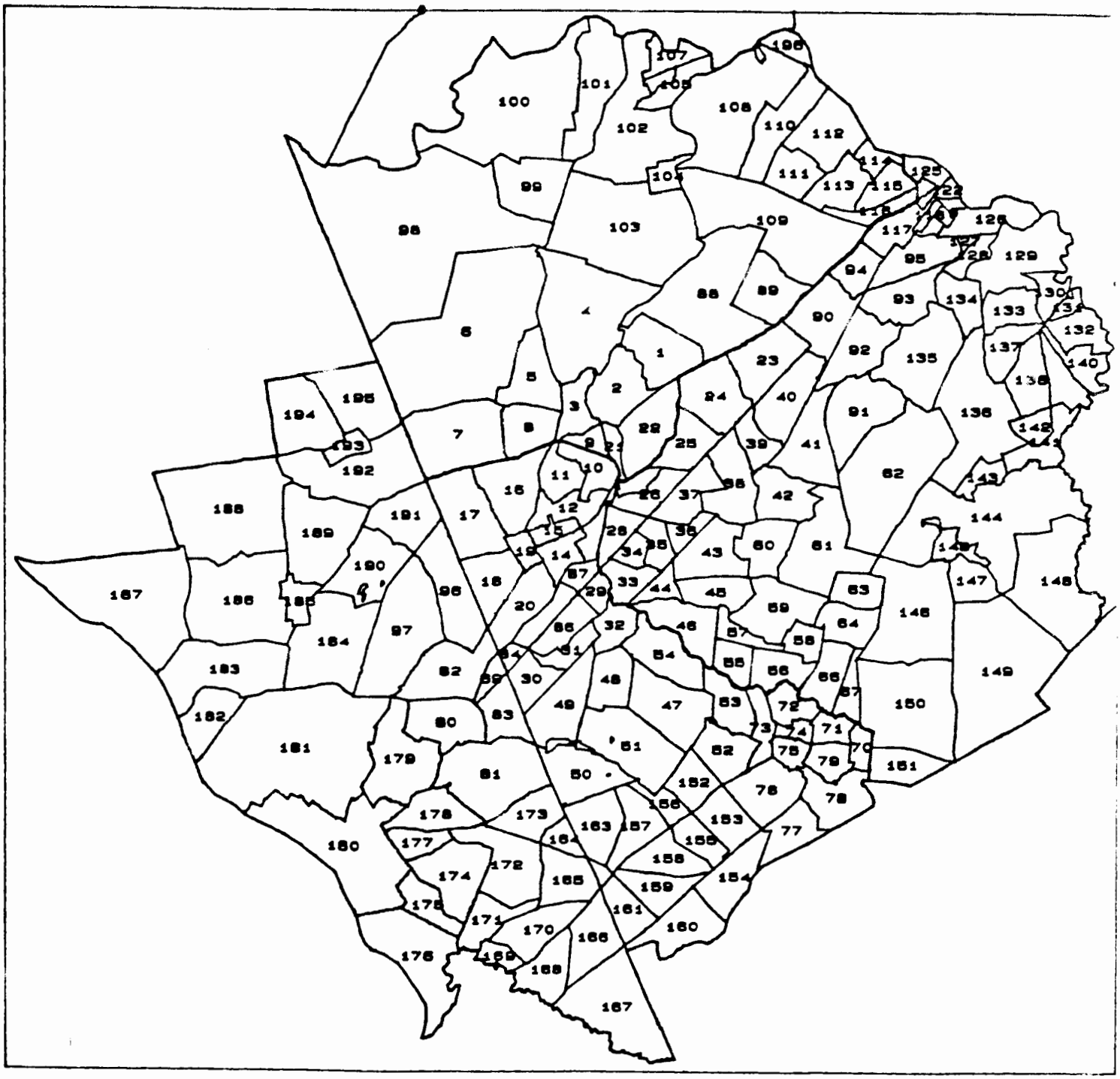
REFERENCES:

1,13 Hooper, p. 94, average for smaller centers.
2,14 No data found on carpool rates per residential unit in suburban centers.
3,4,5 Moderate increases estimated due to increase in housing units, design, density
Increases bring total to 33% -- compare to Hooper, p. 94
6,18 NYC commuters estimated at 10%
7,19 Moderate carpool increase seen as result of higher residential density
8,9 No increases over base data seen for short drive
10,22 Moderate carpool increase seen as result of higher residential density
11,23 Reduced internal trips dbeyond base due to fewer employment opportunities within zone
12,24 Residential clustering assumed to foster carpooling - 10% of HBW trips
15,16,17 Moderate increases estimated due to increase in housing units, design, density
Increases bring total to 33% -- compare to Hooper, p. 94
20,21 No increases over base data seen for short drive
25 50% of non-employee trips (14%) internal to construct - H/SH estimate
26,27,28 Overall 10% increase in internal tripmaking due to constrained parking, land use mix
29 Low off-peak transit use increase -- trips to NYC
30,31,32 Overall increase in internal tripmaking due to fewer workers/hh (more families), land use mix, design
33,34 Increase over base condition in internal offpeak tripmaking,due to larger HH size, more families, fewer workers, clustering, presence of shopping, services within construct

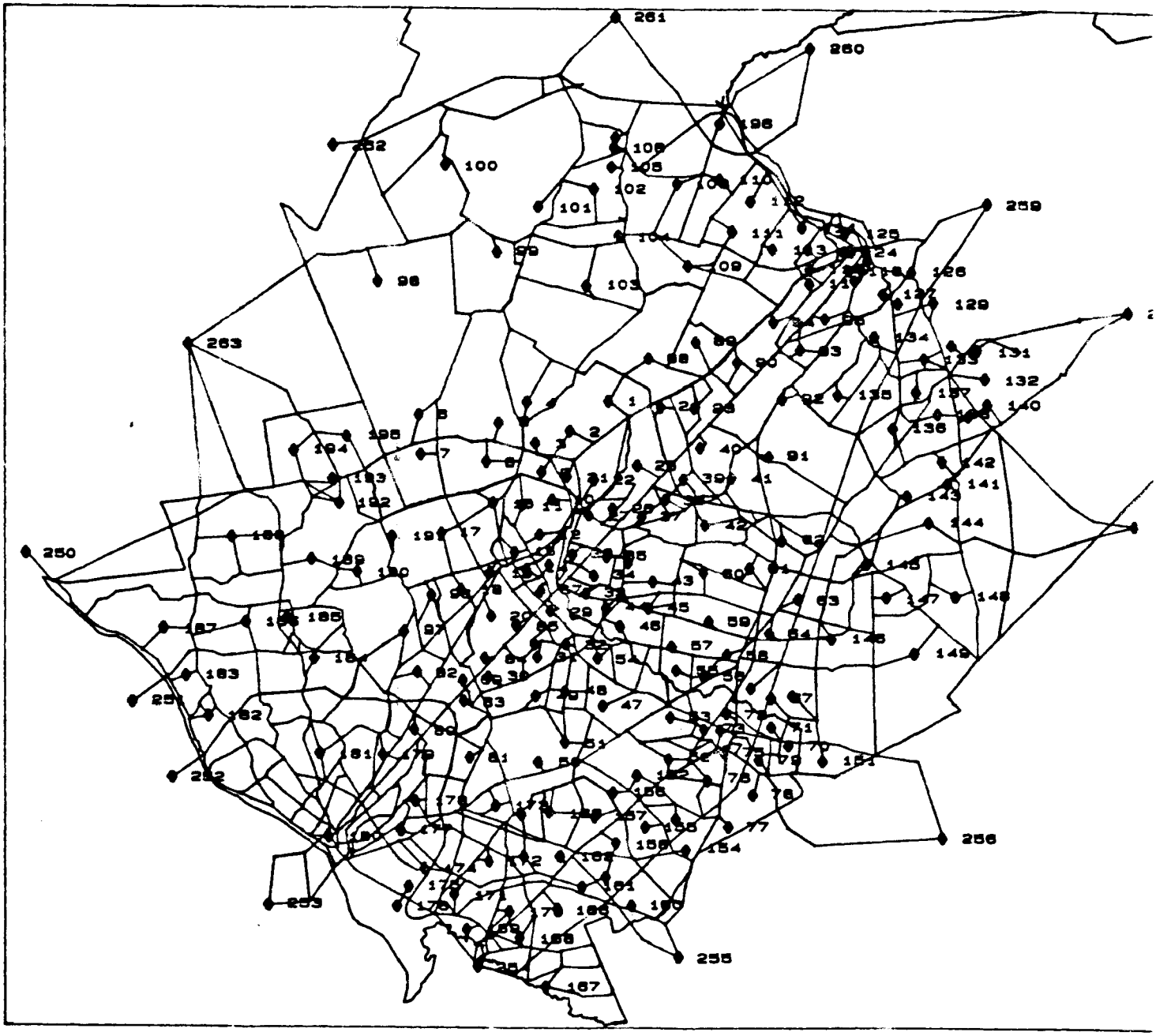
Appendix B

MSM Region Traffic Zones and 1988 Calibration Network

MSM UMTA Study, Transportation Analysis Zones



MSM Calibration Network - 1988



Appendix C

TransCAD Package Steps and Trip Generation Equations

Appendix 3

Models - Calibration

The following discussion detailing the steps involved in running model applications in TransCAD is being supplied to MSM staff to supplement tutorial and seminar training already completed.

The model execution involves creating a database network, building a matrix table of shortest paths, determining trip distribution with the gravity model, assigning the trips to the network and evaluating the results. This is accomplished through a series of models and worksheets executed sequentially. They will be discussed in the order which they occur.

I. Data Assignment Network

The MSM application database contains a line database commonly refered to as the network. When it is used as part of an application line database, it will be referred to as a database network. When being used as input to one of the transportation models, it will be referred to as the assignment network.

To create a database assignment network, select all the links in a line application database that will be used in the assignment process. Select all the centroids that will be used in zonal interchanges. It is not necessary to select all links and centroids in a line database. If a small area is to be studied such as Mercer County, only those links and centroids need to be selected from the three county set. From the procedures menu, choose Network Builder (80386). Fill in the template with information on the name and location of the new network. A listing of the node fields of the line database will be displayed. Select those fields that will be used in any calculations based on the nodes in the network. Node fields that may be included in the application network are those that contain transfer penalties. Because the MSM application database does not currently contain any information on transit routes, no fields should be selected.

The next list is of the available fields on the links in the network. Select the fields containing generalized cost and capacity for the link. The generalized cost of any link is the free flow travel time for that link plus any additional cost (in minutes) that would be incurred by any user of the link. A toll fee is an example of an additional cost to a user of that link. The current version of the MSM application network only uses the free flow travel time in the generalized cost for most links. The exception to this

is the centroid connectors. Centroid connectors are given an additional penalty of 999 minutes to every user on the link. This is done to prevent trips from passing through a zone via the centroid connectors on the way to a destination zone. Because of this, travel times for all origin/destination pairs will be increased by 1998 minutes (999 when leaving a zone and 999 when entering) The 1998 minutes are later removed to arrive at the true travel time. The resultant file will be used to create a shortest path table and assign trips.

II. Matrix of Travel Time

With the assignment network built, the next step is to calculate the shortest path between zones which are represented as centroid connectors. TransCAD calculates the shortest path based on the generalized cost for a set of links whether it is in travel time or distance. First set the current layer to a node layer of a line database, and select all the centroids and external stations that will be used in the travel time matrix table. From the procedure list, choose Pathtab1, and fill in the template with file name, location and a descriptive label for the table. Choose a network file created in Step I. Enter the weights for link fields contained in the network. For our discussion, enter 1 for generalized cost and 0 for link capacity. The cost of the path is a linear equation (Field 1 * Weight + Field 2 * Weight...). The resulting matrix table of zone to zone travel times will be used in the gravity model in Step 3. Because it is a zone to zone matrix, the internal zone travel time is not calculated and is represented in the table as a missing value. Because of the addition of 999 to all centroid connectors, every cell in the travel time matrix table will be 1998 too high. This value can be removed by creating a second matrix table in the Table Editor using the same set of centroids and external stations as were used to create the travel time matrix table in Pathtab1. Fill the new table with 1998. Using the Table Manipulations procedure, subtract the 1998 table from the travel time matrix table. This will yield a table with the correct travel time except for internal trips (the diagonal) which will be -1998. This number must be changed to either missing (press delete key) or any amount of positive travel time in minutes. By leaving the diagonal value as missing, all trips generated are forced onto the network. The lower the diagonal number, the more intrazonal trips will occur. Inversely, the higher the intrazonal time, the fewer the number of trips. Edits to the diagonal must be done one cell at a time, either in a different matrix table where they can be manipulated and added to the travel time matrix, or the diagonal of the travel time matrix can be edited directly.

III. Gravity Model

Trip distribution is accomplished through the gravity model. To execute the gravity model, you will need to create two table files, one with production and the other with attractions. The structure of these files must be the same as the matrix table created in the Pathtabl step. There are three choices of gravity models, Origin Constrained, Destination Constrained or Doubly Constrained. If the Doubly Constrained model is used, then the production and attractions (P's and A's) must be balanced. To balance P's and A's, choose the Balance procedure and balance P's and A's to either P's or A's; or use Balance2 to adjust both P's and A's. To accomplish the balancing, first, import the raw productions and attractions into the node list, and run either Balance or Balance2. Copy the results to the table files through the table menu. From the procedure list, choose Grav04. Select the type of gravity model to be used (Origin, Destination or Doubly Constrained). Enter the output table file name and path location. Use a generalized cost table created in Step II. Enter the name of the production and/or attraction table to be used (this is based on the type of gravity model used). Select the type of functional form to be used, either negative exponential or inverse power. Finally, enter the cost function (friction factor) to be used. The output file will contain a zone to zone matrix of the trip distribution (O/D demand).

IV. Assignment

The assignment model procedure brings together the output produced in Steps II and III. To run an assignment, select the capacity restrained assignment model from the traffic assignment menu. Enter the name of the solution file and where it is located. Select a network created in Step I. Select the fields with generalized cost and link capacity data. Enter the values for alpha and beta in the Bureau of Public Roads (BPR) formula (.15 and 4.0 respectively). Enter the trip distribution table created in Step III. Finally, enter the number of iterations to be run if closure is not made. Twenty iterations are recommended. At the completion of the assignment, the user will be prompted to input the fields in the network application database that will contain the forward and reverse flows. Forward flows are those traveling from Node A to Node B on any link. Reverse flows are trips from Node B to Node A on two-way links. All two-way links will contain both forward and reverse flows, while one-way links will contain only forward flows.

V. Measures of Effectiveness

Post processing of assignments is done both inside and outside of TransCAD. Numerous measures of effectiveness were used to monitor the calibration process and gauge the effect of changes to scenarios. Measures of effectiveness used during post processing included Root Mean Square Error (RMSE), Volume to Capacity Ratio (V/CR), Level of Service (LOS), congested travel time, average trip length (in both miles and minutes), Vehicle Miles of Travel (VMT), Average Speed and percent of intrazonal trips.

RMSE

RMSE is the only measure that must be calculated outside of TransCAD. The remaining can be calculated using the data editor. The formula to calculate RMSE is as follows:

$$\sqrt{\frac{\sum \left(\frac{Sim - Obs}{Obs}\right)^2}{n}}$$

where: sim = Simulated Flow
obs = Observed Flow
n = Number of Observed Counts

The resulting value indicator of the effectiveness of the simulation. The caveat to this is if the observed counts are taken at locations with large variations day to day, the RMSE is less reliable. Observed counts along major arterials are most desirable because of the consistency of the daily volumes, while counts along local or neighborhood streets are less desirable. RMSE can be applied to the network at regional levels as well as subregional levels (such as a separate RMSE calculated for each county) dependant on the number of counts available.

Traffic Counts

Traffic count data was supplied by NJDOT for state roads in the MSM region from their traffic survey program. The time frame of the counts ranged from 1986 to 1990. Where the 1988 data was available, it was used as is. On the segments where there was no data for 1988, the counts were adjusted by weighting to represent a 1988 count. The distribution of available data throughout the MSM region is not as even as we would like with most of the counts along Routes 1, 130, 31, and Interstate 195/295 in Mercer and Middlesexx counties. Somerset County contained only three points with usable count data. This lack of observed traffic data brings up concern about calibration volumes in the south Somerset sub-region. Because it is an isolated area, its effects on the rest of the regional calibration would be minimal. If the Somerset area will be used in the future for a more detailed

study, it is recommended additional traffic counts be obtained to assist in refining the calibration and subsequent applications.

Volume to Capacity Ratios/LOS

Volume to Capacity Ratio is used to determine simulated levels of service. This is a link level measure that should be looked at with an area wide approach. Groups of links should be compared, not individual link segments. This can be used as another measure to judge the effectiveness of the calibration process. It could also be used as an indicator of possible future conditions. Again, it should only be taken in a general area context. LOS categories used were taken from the Highway Capacity Manual:

A = 0.0 - 0.4;
B = 0.4 - 0.7;
C = 0.7 - 0.8;
D = 0.8 - 0.95;
E = 0.95 - 1.05;
F = 1.05 - 1.5.

Congested Travel Times and Speeds

Congested Travel Time and Speeds is another good measure of the effectiveness of the calibration process. It is similar to V/CR and LOS in that it should be used on an area basis when compared to real world conditions. By comparing them to free flow travel time and speeds, the effect of the simulation becomes readily apparent. To calculate congested travel time and speeds, apply the following formula to the links in the network.

Congested Travel Time = $time_o[1 + A(V_t/C)]$
where: $time_o$ = free flow travel time
A = alpha from BPR formula
B = beta from BPR formula
V_t = calculated flow
C = capacity

Congested speeds are derived from the congested travel time. Congested travel time/distance * 60.

Average Trip Length in Miles and Minutes

During calibration, average trip length in miles and minutes is an indicator of the improvement of the calibration process. Average trip lengths in miles are calculated by simply taking the sum of the miles traveled divided by the sum of the trips assigned. For the average length of trip in minutes and the sum of minutes of travel over the sum of the trips assigned will yield the average length of trips in minutes. Targets used were 8 miles and 20 minutes in length which were based on Montgomery County, Maryland travel time.

Vehicle Miles of Travel

VMT is used as an indicator of the increased use of a network during scenario applications. VMT is calculated by summing the number of trips and multiplying that by link length and number of lanes. The difference between calibration VMT and scenario application VMT can be due to an increase in the P's and A's, or excessive congestion causing increased trip length. If there is little or no change in the average trip length, then the increase VMT would be due to an increase in the number of trips on the system.

Table 5

Trip Generation Equations

Independent Variables

DU - Dwelling Units - all sizes/types
RE - Retail Employees
NE - All Other Employees
US - University Students

Present (1980 - 1990)

Production

HBW = 2.48 * DU
HBO = 6.64 * DU + 0.84 * US
NHB = 0.25 * DU =0.39 * US + 2.92 * RE +1.13 *NE

Attractions

HBW = 0.57 * US +1.84 * RE + 1.89 * NE
HBO = 0.99 * DU + 0.81 * US + 23.24 * RE + 0.45 * NE
NHB = 0.25 * DU + 0.39 * US + 2.92 * RE + 1.13 * NE

Future (2005 - 2010)

Production

HBW = 2.34 * DU
HBO = 6.03 * DU + 0.84 * US
NHB = 0.25 * DU + 0.39 * US + 3.47 * RE +1.16 * NE

Attractions

HBW = 0.57 * US + 1.89 * RE + 1.89 * NE
HBO = 0.99 * DU + 0.81 * US + 20.56 * RE + 0.47 * NE
NHB = 0.25 * DU + 0.39 * US + 3.47 * RE + 1.16 *NE

APPENDIX D: DEVELOPMENT OF LAND USE DATA FOR MUNICIPALITIES AND ZONES

General Description

The modeling process required the formulation of land use data at the municipal and zone levels. The basic units of analysis were: number of dwelling units and students (to represent the population), and retail and non-retail employment. The most up-to-date municipal population available at the commencement of the study was for 1988; therefore, this was chosen as the base year. The future year 2010 was selected, in part, because of the municipal employment and population projections made available by the counties to satisfy the requirements of the State Plan cross-acceptance process.

Tables 1 and 2 present the derivation of the traffic zone structure itself. New Jersey Department of Transportation provided data from four of their modeling efforts: the Route 1 Corridor Study, the North New Jersey Model, the Route 130 Study and the Route 518 Study. Because of some redundancy among models, we found it necessary to use only the first three in establishing the boundaries of the traffic zones. New zones were delineated in the portions of the region outside the scope of these existing models.

Tables 3 and 8 show the municipal population and employment figures we assumed for 1988, 2010 Trend, Scenario 1 and Scenario 2. While the total number of dwelling units and employment is held constant for the region in Trend and Scenarios 1 and 2, these tables illustrate the fundamental differences in the allocation of growth in each of the three cases. The Trend assumes that the regional distribution of growth among municipalities will occur as projected by the three counties and MSM. In Scenario 1, the cities receive a much larger share of the growth than projected in Trend, while the remainder is absorbed by the constructs. In Scenario 2, the cities are assumed to grow only by the 2010 Trend amount, with the increment allocated among the constructs.

Tables 4 to 7 and 9 to 12 show the assumptions made about the distribution of land uses at the zone level. Data from the NJDOT models and MSM's Current Development Survey was utilized to calculate the figures. The municipal totals were used as controls for the 1988 and 2010 Trend allocation process. The 1988 numbers were derived from 1980 zone data, in the case of the Route 1 Study portion, and 1986 zone data for the North New Jersey and Route 130 areas. Only the Route 1 and Route 130 models included future year zone data (2005 and 2006, respectively), and this was used to guide the allocation process for the 2010 Trend. Zoning ordinances and other in-house land use information were utilized whenever necessary, particularly in the portions of the region where new zones were created.

For Scenarios 1 and 2, it was determined that four additional zones were needed to accommodate walking constructs. Zones 200 to 203 were established for this purpose, having been split off from much larger zones 4, 88, 189 and 194. This step was taken because it was assumed that in these particular areas, traffic behavior in the remainder of the zones outside the walking constructs would not be like that within the constructs and should be modeled differently.

Table 1: Derivation of Zones from Existing Studies

	Route 1	North New Jersey	Route 130	New
Cranbury Twp.	X			
East Brunswick Twp.		X		
Helmetta Boro		X		
Jamesburg Boro			X	
Milltown Boro		X		
Monroe Twp.			X	
New Brunswick City		X		
North Brunswick Twp.	X	X		
Plainsboro Twp.	X			
South Brunswick Twp.	X			
South River Boro		X		
Spotswood Boro		X		
Franklin Twp.	X	X		
Hillsborough Twp.		X		
Manville Boro		X		
Millstone Boro		X		
Montgomery Twp.	X			
Rocky Hill Boro	X			
So. Bound Brook Boro				X
East Windsor Twp.	X			
Ewing Twp.			X	X
Hamilton Twp.	X		X	
Hightstown Boro	X			
Hopewell Boro				X
Hopewell Twp.				X
Lawrence Twp.	X		X	
Pennington Boro				X
Princeton Boro	X			
Princeton Twp.	X			
Trenton City				X
Washington Twp.			X	
West Windsor Twp.	X			

Note: 'Route 1,' 'North New Jersey', and 'Route 130' refer to zones drawn from modeling efforts previously undertaken by the NJ Dept. of Transportation; otherwise, new zones were created as indicated by 'New.'

Table 2: Derivation of the Study Zone Structure

Zone	Municipality	Route 1 Model	North NJ Model	Route 130 Model	New Zone
1	Franklin	1			
2	Franklin	2			
3	Montgomery/Rocky Hill	3			
4	Montgomery	4			
5	Montgomery	5			
6	Montgomery	6			
7	Montgomery	7			
8	Montgomery	8			
9	Montgomery	9			
10	Princeton Township	10			
11	Princeton Township	11			
12	Princeton Township	12			
13	Princeton Township	13			
14	Princeton Township/Boro	14			
15	Princeton Boro	15			
16	Princeton Township	16			
17	Princeton Township	17			
18	Princeton Township	18			
19	Princeton Boro	19			
20	Princeton Township	20			
21	Franklin	21			
22	Franklin	22			
23	South Brunswick	23			
24	South Brunswick	24			
25	South Brunswick	25			
26	South Brunswick	26			
27	South Brunswick	27			
28	Plainsboro	28			
29	West Windsor	29			
30	West Windsor	30			
31	West Windsor	31			
32	West Windsor	32			
33	Plainsboro	33			
34	Plainsboro	34			
35	Plainsboro	35			
36	Plainsboro	36			
37	South Brunswick	37			
38	South Brunswick	38			
39	South Brunswick	39			
40	South Brunswick	40			
41	South Brunswick	41			
42	South Brunswick	42			
43	Plainsboro	43			
44	Plainsboro	44			
45	Plainsboro	45			
46	Plainsboro	46			
47	West Windsor	47			
48	West Windsor	48			
49	West Windsor	49			
50	West Windsor	50			
51	West Windsor	51			
52	East Windsor	52			
53	East Windsor	53			
54	West Windsor	54			
55	Cranbury	55			
56	Cranbury	56			

Table 2: Derivation of the Study Zone Structure

Zone	Municipality	Route 1 Model	North NJ Model	Route 130 Model	New Zone
57	Cranbury	57			
58	Cranbury	58			
59	Cranbury	59			
60	South Brunswick	60			
61	South Brunswick	61			
62	South Brunswick	62			
63	Cranbury	63			
64	Cranbury	64			
65	--	65			
66	Cranbury	66			
67	Cranbury	67			
68	--	68			
69	Lawrence	69			
70	East Windsor	70			
71	East Windsor	71			
72	East Windsor	72			
73	East Windsor	73			
74	Hightstown	74			
75	Hightstown	75			
76	East Windsor	76			
77	East Windsor	77			
78	East Windsor	78			
79	East Windsor	79			
80	Lawrence	80			
81	Hamilton	81			
82	Lawrence	82			
83	Lawrence	83			
84	West Windsor	84			
85	West Windsor	85			
86	West Windsor	86			
87	West Windsor	87			
88	Franklin	88			
89	Franklin	89			
90	North Brunswick	90			
91	South Brunswick	91			
92	North Brunswick	92			
93	North Brunswick	93			
94	North Brunswick	94			
95	North Brunswick	95			
96	Lawrence	96			
97	Lawrence	97			
98	Hillsborough		1097		
99	Hillsborough		1098		
100	Hillsborough		1096		
101	Hillsborough		1101		
102	Hillsborough		1102		
103	Hillsborough		1100		
104	Millstone		1099		
105	Manville		1064		
106	Manville		1065		
107	Manville		1066		
108	Franklin		1092		
109	Franklin		1091-p		
110	Franklin		1093		
111	Franklin		1087		
112	Franklin		1088		

Table 2: Derivation of the Study Zone Structure

Zone	Municipality	Route 1 Model	North NJ Model	Route 130 Model	New Zone
113	Franklin		1086		
114	Franklin		1085		
115	Franklin		1089		
116	Franklin		1090		
117	New Brunswick		617		
118	New Brunswick		618		
119	New Brunswick		619		
120	New Brunswick		620		
121	New Brunswick		621		
122	New Brunswick		616		
123	New Brunswick		615		
124	New Brunswick		614		
125	New Brunswick		613		
126	New Brunswick		622		
127	North Brunswick		623-p		
128	North Brunswick		627-p		
129	East Brunswick		629		
130	South River		637		
131	South River		638		
132	South River		639		
133	East Brunswick		630		
134	Milltown		628		
135	East Brunswick		632		
136	East Brunswick		633		
137	East Brunswick		631		
138	East Brunswick		634		
139	East Brunswick		635		
140	East Brunswick		636		
141	Spotswood		659		
142	Spotswood		660		
143	Helmetta		661		
144	Monroe			46	
145	Jamesburg			47	
146	Monroe			48	
147	Monroe			49	
148	Monroe			50	
149	Monroe			52	
150	Monroe			51	
151	Monroe			53	
152	Washington			68	
153	Washington			69	
154	Washington			72	
155	Washington			71	
156	Washington			70	
157	Washington			74	
158	Washington			75	
159	Washington			76	
160	Washington			79	
161	Washington			78	
162	Washington			77	
163	Washington			73	
164	Hamilton			82	
165	Hamilton			85	
166	Hamilton			90	
167	Hamilton			95	
168	Hamilton			94	

Table 2: Derivation of the Study Zone Structure

Zone	Municipality	Route 1 Model	North NJ Model	Route 130 Model	New Zone
169	Hamilton			93	
170	Hamilton			89	
171	Hamilton			88	
172	Hamilton			84	
173	Hamilton			81	
174	Hamilton			87	
175	Hamilton			91	
176	Hamilton			92	
177	Hamilton			86	
178	Hamilton			83	
179	Lawrence			140-p	
180	Trenton			147	
181	Ewing			146	
182	Ewing				X
183	Hopewell Township				X
184	Hopewell Township				X
185	Pennington				X
186	Hopewell Township				X
187	Hopewell Township				X
188	Hopewell Township				X
189	Hopewell Township				X
190	Hopewell Township				X
191	Hopewell Township				X
192	Hopewell Township				X
193	Hopewell Boro				X
194	Hopewell Township				X
195	Hopewell Township				X
196	South Bound Brook				X

Note: Any zone number with the suffix "-p" indicates that only a portion of that zone was used to create a new one.

Table 3: Dwelling Unit Growth Assumptions - 1988, 2010 Trend, 2010 Scenarios

	Number of Households* 1988	Number of Households* 2010	Household* Growth 1988-2010	Growth in Constructs Scenario 1	Growth in Cities Scenario 1	Growth in Constructs Scenario 2	Growth in Cities Scenario 2
Cranbury Twp.	913	2,165	1,252	1,600		2,481	
East Brunswick Twp.	13,555	17,768	4,213				
Helmetta Boro	439	986	547				
Jamesburg Boro	1,688	2,215	527				
Milltown Boro	2,412	3,000	588				
Monroe Twp.	8,640	14,215	5,575				
New Brunswick City	12,682	16,461	3,779		19,408		3,779
North Brunswick Twp.	10,730	15,223	4,493	2,800		4,342	
Plainsboro Twp.	6,833	13,566	6,733	2,800		4,342	
South Brunswick Twp.	8,341	15,645	7,304	10,400		16,152	
South River Boro	4,823	5,504	681				
Spotswood Boro	2,904	3,354	450				
Franklin Twp.	13,502	23,293	9,791	4,400		6,823	
Hillsborough Twp.	9,165	14,249	5,084	2,800		4,342	
Manville Boro	3,868	4,133	265				
Millstone Boro	180	187	7				
Montgomery Twp./ Rocky Hill Boro	3,290	5,548	2,258	3,200		4,963	
So. Bound Brook Boro	1,502	1,669	167				
East Windsor Twp.	8,666	13,562	4,896	6,000		9,328	
Ewing Twp.	12,541	14,512	1,971				
Hamilton Twp.	31,336	40,394	9,058				
Hightstown Boro	1,818	1,819	1				
Hopewell Boro	803	1,083	280				
Hopewell Twp.	3,870	6,148	2,278	6,000		9,303	
Lawrence Twp.	8,616	11,235	2,619	2,800		4,342	
Pennington Boro	872	1,113	241				
Princeton Boro/ Princeton Twp.	8,804	13,295	4,491				
Trenton City	33,952	39,619	5,667		19,407		5,667
Washington Twp.	2,250	4,159	1,909	4,400		6,823	
West Windsor Twp.	4,436	9,327	4,891	6,000		9,328	
STUDY AREA (TOTAL)	223,431	315,446	92,015	53,200	38,815	82,569	9,446

*Note: For the purposes of this study, it was assumed that the number of households, derived from population estimates, is equal to the number of dwelling units which would generate traffic.

Sources: MSM Regional Council - "Estimated Average Household Size in 1980, 1984 & 2000;"
NJ Dept. of Labor - Population Estimates; Middlesex, Somerset, Mercer Counties - Population Projections.

Table 4: Derivation of Dwelling Units by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Dwelling Units	1988 Dwelling Units	Estimated University Students
1	Franklin	223	223	
2	Franklin	88	138	
3	Montgomery/Rocky Hill	643	653	
4	Montgomery	740	795	
5	Montgomery	107	195	
6	Montgomery	938	958	
7	Montgomery	175	185	
8	Montgomery	121	121	
9	Montgomery	33	383	
10	Princeton Township	203	203	
11	Princeton Township	300	365	
12	Princeton Township	1,725	1,725	
13	Princeton Township	787	807	
14	Princeton Township/Boro	1,073	1,073	3,945
15	Princeton Boro	2,132	2,132	650
16	Princeton Township	392	727	
17	Princeton Township	358	375	
18	Princeton Township	399	449	
19	Princeton Boro	576	576	915
20	Princeton Township	372	372	190
21	Franklin	28	28	
22	Franklin	145	145	
23	South Brunswick	1,400	1,288	
24	South Brunswick	1,855	2,097	
25	South Brunswick	130	425	
26	South Brunswick	158	158	
27	South Brunswick	217	423	
28	Plainsboro	326	551	
29	West Windsor	250	250	
30	West Windsor	5	20	
31	West Windsor	8	8	
32	West Windsor	600	600	
33	Plainsboro	39	39	
34	Plainsboro	10	10	
35	Plainsboro	6	6	
36	Plainsboro	224	224	
37	South Brunswick	21	42	
38	South Brunswick	326	707	
39	South Brunswick	93	82	
40	South Brunswick	172	611	
41	South Brunswick	604	1,669	
42	South Brunswick	94	178	
43	Plainsboro	27	27	
44	Plainsboro	992	992	
45	Plainsboro	1,669	4,897	
46	Plainsboro	87	87	
47	West Windsor	248	466	
48	West Windsor	551	781	
49	West Windsor	154	484	
50	West Windsor	80	80	
51	West Windsor	252	392	
52	East Windsor	2,616	2,642	
53	East Windsor	108	108	
54	West Windsor	232	420	
55	Cranbury	4	6	

Table 4: Derivation of Dwelling Units by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Dwelling Units	1988 Dwelling Units	Estimated University Students
56	Cranbury	63	273	
57	Cranbury	14	14	
58	Cranbury	358	358	
59	Cranbury	96	96	
60	South Brunswick	49	47	
61	South Brunswick	95	288	
62	South Brunswick	124	137	
63	Cranbury	34	34	
64	Cranbury	92	102	
65	--	--	--	
66	Cranbury	35	15	
67	Cranbury	15	15	
68	--	--	--	
69	Lawrence	22	22	
70	East Windsor	2,648	2,648	
71	East Windsor	30	56	
72	East Windsor	1,007	1,033	
73	East Windsor	543	1,169	
74	Hightstown	630	691	
75	Hightstown	1,066	1,127	
76	East Windsor	161	381	
77	East Windsor	150	176	
78	East Windsor	301	327	
79	East Windsor	100	126	
80	Lawrence	825	978	
81	Hamilton	1,245	3,021	
82	Lawrence	692	692	
83	Lawrence	27	627	
84	West Windsor	5	5	
85	West Windsor	190	790	
86	West Windsor	130	130	
87	West Windsor	10	10	
88	Franklin	191	627	
89	Franklin	155	455	
90	North Brunswick	1,308	2,668	
91	South Brunswick	105	189	
92	North Brunswick	479	1,129	
93	North Brunswick	1,721	2,399	
94	North Brunswick	1,211	1,211	
95	North Brunswick	2,765	3,311	
96	Lawrence	232	898	
97	Lawrence	1,012	2,558	
98	Hillsborough	1,045	1,062	
99	Hillsborough	2,059	2,654	
100	Hillsborough	773	1,167	
101	Hillsborough	1,526	1,526	
102	Hillsborough	1,017	1,017	
103	Hillsborough	1,356	1,739	
104	Millstone	180	180	
105	Manville	1,728	1,679	
106	Manville	1,104	1,055	
107	Manville	1,183	1,134	
108	Franklin	613	613	
109	Franklin	1,622	342	
110	Franklin	310	310	

Table 4: Derivation of Dwelling Units by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Dwelling Units	1988 Dwelling Units	Estimated University Students
111	Franklin	601	601	
112	Franklin	1,049	2,038	
113	Franklin	1,957	1,957	
114	Franklin	1,887	2,373	
115	Franklin	2,309	2,309	
116	Franklin	1,343	1,343	
117	New Brunswick	1,637	1,637	
118	New Brunswick	1,536	1,511	
119	New Brunswick	842	817	
120	New Brunswick	1,390	1,365	500
121	New Brunswick	1,190	1,165	500
122	New Brunswick	462	437	
123	New Brunswick	856	831	
124	New Brunswick	2,052	2,027	
125	New Brunswick	1,155	1,015	4,500
126	New Brunswick	1,992	1,877	2,000
127	North Brunswick	1,814-p	7	
128	North Brunswick	2,105-p	5	
129	East Brunswick	2,199	2,672	
130	South River	1,536	1,516	
131	South River	1,194	1,174	
132	South River	2,153	2,133	
133	East Brunswick	838	838	
134	Milltown	2,436	2,412	
135	East Brunswick	802	853	
136	East Brunswick	2,609	3,057	
137	East Brunswick	1,559	1,627	
138	East Brunswick	1,472	1,722	
139	East Brunswick	1,166	1,166	
140	East Brunswick	1,525	1,620	
141	Spotswood	1,862	1,859	
142	Spotswood	1,047	1,045	
143	Helmetta	342	439	
144	Monroe	3,881	4,252	
145	Jamesburg	1,558	1,688	
146	Monroe	3,178	3,553	
147	Monroe	52	52	
148	Monroe	262	262	
149	Monroe	313	313	
150	Monroe	149	149	
151	Monroe	59	59	
152	Washington	66	66	
153	Washington	53	53	
154	Washington	57	57	
155	Washington	10	10	
156	Washington	66	66	
157	Washington	124	124	
158	Washington	177	351	
159	Washington	554	554	
160	Washington	25	25	
161	Washington	65	65	
162	Washington	202	202	
163	Washington	220	677	
164	Hamilton	1,226	1,226	
165	Hamilton	1,901	1,901	

Table 4: Derivation of Dwelling Units by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Dwelling Units	1988 Dwelling Units	Estimated University Students
166	Hamilton	104	104	
167	Hamilton	324	336	
168	Hamilton	1,091	1,211	
169	Hamilton	633	642	
170	Hamilton	1,545	1,545	
171	Hamilton	2,091	2,091	
172	Hamilton	2,702	3,102	
173	Hamilton	1,957	1,973	
174	Hamilton	4,413	4,413	
175	Hamilton	3,264	3,264	
176	Hamilton	2,694	2,695	
177	Hamilton	2,095	2,095	
178	Hamilton	1,717	1,717	
179	Lawrence		2,841	2,500
180	Trenton		33,952	
181	Ewing		11,341	2,500
182	Ewing		1,200	
183	Hopewell Township		420	
184	Hopewell Township		460	
185	Pennington		872	
186	Hopewell Township		310	
187	Hopewell Township		360	
188	Hopewell Township		410	
189	Hopewell Township		310	
190	Hopewell Township		360	
191	Hopewell Township		260	
192	Hopewell Township		360	
193	Hopewell Boro		803	
194	Hopewell Township		310	
195	Hopewell Township		310	
196	South Bound Brook		1,502	
	STUDY AREA (TOTAL)		223,431	18,200

*Note: Zones 1 - 97 have a 1980 base; zones 98 - 178 have a 1986 base.

Sources: NJDOT - Route 1 Corridor Study, North New Jersey Model, Route 130 Model; MSM Regional Council - Current Development Survey, 1987, 1988.

Table 5: Dwelling Units by Zone - 2010 Trend

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
1	Franklin	223		816	593
2	Franklin	138		731	593
3	Montgomery/Rocky Hill	653		700	47
4	Montgomery	795		1,895	1,100
5	Montgomery	195		418	223
6	Montgomery	958		1,180	222
7	Montgomery	185		407	222
8	Montgomery	121		343	222
9	Montgomery	383		605	222
10	Princeton Township	203		668	465
11	Princeton Township	365		831	466
12	Princeton Township	1,725		2,191	466
13	Princeton Township	807		1,273	466
14	Princeton Township/Boro	1,073	4,245	1,328	255
15	Princeton Boro	2,132	650	2,386	254
16	Princeton Township	727		1,193	466
17	Princeton Township	375		841	466
18	Princeton Township	449		915	466
19	Princeton Boro	576	915	831	255
20	Princeton Township	372	190	838	466
21	Franklin	28		621	593
22	Franklin	145		738	593
23	South Brunswick	1,288		2,192	904
24	South Brunswick	2,097		2,413	316
25	South Brunswick	425		1,499	1,074
26	South Brunswick	158		269	111
27	South Brunswick	423		1,619	1,196
28	Plainsboro	551		1,513	962
29	West Windsor	250		250	0
30	West Windsor	20		20	0
31	West Windsor	8		1,775	1,767
32	West Windsor	600		600	0
33	Plainsboro	39		1,001	962
34	Plainsboro	10		10	0
35	Plainsboro	6		6	0
36	Plainsboro	224		1,186	962
37	South Brunswick	42		154	112
38	South Brunswick	707		855	148
39	South Brunswick	82		1,131	1,049
40	South Brunswick	611		1,019	408
41	South Brunswick	1,669		2,469	800
42	South Brunswick	178		459	281
43	Plainsboro	27		989	962
44	Plainsboro	992		1,954	962
45	Plainsboro	4,897		5,859	962
46	Plainsboro	87		1,048	961
47	West Windsor	466		865	399
48	West Windsor	781		1,127	346
49	West Windsor	484		1,179	695
50	West Windsor	80		537	457
51	West Windsor	392		859	467
52	East Windsor	2,642		3,132	490
53	East Windsor	108		598	490
54	West Windsor	420		861	441
55	Cranbury	6		145	139

Table 5: Dwelling Units by Zone - 2010 Trend

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
56	Cranbury	273		412	139
57	Cranbury	14		153	139
58	Cranbury	358		497	139
59	Cranbury	96		235	139
60	South Brunswick	47		159	112
61	South Brunswick	288		857	569
62	South Brunswick	137		249	112
63	Cranbury	34		173	139
64	Cranbury	102		241	139
65	--	--			
66	Cranbury	15		154	139
67	Cranbury	15		155	140
68	--	--			
69	Lawrence	22		988	966
70	East Windsor	2,648		3,138	490
71	East Windsor	56		546	490
72	East Windsor	1,033		1,523	490
73	East Windsor	1,169		1,658	489
74	Hightstown	691		692	1
75	Hightstown	1,127		1,127	0
76	East Windsor	381		871	490
77	East Windsor	176		665	489
78	East Windsor	327		816	489
79	East Windsor	126		615	489
80	Lawrence	978		1,182	204
81	Hamilton	3,021		3,587	566
82	Lawrence	692		970	278
83	Lawrence	627		1,243	616
84	West Windsor	5		5	0
85	West Windsor	790		1,109	319
86	West Windsor	130		130	0
87	West Windsor	10		10	0
88	Franklin	627		2,109	1,482
89	Franklin	455		1,048	593
90	North Brunswick	2,668		3,587	919
91	South Brunswick	189		301	112
92	North Brunswick	1,129		4,129	3,000
93	North Brunswick	2,399		2,779	380
94	North Brunswick	1,211		1,211	0
95	North Brunswick	3,311		3,505	194
96	Lawrence	898		898	0
97	Lawrence	2,558		2,671	113
98	Hillsborough	1,062		1,699	637
99	Hillsborough	2,654		3,885	1,231
100	Hillsborough	1,167		2,198	1,031
101	Hillsborough	1,526		2,164	638
102	Hillsborough	1,017		1,655	638
103	Hillsborough	1,739		2,648	909
104	Millstone	180		187	7
105	Manville	1,679		1,768	89
106	Manville	1,055		1,143	88
107	Manville	1,134		1,222	88
108	Franklin	613		1,206	593
109	Franklin	342		935	593
110	Franklin	310		904	594

Table 5: Dwelling Units by Zone - 2010 Trend

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
166	Hamilton	104		670	566
167	Hamilton	336		902	566
168	Hamilton	1,211		1,777	566
169	Hamilton	642		1,208	566
170	Hamilton	1,545		2,111	566
171	Hamilton	2,091		2,657	566
172	Hamilton	3,102		3,668	566
173	Hamilton	1,973		2,539	566
174	Hamilton	4,413		4,979	566
175	Hamilton	3,264		3,830	566
176	Hamilton	2,695		3,262	567
177	Hamilton	2,095		2,662	567
178	Hamilton	1,717		2,283	566
179	Lawrence	2,841	3,000	3,283	442
180	Trenton	33,952		39,619	5,667
181	Ewing	11,341	3,000	13,073	1,732
182	Ewing	1,200		1,439	239
183	Hopewell Township	420		490	70
184	Hopewell Township	460		541	81
185	Pennington	872		1,113	241
186	Hopewell Township	310		353	43
187	Hopewell Township	360		412	52
188	Hopewell Township	410		524	114
189	Hopewell Township	310		524	214
190	Hopewell Township	360		398	38
191	Hopewell Township	260		749	489
192	Hopewell Township	360		1,375	1,015
193	Hopewell Boro	803		1,083	280
194	Hopewell Township	310		349	39
195	Hopewell Township	310		433	123
196	South Bound Brook	1,502		1,669	167
	STUDY AREA (TOTAL)	223,431	20,500	315,447	92,016

Sources: NJDOT - Route 1 Corridor Study, Route 130 Model; MSM Regional Council - Current Development Survey, 1989.

Table 6: Dwelling Units by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
1	Franklin	223		223	0
2	Franklin	138		138	0
3	Montgomery/Rocky Hill	653		653	0
4*	Montgomery	795		795	0
5	Montgomery	195		195	0
6	Montgomery	958		958	0
7	Montgomery	185		185	0
8*	Montgomery	121		1,721	1,600
9	Montgomery	383		383	0
10	Princeton Township	203		203	0
11	Princeton Township	365		365	0
12	Princeton Township	1,725		1,725	0
13	Princeton Township	807		807	0
14	Princeton Township/Boro	1,073	4,245	1,073	0
15	Princeton Boro	2,132	650	2,132	0
16	Princeton Township	727		727	0
17	Princeton Township	375		375	0
18	Princeton Township	449		449	0
19	Princeton Boro	576	915	576	0
20	Princeton Township	372	190	372	0
21	Franklin	28		28	0
22	Franklin	145		145	0
23	South Brunswick	1,288		1,288	0
24	South Brunswick	2,097		2,097	0
25	South Brunswick	425		425	0
26	South Brunswick	158		158	0
27	South Brunswick	423		423	0
28*	Plainsboro	551		3,351	2,800
29	West Windsor	250		250	0
30	West Windsor	20		20	0
31	West Windsor	8		8	0
32*	West Windsor	600		6,600	6,000
33	Plainsboro	39		39	0
34	Plainsboro	10		10	0
35	Plainsboro	6		6	0
36	Plainsboro	224		224	0
37	South Brunswick	42		42	0
38	South Brunswick	707		707	0
39	South Brunswick	82		82	0
40*	South Brunswick	611		6,611	6,000
41	South Brunswick	1,669		1,669	0
42	South Brunswick	178		178	0
43	Plainsboro	27		27	0
44	Plainsboro	992		992	0
45	Plainsboro	4,897		4,897	0
46	Plainsboro	87		87	0
47	West Windsor	466		466	0
48	West Windsor	781		781	0
49	West Windsor	484		484	0
50	West Windsor	80		80	0
51	West Windsor	392		392	0
52	East Windsor	2,642		2,642	0
53	East Windsor	108		108	0
54	West Windsor	420		420	0
55	Cranbury	6		6	0

Table 6: Dwelling Units by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
56	Cranbury	273		273	0
57	Cranbury	14		14	0
58	Cranbury	358		358	0
59	Cranbury	96		96	0
60*	South Brunswick	47		1,647	1,600
61	South Brunswick	288		288	0
62*	South Brunswick	137		2,937	2,800
63	Cranbury	34		34	0
64*	Cranbury	102		1,702	1,600
65	--	--		--	
66	Cranbury	15		15	0
67	Cranbury	15		15	0
68	--	--		--	
69	Lawrence	22		22	0
70	East Windsor	2,648		2,648	0
71*	East Windsor	56		56	0
72	East Windsor	1,033		1,033	0
73	East Windsor	1,169		1,169	0
74	Hightstown	691		691	0
75	Hightstown	1,127		1,127	0
76	East Windsor	381		381	0
77	East Windsor	176		176	0
78	East Windsor	327		327	0
79*	East Windsor	126		6,126	6,000
80	Lawrence	978		978	0
81	Hamilton	3,021		3,021	0
82	Lawrence	692		692	0
83*	Lawrence	627		3,427	2,800
84	West Windsor	5		5	0
85	West Windsor	790		790	0
86	West Windsor	130		130	0
87	West Windsor	10		10	0
88*	Franklin	627		627	0
89	Franklin	455		455	0
90	North Brunswick	2,668		2,668	0
91	South Brunswick	189		189	0
92*	North Brunswick	1,129		3,929	2,800
93	North Brunswick	2,399		2,399	0
94	North Brunswick	1,211		1,211	0
95	North Brunswick	3,311		3,311	0
96	Lawrence	898		898	0
97	Lawrence	2,558		2,558	0
98	Hillsborough	1,062		1,062	0
99*	Hillsborough	2,654		5,454	2,800
100	Hillsborough	1,167		1,167	0
101	Hillsborough	1,526		1,526	0
102	Hillsborough	1,017		1,017	0
103	Hillsborough	1,739		1,739	0
104	Millstone	180		180	0
105	Manville	1,679		1,679	0
106	Manville	1,055		1,055	0
107	Manville	1,134		1,134	0
108	Franklin	613		613	0
109	Franklin	342		342	0
110*	Franklin	310		3,110	2,800

Table 6: Dwelling Units by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
111	Franklin	601		601	0
112	Franklin	2,038		2,038	0
113	Franklin	1,957		1,957	0
114	Franklin	2,373		2,373	0
115	Franklin	2,309		2,309	0
116	Franklin	1,343		1,343	0
117	New Brunswick	1,637		3,578	1,941
118	New Brunswick	1,511		3,452	1,941
119	New Brunswick	817		2,758	1,941
120	New Brunswick	1,365	500	3,306	1,941
121	New Brunswick	1,165	500	3,106	1,941
122	New Brunswick	437		2,378	1,941
123	New Brunswick	831		2,772	1,941
124	New Brunswick	2,027		3,968	1,941
125	New Brunswick	1,015	5,500	2,955	1,940
126	New Brunswick	1,877	2,000	3,817	1,940
127	North Brunswick	7		7	0
128	North Brunswick	5		5	0
129	East Brunswick	2,672		2,672	0
130	South River	1,516		1,516	0
131	South River	1,174		1,174	0
132	South River	2,133		2,133	0
133	East Brunswick	838		838	0
134	Milltown	2,412		2,412	0
135	East Brunswick	853		853	0
136	East Brunswick	3,057		3,057	0
137	East Brunswick	1,627		1,627	0
138	East Brunswick	1,722		1,722	0
139	East Brunswick	1,166		1,166	0
140	East Brunswick	1,620		1,620	0
141	Spotswood	1,859		1,859	0
142	Spotswood	1,045		1,045	0
143	Helmetta	439		439	0
144	Monroe	4,252		4,252	0
145	Jamesburg	1,688		1,688	0
146	Monroe	3,553		3,553	0
147	Monroe	52		52	0
148	Monroe	262		262	0
149	Monroe	313		313	0
150	Monroe	149		149	0
151	Monroe	59		59	0
152	Washington	66		66	0
153	Washington	53		53	0
154	Washington	57		57	0
155	Washington	10		10	0
156	Washington	66		66	0
157*	Washington	124		1,724	1,600
158	Washington	351		351	0
159	Washington	554		554	0
160*	Washington	25		2,825	2,800
161	Washington	65		65	0
162	Washington	202		202	0
163	Washington	677		677	0
164	Hamilton	1,226		1,226	0
165	Hamilton	1,901		1,901	0

Table 6: Dwelling Units by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
166	Hamilton	104		104	0
167	Hamilton	336		336	0
168	Hamilton	1,211		1,211	0
169	Hamilton	642		642	0
170	Hamilton	1,545		1,545	0
171	Hamilton	2,091		2,091	0
172	Hamilton	3,102		3,102	0
173	Hamilton	1,973		1,973	0
174	Hamilton	4,413		4,413	0
175	Hamilton	3,264		3,264	0
176	Hamilton	2,695		2,695	0
177	Hamilton	2,095		2,095	0
178	Hamilton	1,717		1,717	0
179	Lawrence	2,841	3,000	2,841	0
180	Trenton	33,952		53,359	19,407
181	Ewing	11,341	3,000	11,341	0
182	Ewing	1,200		1,200	0
183	Hopewell Township	420		420	0
184*	Hopewell Township	460		3,260	2,800
185	Pennington	872		872	0
186	Hopewell Township	310		310	0
187	Hopewell Township	360		360	0
188	Hopewell Township	410		410	0
189*	Hopewell Township	310		310	0
190	Hopewell Township	360		360	0
191	Hopewell Township	260		260	0
192	Hopewell Township	360		360	0
193	Hopewell Boro	803		803	0
194*	Hopewell Township	310		310	0
195	Hopewell Township	310		310	0
196	South Bound Brook	1,502		1,502	0
200	Montgomery (W/C)	0		1,600	1,600
201	Franklin (W/C)	0		1,600	1,600
202	Hopewell (W/C)	0		1,600	1,600
203	Hopewell (W/C)	0		1,600	1,600
	STUDY AREA (TOTAL)	223,431	20,500	315,446	92,015

*Note: Constructs are located in these zones. Zones 200 - 203 are new zones created from sections of zones 4, 88, 189 and 194 for walking constructs.

Table 7: Dwelling Units by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
1	Franklin	223		223	0
2	Franklin	138		138	0
3	Montgomery/Rocky Hill	653		653	0
4*	Montgomery	795		795	0
5	Montgomery	195		195	0
6	Montgomery	958		958	0
7	Montgomery	185		185	0
8*	Montgomery	121		2,603	2,482
9	Montgomery	383		383	0
10	Princeton Township	203		203	0
11	Princeton Township	365		365	0
12	Princeton Township	1,725		1,725	0
13	Princeton Township	807		807	0
14	Princeton Township/Boro	1,073	4,245	1,073	0
15	Princeton Boro	2,132	650	2,132	0
16	Princeton Township	727		727	0
17	Princeton Township	375		375	0
18	Princeton Township	449		449	0
19	Princeton Boro	576	915	576	0
20	Princeton Township	372	190	372	0
21	Franklin	28		28	0
22	Franklin	145		145	0
23	South Brunswick	1,288		1,288	0
24	South Brunswick	2,097		2,097	0
25	South Brunswick	425		425	0
26	South Brunswick	158		158	0
27	South Brunswick	423		423	0
28*	Plainsboro	551		4,893	4,342
29	West Windsor	250		250	0
30	West Windsor	20		20	0
31	West Windsor	8		8	0
32*	West Windsor	600		9,928	9,328
33	Plainsboro	39		39	0
34	Plainsboro	10		10	0
35	Plainsboro	6		6	0
36	Plainsboro	224		224	0
37	South Brunswick	42		42	0
38	South Brunswick	707		707	0
39	South Brunswick	82		82	0
40*	South Brunswick	611		9,940	9,329
41	South Brunswick	1,669		1,669	0
42	South Brunswick	178		178	0
43	Plainsboro	27		27	0
44	Plainsboro	992		992	0
45	Plainsboro	4,897		4,897	0
46	Plainsboro	87		87	0
47	West Windsor	466		466	0
48	West Windsor	781		781	0
49	West Windsor	484		484	0
50	West Windsor	80		80	0
51	West Windsor	392		392	0
52	East Windsor	2,642		2,642	0
53	East Windsor	108		108	0
54	West Windsor	420		420	0
55	Cranbury	6		6	0

Table 7: Dwelling Units by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
56	Cranbury	273		273	0
57	Cranbury	14		14	0
58	Cranbury	358		358	0
59	Cranbury	96		96	0
60*	South Brunswick	47		2,528	2,481
61	South Brunswick	288		288	0
62*	South Brunswick	137		4,479	4,342
63	Cranbury	34		34	0
64*	Cranbury	102		2,583	2,481
65	---	---		---	
66	Cranbury	15		15	0
67	Cranbury	15		15	0
68	---	---		---	
69	Lawrence	22		22	0
70	East Windsor	2,648		2,648	0
71*	East Windsor	56		56	0
72	East Windsor	1,033		1,033	0
73	East Windsor	1,169		1,169	0
74	Hightstown	691		691	0
75	Hightstown	1,127		1,127	0
76	East Windsor	381		381	0
77	East Windsor	176		176	0
78	East Windsor	327		327	0
79*	East Windsor	126		9,454	9,328
80	Lawrence	978		978	0
81	Hamilton	3,021		3,021	0
82	Lawrence	692		692	0
83*	Lawrence	627		4,969	4,342
84	West Windsor	5		5	0
85	West Windsor	790		790	0
86	West Windsor	130		130	0
87	West Windsor	10		10	0
88*	Franklin	627		627	0
89	Franklin	455		455	0
90	North Brunswick	2,668		2,668	0
91	South Brunswick	189		189	0
92*	North Brunswick	1,129		5,471	4,342
93	North Brunswick	2,399		2,399	0
94	North Brunswick	1,211		1,211	0
95	North Brunswick	3,311		3,311	0
96	Lawrence	898		898	0
97	Lawrence	2,558		2,558	0
98	Hillsborough	1,062		1,062	0
99*	Hillsborough	2,654		6,996	4,342
100	Hillsborough	1,167		1,167	0
101	Hillsborough	1,526		1,526	0
102	Hillsborough	1,017		1,017	0
103	Hillsborough	1,739		1,739	0
104	Millstone	180		180	0
105	Manville	1,679		1,679	0
106	Manville	1,055		1,055	0
107	Manville	1,134		1,134	0
108	Franklin	613		613	0
109	Franklin	342		342	0
110*	Franklin	310		4,652	4,342

Table 7: Dwelling Units by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
111	Franklin	601		601	0
112	Franklin	2,038		2,038	0
113	Franklin	1,957		1,957	0
114	Franklin	2,373		2,373	0
115	Franklin	2,309		2,309	0
116	Franklin	1,343		1,343	0
117	New Brunswick	1,637		2,015	378
118	New Brunswick	1,511		1,889	378
119	New Brunswick	817		1,195	378
120	New Brunswick	1,365	500	1,743	378
121	New Brunswick	1,165	500	1,543	378
122	New Brunswick	437		815	378
123	New Brunswick	831		1,209	378
124	New Brunswick	2,027		2,405	378
125	New Brunswick	1,015	5,500	1,393	378
126	New Brunswick	1,877	2,000	2,254	377
127	North Brunswick	7		7	0
128	North Brunswick	5		5	0
129	East Brunswick	2,672		2,672	0
130	South River	1,516		1,516	0
131	South River	1,174		1,174	0
132	South River	2,133		2,133	0
133	East Brunswick	838		838	0
134	Milltown	2,412		2,412	0
135	East Brunswick	853		853	0
136	East Brunswick	3,057		3,057	0
137	East Brunswick	1,627		1,627	0
138	East Brunswick	1,722		1,722	0
139	East Brunswick	1,166		1,166	0
140	East Brunswick	1,620		1,620	0
141	Spotswood	1,859		1,859	0
142	Spotswood	1,045		1,045	0
143	Helmetta	439		439	0
144	Monroe	4,252		4,252	0
145	Jamesburg	1,688		1,688	0
146	Monroe	3,553		3,553	0
147	Monroe	52		52	0
148	Monroe	262		262	0
149	Monroe	313		313	0
150	Monroe	149		149	0
151	Monroe	59		59	0
152	Washington	66		66	0
153	Washington	53		53	0
154	Washington	57		57	0
155	Washington	10		10	0
156	Washington	66		66	0
157*	Washington	124		2,605	2,481
158	Washington	351		351	0
159	Washington	554		554	0
160*	Washington	25		4,367	4,342
161	Washington	65		65	0
162	Washington	202		202	0
163	Washington	677		677	0
164	Hamilton	1,226		1,226	0
165	Hamilton	1,901		1,901	0

Table 7: Dwelling Units by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Dwelling Units	Estimated University Students	2010 Dwelling Units	Dwelling Unit Growth
166	Hamilton	104		104	0
167	Hamilton	336		336	0
168	Hamilton	1,211		1,211	0
169	Hamilton	642		642	0
170	Hamilton	1,545		1,545	0
171	Hamilton	2,091		2,091	0
172	Hamilton	3,102		3,102	0
173	Hamilton	1,973		1,973	0
174	Hamilton	4,413		4,413	0
175	Hamilton	3,264		3,264	0
176	Hamilton	2,695		2,695	0
177	Hamilton	2,095		2,095	0
178	Hamilton	1,717		1,717	0
179	Lawrence	2,841	3,000	2,841	0
180	Trenton	33,952		39,619	5,667
181	Ewing	11,341	3,000	11,341	0
182	Ewing	1,200		1,200	0
183	Hopewell Township	420		420	0
184*	Hopewell Township	460		4,801	4,341
185	Pennington	872		872	0
186	Hopewell Township	310		310	0
187	Hopewell Township	360		360	0
188	Hopewell Township	410		410	0
189*	Hopewell Township	310		310	0
190	Hopewell Township	360		360	0
191	Hopewell Township	260		260	0
192	Hopewell Township	360		360	0
193	Hopewell Boro	803		803	0
194*	Hopewell Township	310		310	0
195	Hopewell Township	310		310	0
196	South Bound Brook	1,502		1,502	0
200	Montgomery (W/C)	0		2,481	2,481
201	Franklin (W/C)	0		2,481	2,481
202	Hopewell (W/C)	0		2,481	2,481
203	Hopewell (W/C)	0		2,481	2,481
	STUDY AREA (TOTAL)	223,431	20,500	315,446	92,015

*Note: Constructs are located in these zones. Zones 200 - 203 are new zones created from sections of zones 4, 88, 189 and 194 for walking constructs.

Table 8: Employment Growth Assumptions - 1988, 2010 Trend, 2010 Scenarios

	Total Employment 1988	Total Employment 2010	Employment Growth 1988-2010	Growth in Constructs Scenario 1	Growth in Cities Scenario 1	Growth in Constructs Scenario 2	Growth in Cities Scenario 2
Cranbury Twp.	6,703	7,676	973	230		340	
East Brunswick Twp.	25,319	32,762	7,443				
Helmetta Boro	165	225	60				
Jamesburg Boro	2,082	2,703	621				
Milltown Boro	2,657	2,857	200				
Monroe Twp.	1,942	12,304	10,362				
New Brunswick City	35,252	37,015	1,763		32,971		1,763
North Brunswick Twp.	15,775	34,332	18,557	9,500		13,519	
Plainsboro Twp.	6,999	33,549	26,550	9,500		13,519	
South Brunswick Twp.	12,686	44,063	31,377	22,830		32,429	
South River Boro	2,237	3,252	1,015				
Spotswood Boro	2,174	2,962	788				
Franklin Twp.	23,942	26,610	2,668	9,730		13,859	
Hillsborough Twp.	4,380	10,650	6,270	9,730		13,519	
Manville Boro	1,279	3,630	2,351				
Millstone Boro	54	210	156				
Montgomery Twp.	7,454	10,260	2,806	230		680	
Rocky Hill Boro	526	850	324				
So. Bound Brook Boro	495	1,080	585				
East Windsor Twp.	8,463	13,500	5,037	13,100		18,568	
Ewing Twp.	28,660	33,740	5,080				
Hamilton Twp.	27,925	34,290	6,365				
Hightstown Boro	2,855	4,680	1,825				
Hopewell Boro	539	680	141				
Hopewell Twp.	2,928	4,140	1,212	9,960		14,199	
Lawrence Twp.	21,301	29,350	8,049	9,000		12,705	
Pennington Boro	1,636	3,550	1,914				
Princeton Boro/ Princeton Twp.	22,262	30,100	7,838				
Trenton City	54,847	69,900	15,053		32,970		15,053
Washington Twp.	2,100	3,940	1,840	9,730		13,859	
West Windsor Twp.	12,162	25,520	13,358	13,100		18,569	
STUDY AREA (TOTAL)	337,799	520,380	182,581	116,640	65,941	165,765	16,816

Sources: MSM Regional Council derived these estimates using NJ Dept. of Labor Covered Employment figures and Middlesex, Somerset, Mercer Counties' Employment Projections.

Table 9: Employment by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Non-Retail Employment	1980/1986* Retail Employment	1988 Non-Retail Employment	1988 Retail Employment
1	Franklin	13	0	13	0
2	Franklin	0	0	0	0
3	Montgomery/Rocky Hill	1,680	507	1,943	550
4	Montgomery	592	0	304	5
5	Montgomery	184	0	200	30
6	Montgomery	2,574	0	4,644	0
7	Montgomery	44	0	44	0
8	Montgomery	237	0	250	10
9	Montgomery	0	0	0	0
10	Princeton Township	73	0	73	0
11	Princeton Township	1,219	0	1,719	25
12	Princeton Township	630	495	1,230	650
13	Princeton Township	84	0	84	0
14	Princeton Township/Boro	6,768	0	9,224	100
15	Princeton Boro	5,030		6,958	772
16	Princeton Township	343	0	343	50
17	Princeton Township	409	0	409	0
18	Princeton Township	197	0	200	0
19	Princeton Boro	159		200	25
20	Princeton Township	175	0	175	25
21	Franklin	281	0	281	40
22	Franklin	53	200	53	160
23	South Brunswick	118	50	150	205
24	South Brunswick	38	125	38	125
25	South Brunswick	11	0	0	130
26	South Brunswick	227	0	227	0
27	South Brunswick	27	0	30	30
28	Plainsboro	60	0	60	685
29	West Windsor	1,468	0	1,500	40
30	West Windsor	749	0	949	0
31	West Windsor	0	0	0	0
32	West Windsor	772	138	1,172	175
33	Plainsboro	980	0	980	0
34	Plainsboro	1,500	0	750	0
35	Plainsboro	3,460	0	3,569	0
36	Plainsboro	210	0	210	0
37	South Brunswick	874	0	2,606	0
38	South Brunswick	565	0	0	184
39	South Brunswick	481	0	0	0
40	South Brunswick	353	22	631	22
41	South Brunswick	1,548	0	1,895	84
42	South Brunswick	1,544	0	3,276	0
43	Plainsboro	0	0	0	0
44	Plainsboro	51	0	81	350
45	Plainsboro	24	0	147	117
46	Plainsboro	0	0	50	0
47	West Windsor	506	0	506	0
48	West Windsor	183	0	183	0
49	West Windsor	285	0	285	0
50	West Windsor	529	0	579	0
51	West Windsor	34	0	34	0
52	East Windsor	0	82	0	82
53	East Windsor	3,398	0	3,609	0
54	West Windsor	12	0	112	0
55	Cranbury	0	0	0	0

Table 9: Employment by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Non-Retail Employment	1980/1986* Retail Employment	1988 Non-Retail Employment	1988 Retail Employment
56	Cranbury	58	0	148	0
57	Cranbury	0	0	0	0
58	Cranbury	518	0	0	25
59	Cranbury	0	0	0	0
60	South Brunswick	0	0	0	0
61	South Brunswick	1,459	0	782	0
62	South Brunswick	1,742	0	2,035	0
63	Cranbury	0	0	783	0
64	Cranbury	383	0	3,101	25
65	--	--	--	--	--
66	Cranbury	431	0	2,621	0
67	Cranbury	1,386	0	0	0
68	--	--	--	--	
69	Lawrence	107	329	107	1,150
70	East Windsor	80	214	587	214
71	East Windsor	1,146	0	1,222	0
72	East Windsor	23	0	100	0
73	East Windsor	411	656	722	552
74	Hightstown	1,185	0	1,742	0
75	Hightstown	1,377	0	313	800
76	East Windsor	241	0	684	0
77	East Windsor	0	0	0	0
78	East Windsor	31	0	0	0
79	East Windsor	630	0	691	0
80	Lawrence	1,330	50	1,730	350
81	Hamilton	1,957	0	2,213	0
82	Lawrence	615	0	2,444	0
83	Lawrence	608	2,361	1,625	2,561
84	West Windsor	6	0	56	0
85	West Windsor	396	0	796	800
86	West Windsor	2,704	0	4,940	25
87	West Windsor	37	0	0	10
88	Franklin	45	62	145	62
89	Franklin	73	50	73	50
90	North Brunswick	3,610	0	1,630	487
91	South Brunswick	473	0	236	0
92	North Brunswick	275	0	838	0
93	North Brunswick	1,290	0	585	72
94	North Brunswick	735	0	997	112
95	North Brunswick	993	625	9,106	1,498
96	Lawrence	4,250	0	4,205	0
97	Lawrence	87	0	110	25
98	Hillsborough	428	100	428	100
99	Hillsborough	198	67	381	188
100	Hillsborough	235	62	790	62
101	Hillsborough	84	33	267	155
102	Hillsborough	286	303	469	425
103	Hillsborough	974	141	974	141
104	Millstone	30	19	35	19
105	Manville	723	200	519	209
106	Manville	192	25	192	33
107	Manville	285	33	285	41
108	Franklin	8,684	414	9,834	414
109	Franklin	2905-p	270-p	2,440	213
110	Franklin	1,612	162	2,428	162

Table 9: Employment by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Non-Retail Employment	1980/1986* Retail Employment	1988 Non-Retail Employment	1988 Retail Employment
111	Franklin	612	89	612	89
112	Franklin	1,541	171	1,541	171
113	Franklin	499	92	499	92
114	Franklin	700	372	700	372
115	Franklin	1,643	143	1,643	143
116	Franklin	1,593	119	1,593	119
117	New Brunswick	3,523	189	3,332	189
118	New Brunswick	558	62	367	62
119	New Brunswick	1,369	63	1,177	63
120	New Brunswick	108	47	108	47
121	New Brunswick	1,675	85	1,483	107
122	New Brunswick	6,837	319	6,645	319
123	New Brunswick	3,789	273	3,597	273
124	New Brunswick	2,428	95	2,236	95
125	New Brunswick	14,874	631	10,111	631
126	New Brunswick	3,530	1,071	3,339	1,071
127	North Brunswick	7176-p	552-p	150	0
128	North Brunswick	585-p	72-p	300	0
129	East Brunswick	3,644	1,815	4,811	1,815
130	South River	1,288	180	1,122	217
131	South River	371	82	288	119
132	South River	487	50	404	87
133	East Brunswick	4,958	1,097	5,537	1,097
134	Milltown	2,083	304	2,415	242
135	East Brunswick	86	44	86	44
136	East Brunswick	1,829	488	1,829	488
137	East Brunswick	689	206	689	206
138	East Brunswick	319	313	898	313
139	East Brunswick	2,028	3,149	2,028	3,149
140	East Brunswick	1,437	892	1,437	892
141	Spotswood	756	118	784	183
142	Spotswood	907	206	936	271
143	Helmetta	52	11	154	11
144	Monroe	0	0	0	0
145	Jamesburg	1,304	0	1,649	433
146	Monroe	1,612	0	1,542	0
147	Monroe	0	0	0	0
148	Monroe	0	0	0	0
149	Monroe	469	0	400	0
150	Monroe	0	0	0	0
151	Monroe	0	0	0	0
152	Washington	0	0	50	75
153	Washington	0	0	50	0
154	Washington	0	0	50	0
155	Washington	0	0	0	0
156	Washington	0	0	50	50
157	Washington	0	0	50	50
158	Washington	0	1,882	50	25
159	Washington	0	0	500	25
160	Washington	0	0	0	0
161	Washington	0	0	225	25
162	Washington	0	0	350	100
163	Washington	0	0	225	150
164	Hamilton	0	0	0	50
165	Hamilton	0	196	270	196

Table 9: Employment by Zone - 1980/1986, 1988

Zone	Municipality	1980/1986* Non-Retail Employment	1980/1986* Retail Employment	1988 Non-Retail Employment	1988 Retail Employment
166	Hamilton	1,133	0	1,133	50
167	Hamilton	440	0	440	0
168	Hamilton	0	0	270	100
169	Hamilton	426	0	426	0
170	Hamilton	327	250	597	250
171	Hamilton	730	466	730	550
172	Hamilton	2,423	1,221	2,576	1,221
173	Hamilton	583	1,166	853	1,893
174	Hamilton	2,629	124	2,763	124
175	Hamilton	654	523	523	523
176	Hamilton	2,504	0	2,720	0
177	Hamilton	3,288	538	3,288	538
178	Hamilton	8,671	128	3,500	128
179	Lawrence			4,463	2,531
180	Trenton			51,442	3,405
181	Ewing			24,952	2,458
182	Ewing			1,200	50
183	Hopewell Township			335	0
184	Hopewell Township			370	0
185	Pennington			1,596	40
186	Hopewell Township			700	98
187	Hopewell Township			300	0
188	Hopewell Township			250	0
189	Hopewell Township			500	30
190	Hopewell Township			0	0
191	Hopewell Township			345	0
192	Hopewell Township			0	0
193	Hopewell Boro			499	40
194	Hopewell Township			0	0
195	Hopewell Township			0	0
196	South Bound Brook			426	69
	STUDY AREA (TOTAL)			293,894	43,905

*Note: Zones 1 - 97 have a 1980 base; zones 98 - 178 have a 1986 base.

Sources: NJDOT - Route 1 Corridor Study, North New Jersey Model, Route 130 Model; MSM Regional Council - Current Development Survey, 1987, 1988; US Census Bureau - 1987 Census of Retail Trade.

Table 10: Non-Retail and Retail Employment by Zone - 2010 Trend.

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
1	Franklin	13	0	13	0	0	0
2	Franklin	0	0	0	0	0	0
3	Montgomery/Rocky Hill	1,943	550	2,841	677	898	127
4	Montgomery	304	5	304	5	0	0
5	Montgomery	200	30	826	157	626	127
6	Montgomery	4,644	0	5,026	173	382	173
7	Montgomery	44	0	44	0	0	0
8	Montgomery	250	10	920	137	670	127
9	Montgomery	0	0	0	0	0	0
10	Princeton Township	73	0	73	0	0	0
11	Princeton Township	1,719	25	4,115	25	2,396	0
12	Princeton Township	1,230	650	3,626	650	2,396	0
13	Princeton Township	84	0	84	0	0	0
14	Princeton Township/Boro	9,224	100	9,224	100	0	0
15	Princeton Boro	6,958	772	7,419	962	461	190
16	Princeton Township	343	50	343	50	0	0
17	Princeton Township	409	0	409	0	0	0
18	Princeton Township	200	0	200	0	0	0
19	Princeton Boro	200	25	200	25	0	0
20	Princeton Township	175	25	2,570	25	2,395	0
21	Franklin	281	40	281	40	0	0
22	Franklin	53	160	53	160	0	0
23	South Brunswick	150	205	303	294	153	89
24	South Brunswick	38	125	38	138	0	13
25	South Brunswick	0	130	0	686	0	556
26	South Brunswick	227	0	524	0	297	0
27	South Brunswick	30	30	30	30	0	0
28	Plainsboro	60	685	10,257	745	10,197	60
29	West Windsor	1,500	40	1,500	40	0	0
30	West Windsor	949	0	1,322	0	373	0
31	West Windsor	0	0	0	0	0	0
32	West Windsor	1,172	175	2,080	175	908	0
33	Plainsboro	980	0	3,883	0	2,903	0
34	Plainsboro	750	0	8,712	60	7,962	60
35	Plainsboro	3,569	0	5,641	60	2,072	60
36	Plainsboro	210	0	210	0	0	0
37	South Brunswick	2,606	0	6,549	0	3,943	0
38	South Brunswick	0	184	0	184	0	0
39	South Brunswick	0	0	0	0	0	0
40	South Brunswick	631	22	8,985	366	8,354	344
41	South Brunswick	1,895	84	2,145	84	250	0
42	South Brunswick	3,276	0	4,200	19	924	19
43	Plainsboro	0	0	0	0	0	0
44	Plainsboro	81	350	2,258	410	2,177	60
45	Plainsboro	147	117	1,086	177	939	60
46	Plainsboro	50	0	50	0	0	0
47	West Windsor	506	0	506	700	0	700
48	West Windsor	183	0	183	0	0	0
49	West Windsor	285	0	285	0	0	0
50	West Windsor	579	0	579	0	0	0
51	West Windsor	34	0	34	0	0	0
52	East Windsor	0	82	0	82	0	0
53	East Windsor	3,609	0	4,009	0	400	0
54	West Windsor	112	0	112	0	0	0
55	Cranbury	0	0	0	0	0	0

Table 10: Non-Retail and Retail Employment by Zone - 2010 Trend.

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
56	Cranbury	148	0	148	0	0	0
57	Cranbury	0	0	0	0	0	0
58	Cranbury	0	25	0	25	0	0
59	Cranbury	0	0	0	0	0	0
60	South Brunswick	0	0	0	0	0	0
61	South Brunswick	782	0	3,225	0	2,443	0
62	South Brunswick	2,035	0	15,093	0	13,058	0
63	Cranbury	783	0	1,490	0	707	0
64	Cranbury	3,101	25	3,101	291	0	266
65	--					0	0
66	Cranbury	2,621	0	2,621	0	0	0
67	Cranbury	0	0	0	0	0	0
68	--					0	0
69	Lawrence	107	1,150	544	1,150	437	0
70	East Windsor	587	214	854	214	267	0
71	East Windsor	1,222	0	1,580	0	358	0
72	East Windsor	100	0	100	400	0	400
73	East Windsor	722	552	722	677	0	125
74	Hightstown	1,742	0	2,554	100	812	100
75	Hightstown	313	800	1,126	900	813	100
76	East Windsor	684	0	3,246	0	2,562	0
77	East Windsor	0	0	0	30	0	30
78	East Windsor	0	0	0	0	0	0
79	East Windsor	691	0	1,586	0	895	0
80	Lawrence	1,730	350	3,614	393	1,884	43
81	Hamilton	2,213	0	2,466	93	253	93
82	Lawrence	2,444	0	3,526	0	1,082	0
83	Lawrence	1,625	2,561	2,723	3,081	1,098	520
84	West Windsor	56	0	3,646	0	3,590	0
85	West Windsor	796	800	796	1,178	0	378
86	West Windsor	4,940	25	12,349	25	7,409	0
87	West Windsor	0	10	0	10	0	0
88	Franklin	145	62	145	346	0	284
89	Franklin	73	50	73	50	0	0
90	North Brunswick	1,630	487	3,369	687	1,739	200
91	South Brunswick	236	0	1,170	0	934	0
92	North Brunswick	838	0	7,907	298	7,069	298
93	North Brunswick	585	72	2,121	272	1,536	200
94	North Brunswick	997	112	2,534	312	1,537	200
95	North Brunswick	9,106	1,498	10,643	1,698	1,537	200
96	Lawrence	4,205	0	6,579	0	2,374	0
97	Lawrence	110	25	230	25	120	0
98	Hillsborough	428	100	428	208	0	108
99	Hillsborough	381	188	924	228	543	40
100	Hillsborough	790	62	3,361	62	2,571	0
101	Hillsborough	267	155	1,248	195	981	40
102	Hillsborough	469	425	1,073	465	604	40
103	Hillsborough	974	141	2,277	181	1,303	40
104	Millstone	35	19	191	19	156	0
105	Manville	519	209	1,302	209	783	0
106	Manville	192	33	976	33	784	0
107	Manville	285	41	1,069	41	784	0
108	Franklin	9,834	414	10,090	414	256	0
109	Franklin	2,440	213	2,977	213	537	0
110	Franklin	2,428	162	4,001	180	1,573	18

Table 10: Non-Retail and Retail Employment by Zone - 2010 Trend.

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
111	Franklin	612	89	612	89	0	0
112	Franklin	1,541	171	1,541	171	0	0
113	Franklin	499	92	499	92	0	0
114	Franklin	700	372	700	372	0	0
115	Franklin	1,643	143	1,643	143	0	0
116	Franklin	1,593	119	1,593	119	0	0
117	New Brunswick	3,332	189	3,805	189	473	0
118	New Brunswick	367	62	367	62	0	0
119	New Brunswick	1,177	63	1,411	63	234	0
120	New Brunswick	108	47	108	47	0	0
121	New Brunswick	1,483	107	1,483	185	0	78
122	New Brunswick	6,645	319	6,645	397	0	78
123	New Brunswick	3,597	273	4,497	273	900	0
124	New Brunswick	2,236	95	2,236	95	0	0
125	New Brunswick	10,111	631	10,111	631	0	0
126	New Brunswick	3,339	1,071	3,339	1,071	0	0
127	North Brunswick	150	0	2,254	200	2,104	200
128	North Brunswick	300	0	1,837	200	1,537	200
129	East Brunswick	4,811	1,815	5,746	2,586	935	771
130	South River	1,122	217	1,460	217	338	0
131	South River	288	119	626	119	338	0
132	South River	404	87	743	87	339	0
133	East Brunswick	5,537	1,097	6,971	1,865	1,434	768
134	Milltown	2,415	242	2,615	242	200	0
135	East Brunswick	86	44	86	44	0	0
136	East Brunswick	1,829	488	2,583	1,332	754	844
137	East Brunswick	689	206	689	206	0	0
138	East Brunswick	898	313	1,005	313	107	0
139	East Brunswick	2,028	3,149	2,090	3,313	62	164
140	East Brunswick	1,437	892	3,041	892	1,604	0
141	Spotswood	784	183	1,178	183	394	0
142	Spotswood	936	271	1,330	271	394	0
143	Helmetta	154	11	214	11	60	0
144	Monroe	0	0	1,269	775	1,269	775
145	Jamesburg	1,649	433	2,270	433	621	0
146	Monroe	1,542	0	3,008	840	1,466	840
147	Monroe	0	0	0	0	0	0
148	Monroe	0	0	1,635	776	1,635	776
149	Monroe	400	0	1,563	0	1,163	0
150	Monroe	0	0	1,275	0	1,275	0
151	Monroe	0	0	1,163	0	1,163	0
152	Washington	50	75	50	75	0	0
153	Washington	50	0	50	0	0	0
154	Washington	50	0	50	0	0	0
155	Washington	0	0	0	0	0	0
156	Washington	50	50	50	50	0	0
157	Washington	50	50	50	50	0	0
158	Washington	50	25	50	25	0	0
159	Washington	500	25	500	25	0	0
160	Washington	0	0	1,521	0	1,521	0
161	Washington	225	25	225	25	0	0
162	Washington	350	100	386	100	36	0
163	Washington	225	150	408	250	183	100
164	Hamilton	0	50	40	103	40	53
165	Hamilton	270	196	270	196	0	0

Table 10: Non-Retail and Retail Employment by Zone - 2010 Trend.

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
166	Hamilton	1,133	50	1,205	50	72	0
167	Hamilton	440	0	440	0	0	0
168	Hamilton	270	100	270	194	0	94
169	Hamilton	426	0	426	0	0	0
170	Hamilton	597	250	4,032	267	3,435	17
171	Hamilton	730	550	730	550	0	0
172	Hamilton	2,576	1,221	3,657	1,270	1,081	49
173	Hamilton	853	1,893	853	1,933	0	40
174	Hamilton	2,763	124	3,302	134	539	10
175	Hamilton	523	523	523	544	0	21
176	Hamilton	2,720	0	2,720	510	0	510
177	Hamilton	3,288	538	3,288	570	0	32
178	Hamilton	3,500	128	3,500	154	0	26
179	Lawrence	4,463	2,531	4,954	2,531	491	0
180	Trenton	51,442	3,405	65,644	4,256	14,202	851
181	Ewing	24,952	2,458	29,749	2,741	4,797	283
182	Ewing	1,200	50	1,200	50	0	0
183	Hopewell Township	335	0	335	200	0	200
184	Hopewell Township	370	0	585	0	215	0
185	Pennington	1,596	40	3,510	40	1,914	0
186	Hopewell Township	700	98	700	98	0	0
187	Hopewell Township	300	0	300	0	0	0
188	Hopewell Township	250	0	250	0	0	0
189	Hopewell Township	500	30	1,297	30	797	0
190	Hopewell Township	0	0	0	0	0	0
191	Hopewell Township	345	0	345	0	0	0
192	Hopewell Township	0	0	0	0	0	0
193	Hopewell Boro	499	40	614	66	115	26
194	Hopewell Township	0	0	0	0	0	0
195	Hopewell Township	0	0	0	0	0	0
196	South Bound Brook	426	69	1,011	69	585	0
	STUDY AREA (TOTAL)	293,894	43,905	462,181	58,199	168,287	14,294

Sources: NJDOT - Route 1 Corridor Study, Route 130 Model; MSM Regional Council - Current Development Survey, 1989.

Table 11: Non-Retail and Retail Employment by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
1	Franklin	13	0	13	0	0	0
2	Franklin	0	0	0	0	0	0
3	Montgomery/Rocky Hill	1,943	550	1,943	550	0	0
4*	Montgomery	304	5	304	5	0	0
5	Montgomery	200	30	200	30	0	0
6	Montgomery	4,644	0	4,644	0	0	0
7	Montgomery	44	0	44	0	0	0
8*	Montgomery	250	10	280	210	30	200
9	Montgomery	0	0	0	0	0	0
10	Princeton Township	73	0	73	0	0	0
11	Princeton Township	1,719	25	1,719	25	0	0
12	Princeton Township	1,230	650	1,230	650	0	0
13	Princeton Township	84	0	84	0	0	0
14	Princeton Township/Boro	9,224	100	9,224	100	0	0
15	Princeton Boro	6,958	772	6,958	772	0	0
16	Princeton Township	343	50	343	50	0	0
17	Princeton Township	409	0	409	0	0	0
18	Princeton Township	200	0	200	0	0	0
19	Princeton Boro	200	25	200	25	0	0
20	Princeton Township	175	25	175	25	0	0
21	Franklin	281	40	281	40	0	0
22	Franklin	53	160	53	160	0	0
23	South Brunswick	150	205	150	205	0	0
24	South Brunswick	38	125	38	125	0	0
25	South Brunswick	0	130	0	130	0	0
26	South Brunswick	227	0	227	0	0	0
27	South Brunswick	30	30	30	30	0	0
28*	Plainsboro	60	685	9,060	1,185	9,000	500
29	West Windsor	1,500	40	1,500	40	0	0
30	West Windsor	949	0	949	0	0	0
31	West Windsor	0	0	0	0	0	0
32*	West Windsor	1,172	175	13,172	1,275	12,000	1,100
33	Plainsboro	980	0	980	0	0	0
34	Plainsboro	750	0	750	0	0	0
35	Plainsboro	3,569	0	3,569	0	0	0
36	Plainsboro	210	0	210	0	0	0
37	South Brunswick	2,606	0	2,606	0	0	0
38	South Brunswick	0	184	0	184	0	0
39	South Brunswick	0	0	0	0	0	0
40*	South Brunswick	631	22	12,631	1,122	12,000	1,100
41	South Brunswick	1,895	84	1,895	84	0	0
42	South Brunswick	3,276	0	3,276	0	0	0
43	Plainsboro	0	0	0	0	0	0
44	Plainsboro	81	350	81	350	0	0
45	Plainsboro	147	117	147	117	0	0
46	Plainsboro	50	0	50	0	0	0
47	West Windsor	506	0	506	0	0	0
48	West Windsor	183	0	183	0	0	0
49	West Windsor	285	0	285	0	0	0
50	West Windsor	579	0	579	0	0	0
51	West Windsor	34	0	34	0	0	0
52	East Windsor	0	82	0	82	0	0
53	East Windsor	3,609	0	3,609	0	0	0
54	West Windsor	112	0	112	0	0	0
55	Cranbury	0	0	0	0	0	0

Table 11: Non-Retail and Retail Employment by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
56	Cranbury	148	0	148	0	0	0
57	Cranbury	0	0	0	0	0	0
58	Cranbury	0	25	0	25	0	0
59	Cranbury	0	0	0	0	0	0
60*	South Brunswick	0	0	30	200	30	200
61	South Brunswick	782	0	782	0	0	0
62*	South Brunswick	2,035	0	11,035	500	9,000	500
63	Cranbury	783	0	783	0	0	0
64*	Cranbury	3,101	25	3,131	225	30	200
65	--						
66	Cranbury	2,621	0	2,621	0	0	0
67	Cranbury	0	0	0	0	0	0
68	--						
69	Lawrence	107	1,150	107	1,150	0	0
70	East Windsor	587	214	587	214	0	0
71*	East Windsor	1,222	0	7,222	550	6,000	550
72	East Windsor	100	0	100	0	0	0
73	East Windsor	722	552	722	552	0	0
74	Hightstown	1,742	0	1,742	0	0	0
75	Hightstown	313	800	313	800	0	0
76	East Windsor	684	0	684	0	0	0
77	East Windsor	0	0	0	0	0	0
78	East Windsor	0	0	0	0	0	0
79*	East Windsor	691	0	6,691	550	6,000	550
80	Lawrence	1,730	350	1,730	350	0	0
81	Hamilton	2,213	0	2,213	0	0	0
82	Lawrence	2,444	0	2,444	0	0	0
83*	Lawrence	1,625	2,561	10,625	2,561	9,000	0
84	West Windsor	56	0	56	0	0	0
85	West Windsor	796	800	796	800	0	0
86	West Windsor	4,940	25	4,940	25	0	0
87	West Windsor	0	10	0	10	0	0
88*	Franklin	145	62	145	62	0	0
89	Franklin	73	50	73	50	0	0
90	North Brunswick	1,630	487	1,630	487	0	0
91	South Brunswick	236	0	236	0	0	0
92*	North Brunswick	838	0	9,838	500	9,000	500
93	North Brunswick	585	72	585	72	0	0
94	North Brunswick	997	112	997	112	0	0
95	North Brunswick	9,106	1,498	9,106	1,498	0	0
96	Lawrence	4,205	0	4,205	0	0	0
97	Lawrence	110	25	110	25	0	0
98	Hillsborough	428	100	428	100	0	0
99*	Hillsborough	381	188	9,381	688	9,000	500
100	Hillsborough	790	62	790	62	0	0
101	Hillsborough	267	155	267	155	0	0
102	Hillsborough	469	425	469	425	0	0
103	Hillsborough	974	141	974	141	0	0
104	Millstone	35	19	35	19	0	0
105	Manville	519	209	519	209	0	0
106	Manville	192	33	192	33	0	0
107	Manville	285	41	285	41	0	0
108	Franklin	9,834	414	9,834	414	0	0
109	Franklin	2,440	213	2,440	213	0	0
110*	Franklin	2,428	162	11,428	662	9,000	500

Table 11: Non-Retail and Retail Employment by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
111	Franklin	612	89	612	89	0	0
112	Franklin	1,541	171	1,541	171	0	0
113	Franklin	499	92	499	92	0	0
114	Franklin	700	372	700	372	0	0
115	Franklin	1,643	143	1,643	143	0	0
116	Franklin	1,593	119	1,593	119	0	0
117	New Brunswick	3,332	189	6,335	484	3,003	295
118	New Brunswick	367	62	3,370	357	3,003	295
119	New Brunswick	1,177	63	4,180	358	3,003	295
120	New Brunswick	108	47	3,111	342	3,003	295
121	New Brunswick	1,483	107	4,485	402	3,002	295
122	New Brunswick	6,645	319	9,647	614	3,002	295
123	New Brunswick	3,597	273	6,599	568	3,002	295
124	New Brunswick	2,236	95	5,238	389	3,002	294
125	New Brunswick	10,111	631	13,113	925	3,002	294
126	New Brunswick	3,339	1,071	6,341	1,365	3,002	294
127	North Brunswick	150	0	150	0	0	0
128	North Brunswick	300	0	300	0	0	0
129	East Brunswick	4,811	1,815	4,811	1,815	0	0
130	South River	1,122	217	1,122	217	0	0
131	South River	288	119	288	119	0	0
132	South River	404	87	404	87	0	0
133	East Brunswick	5,537	1,097	5,537	1,097	0	0
134	Milltown	2,415	242	2,415	242	0	0
135	East Brunswick	86	44	86	44	0	0
136	East Brunswick	1,829	488	1,829	488	0	0
137	East Brunswick	689	206	689	206	0	0
138	East Brunswick	898	313	898	313	0	0
139	East Brunswick	2,028	3,149	2,028	3,149	0	0
140	East Brunswick	1,437	892	1,437	892	0	0
141	Spotswood	784	183	784	183	0	0
142	Spotswood	936	271	936	271	0	0
143	Helmetta	154	11	154	11	0	0
144	Monroe	0	0	0	0	0	0
145	Jamesburg	1,649	433	1,649	433	0	0
146	Monroe	1,542	0	1,542	0	0	0
147	Monroe	0	0	0	0	0	0
148	Monroe	0	0	0	0	0	0
149	Monroe	400	0	400	0	0	0
150	Monroe	0	0	0	0	0	0
151	Monroe	0	0	0	0	0	0
152	Washington	50	75	50	75	0	0
153	Washington	50	0	50	0	0	0
154	Washington	50	0	50	0	0	0
155	Washington	0	0	0	0	0	0
156	Washington	50	50	50	50	0	0
157*	Washington	50	50	80	250	30	200
158	Washington	50	25	50	25	0	0
159	Washington	500	25	500	25	0	0
160*	Washington	0	0	9,000	500	9,000	500
161	Washington	225	25	225	25	0	0
162	Washington	350	100	350	100	0	0
163	Washington	225	150	225	150	0	0
164	Hamilton	0	50	0	50	0	0
165	Hamilton	270	196	270	196	0	0

Table 11: Non-Retail and Retail Employment by Zone - 2010 Scenario No.1

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
166	Hamilton	1,133	50	1,133	50	0	0
167	Hamilton	440	0	440	0	0	0
168	Hamilton	270	100	270	100	0	0
169	Hamilton	426	0	426	0	0	0
170	Hamilton	597	250	597	250	0	0
171	Hamilton	730	550	730	550	0	0
172	Hamilton	2,576	1,221	2,576	1,221	0	0
173	Hamilton	853	1,893	853	1,893	0	0
174	Hamilton	2,763	124	2,763	124	0	0
175	Hamilton	523	523	523	523	0	0
176	Hamilton	2,720	0	2,720	0	0	0
177	Hamilton	3,288	538	3,288	538	0	0
178	Hamilton	3,500	128	3,500	128	0	0
179	Lawrence	4,463	2,531	4,463	2,531	0	0
180	Trenton	51,442	3,405	81,465	6,352	30,023	2,947
181	Ewing	24,952	2,458	24,952	2,458	0	0
182	Ewing	1,200	50	1,200	50	0	0
183	Hopewell Township	335	0	335	0	0	0
184*	Hopewell Township	370	0	9,370	500	9,000	500
185	Pennington	1,596	40	1,596	40	0	0
186	Hopewell Township	700	98	700	98	0	0
187	Hopewell Township	300	0	300	0	0	0
188	Hopewell Township	250	0	250	0	0	0
189*	Hopewell Township	500	30	500	30	0	0
190	Hopewell Township	0	0	0	0	0	0
191	Hopewell Township	345	0	345	0	0	0
192	Hopewell Township	0	0	0	0	0	0
193	Hopewell Boro	499	40	499	40	0	0
194*	Hopewell Township	0	0	0	0	0	0
195	Hopewell Township	0	0	0	0	0	0
196	South Bound Brook	426	69	426	69	0	0
200	Montgomery (W/C)	0	0	30	200	30	200
201	Franklin (W/C)	0	0	30	200	30	200
202	Hopewell (W/C)	0	0	30	200	30	200
203	Hopewell (W/C)	0	0	30	200	30	200
	STUDY AREA (TOTAL)	293,894	43,905	462,181	58,199	168,287	14,294

*Note: Constructs are located in these zones. Zones 200 - 203 are new zones created from sections of zones 4, 88, 189 and 194 for walking constructs.

Table 12: Non-Retail and Retail Employment by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
1	Franklin	13	0	13	0	0	0
2	Franklin	0	0	0	0	0	0
3	Montgomery/Rocky Hill	1,943	550	1,943	550	0	0
4*	Montgomery	304	5	304	5	0	0
5	Montgomery	200	30	200	30	0	0
6	Montgomery	4,644	0	4,644	0	0	0
7	Montgomery	44	0	44	0	0	0
8*	Montgomery	250	10	280	320	30	310
9	Montgomery	0	0	0	0	0	0
10	Princeton Township	73	0	73	0	0	0
11	Princeton Township	1,719	25	1,719	25	0	0
12	Princeton Township	1,230	650	1,230	650	0	0
13	Princeton Township	84	0	84	0	0	0
14	Princeton Township/Boro	9,224	100	9,224	100	0	0
15	Princeton Boro	6,958	772	6,958	772	0	0
16	Princeton Township	343	50	343	50	0	0
17	Princeton Township	409	0	409	0	0	0
18	Princeton Township	200	0	200	0	0	0
19	Princeton Boro	200	25	200	25	0	0
20	Princeton Township	175	25	175	25	0	0
21	Franklin	281	40	281	40	0	0
22	Franklin	53	160	53	160	0	0
23	South Brunswick	150	205	150	205	0	0
24	South Brunswick	38	125	38	125	0	0
25	South Brunswick	0	130	0	130	0	0
26	South Brunswick	227	0	227	0	0	0
27	South Brunswick	30	30	30	30	0	0
28*	Plainsboro	60	685	12,765	1,499	12,705	814
29	West Windsor	1,500	40	1,500	40	0	0
30	West Windsor	949	0	949	0	0	0
31	West Windsor	0	0	0	0	0	0
32*	West Windsor	1,172	175	18,038	1,878	16,866	1,703
33	Plainsboro	980	0	980	0	0	0
34	Plainsboro	750	0	750	0	0	0
35	Plainsboro	3,569	0	3,569	0	0	0
36	Plainsboro	210	0	210	0	0	0
37	South Brunswick	2,606	0	2,606	0	0	0
38	South Brunswick	0	184	0	184	0	0
39	South Brunswick	0	0	0	0	0	0
40*	South Brunswick	631	22	17,498	1,725	16,867	1,703
41	South Brunswick	1,895	84	1,895	84	0	0
42	South Brunswick	3,276	0	3,276	0	0	0
43	Plainsboro	0	0	0	0	0	0
44	Plainsboro	81	350	81	350	0	0
45	Plainsboro	147	117	147	117	0	0
46	Plainsboro	50	0	50	0	0	0
47	West Windsor	506	0	506	0	0	0
48	West Windsor	183	0	183	0	0	0
49	West Windsor	285	0	285	0	0	0
50	West Windsor	579	0	579	0	0	0
51	West Windsor	34	0	34	0	0	0
52	East Windsor	0	82	0	82	0	0
53	East Windsor	3,609	0	3,609	0	0	0
54	West Windsor	112	0	112	0	0	0
55	Cranbury	0	0	0	0	0	0

Table 12: Non-Retail and Retail Employment by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
56	Cranbury	148	0	148	0	0	0
57	Cranbury	0	0	0	0	0	0
58	Cranbury	0	25	0	25	0	0
59	Cranbury	0	0	0	0	0	0
60*	South Brunswick	0	0	30	310	30	310
61	South Brunswick	782	0	782	0	0	0
62*	South Brunswick	2,035	0	14,740	814	12,705	814
63	Cranbury	783	0	783	0	0	0
64*	Cranbury	3,101	25	3,131	335	30	310
65	--						
66	Cranbury	2,621	0	2,621	0	0	0
67	Cranbury	0	0	0	0	0	0
68	--						
69	Lawrence	107	1,150	107	1,150	0	0
70	East Windsor	587	214	587	214	0	0
71*	East Windsor	1,222	0	9,655	851	8,433	851
72	East Windsor	100	0	100	0	0	0
73	East Windsor	722	552	722	552	0	0
74	Hightstown	1,742	0	1,742	0	0	0
75	Hightstown	313	800	313	800	0	0
76	East Windsor	684	0	684	0	0	0
77	East Windsor	0	0	0	0	0	0
78	East Windsor	0	0	0	0	0	0
79*	East Windsor	691	0	9,124	851	8,433	851
80	Lawrence	1,730	350	1,730	350	0	0
81	Hamilton	2,213	0	2,213	0	0	0
82	Lawrence	2,444	0	2,444	0	0	0
83*	Lawrence	1,625	2,561	14,330	2,561	12,705	0
84	West Windsor	56	0	56	0	0	0
85	West Windsor	796	800	796	800	0	0
86	West Windsor	4,940	25	4,940	25	0	0
87	West Windsor	0	10	0	10	0	0
88*	Franklin	145	62	145	62	0	0
89	Franklin	73	50	73	50	0	0
90	North Brunswick	1,630	487	1,630	487	0	0
91	South Brunswick	236	0	236	0	0	0
92*	North Brunswick	838	0	13,543	814	12,705	814
93	North Brunswick	585	72	585	72	0	0
94	North Brunswick	997	112	997	112	0	0
95	North Brunswick	9,106	1,498	9,106	1,498	0	0
96	Lawrence	4,205	0	4,205	0	0	0
97	Lawrence	110	25	110	25	0	0
98	Hillsborough	428	100	428	100	0	0
99*	Hillsborough	381	188	13,086	1,002	12,705	814
100	Hillsborough	790	62	790	62	0	0
101	Hillsborough	267	155	267	155	0	0
102	Hillsborough	469	425	469	425	0	0
103	Hillsborough	974	141	974	141	0	0
104	Millstone	35	19	35	19	0	0
105	Manville	519	209	519	209	0	0
106	Manville	192	33	192	33	0	0
107	Manville	285	41	285	41	0	0
108	Franklin	9,834	414	9,834	414	0	0
109	Franklin	2,440	213	2,440	213	0	0
110*	Franklin	2,428	162	15,133	976	12,705	814

SCEN2EMP

Table 12: Non-Retail and Retail Employment by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
111	Franklin	612	89	612	89	0	0
112	Franklin	1,541	171	1,541	171	0	0
113	Franklin	499	92	499	92	0	0
114	Franklin	700	372	700	372	0	0
115	Franklin	1,643	143	1,643	143	0	0
116	Franklin	1,593	119	1,593	119	0	0
117	New Brunswick	3,332	189	3,805	189	473	0
118	New Brunswick	367	62	367	62	0	0
119	New Brunswick	1,177	63	1,411	63	234	0
120	New Brunswick	108	47	108	47	0	0
121	New Brunswick	1,483	107	1,483	185	0	78
122	New Brunswick	6,645	319	6,645	397	0	78
123	New Brunswick	3,597	273	4,497	273	900	0
124	New Brunswick	2,236	95	2,236	95	0	0
125	New Brunswick	10,111	631	10,111	631	0	0
126	New Brunswick	3,339	1,071	3,339	1,071	0	0
127	North Brunswick	150	0	150	0	0	0
128	North Brunswick	300	0	300	0	0	0
129	East Brunswick	4,811	1,815	4,811	1,815	0	0
130	South River	1,122	217	1,122	217	0	0
131	South River	288	119	288	119	0	0
132	South River	404	87	404	87	0	0
133	East Brunswick	5,537	1,097	5,537	1,097	0	0
134	Milltown	2,415	242	2,415	242	0	0
135	East Brunswick	86	44	86	44	0	0
136	East Brunswick	1,829	488	1,829	488	0	0
137	East Brunswick	689	206	689	206	0	0
138	East Brunswick	898	313	898	313	0	0
139	East Brunswick	2,028	3,149	2,028	3,149	0	0
140	East Brunswick	1,437	892	1,437	892	0	0
141	Spotswood	784	183	784	183	0	0
142	Spotswood	936	271	936	271	0	0
143	Helmetta	154	11	154	11	0	0
144	Monroe	0	0	0	0	0	0
145	Jamesburg	1,649	433	1,649	433	0	0
146	Monroe	1,542	0	1,542	0	0	0
147	Monroe	0	0	0	0	0	0
148	Monroe	0	0	0	0	0	0
149	Monroe	400	0	400	0	0	0
150	Monroe	0	0	0	0	0	0
151	Monroe	0	0	0	0	0	0
152	Washington	50	75	50	75	0	0
153	Washington	50	0	50	0	0	0
154	Washington	50	0	50	0	0	0
155	Washington	0	0	0	0	0	0
156	Washington	50	50	50	50	0	0
157*	Washington	50	50	80	360	30	310
158	Washington	50	25	50	25	0	0
159	Washington	500	25	500	25	0	0
160*	Washington	0	0	12,705	814	12,705	814
161	Washington	225	25	225	25	0	0
162	Washington	350	100	350	100	0	0
163	Washington	225	150	225	150	0	0
164	Hamilton	0	50	0	50	0	0
165	Hamilton	270	196	270	196	0	0

Table 12: Non-Retail and Retail Employment by Zone - 2010 Scenario No.2

Zone	Municipality	1988 Non-Retail Employment	1988 Retail Employment	2010 Non-Retail Employment	2010 Retail Employment	Non-Retail Employment Growth	Retail Employment Growth
166	Hamilton	1,133	50	1,133	50	0	0
167	Hamilton	440	0	440	0	0	0
168	Hamilton	270	100	270	100	0	0
169	Hamilton	426	0	426	0	0	0
170	Hamilton	597	250	597	250	0	0
171	Hamilton	730	550	730	550	0	0
172	Hamilton	2,576	1,221	2,576	1,221	0	0
173	Hamilton	853	1,893	853	1,893	0	0
174	Hamilton	2,763	124	2,763	124	0	0
175	Hamilton	523	523	523	523	0	0
176	Hamilton	2,720	0	2,720	0	0	0
177	Hamilton	3,288	538	3,288	538	0	0
178	Hamilton	3,500	128	3,500	128	0	0
179	Lawrence	4,463	2,531	4,463	2,531	0	0
180	Trenton	51,442	3,405	65,644	4,256	14,202	851
181	Ewing	24,952	2,458	24,952	2,458	0	0
182	Ewing	1,200	50	1,200	50	0	0
183	Hopewell Township	335	0	335	0	0	0
184*	Hopewell Township	370	0	13,074	815	12,704	815
185	Pennington	1,596	40	1,596	40	0	0
186	Hopewell Township	700	98	700	98	0	0
187	Hopewell Township	300	0	300	0	0	0
188	Hopewell Township	250	0	250	0	0	0
189*	Hopewell Township	500	30	500	30	0	0
190	Hopewell Township	0	0	0	0	0	0
191	Hopewell Township	345	0	345	0	0	0
192	Hopewell Township	0	0	0	0	0	0
193	Hopewell Boro	499	40	499	40	0	0
194*	Hopewell Township	0	0	0	0	0	0
195	Hopewell Township	0	0	0	0	0	0
196	South Bound Brook	426	69	426	69	0	0
200	Montgomery (W/C)	0	0	30	310	30	310
201	Franklin (W/C)	0	0	30	310	30	310
202	Hopewell (W/C)	0	0	30	310	30	310
203	Hopewell (W/C)	0	0	30	310	30	310
	STUDY AREA (TOTAL)	293,894	43,905	462,181	58,199	168,287	14,294

*Note: Constructs are located in these zones. Zones 200 - 203 are new zones created from sections of 4, 88, 189 and 194 for walking constructs.

Appendix E

MSM Employment and Housing Projections, Vehicle Trip Productions and Attractions, Daily Trip Ends, and Jobs/Housing Ratios: 1988, 2010 Trend, Scenario 1, Scenario 2

MSM Land Use Changes 1988 - 2010

Zone	Growth Code Municipality	Land Area Sq.Mi.	Non-Retail Employment 1988 Non-Retail Employment	2010 Non-Ret Employ't	Trend Non-Ret Growth	Percent Growth	Non-Retail Employment Density Jobs/Square Mile 1988	2010	Retail Employment 1988	2010	Retail Growth	Percent Growth Retail	Retail Employment Density Jobs/Square Mile 1988	2010	Total Employment Density Jobs/Square Mile 1988	2010
52	East Windsor	1.97	0	0	0	0%	0	0	82	82	0	0%	42	42	42	42
53	East Windsor	1.75	3,609	4,009	400	11%	2,067	2,297	0	0	0	0%	0	0	2,067	2,297
70	East Windsor	0.71	587	854	267	45%	824	1,199	214	214	0	0%	300	300	1,125	1,499
71	East Windsor	0.88	1,222	1,580	358	29%	1,392	1,800	0	0	0	0%	0	0	1,392	1,800
72	East Windsor	1.18	100	100	0	0%	85	85	0	400	400	0%	0	340	85	425
73	East Windsor	1.10	722	722	0	0%	658	658	552	677	125	23%	503	617	1,161	1,275
76	East Windsor	2.67	684	3,246	2,562	375%	256	1,217	0	0	0	0%	0	0	256	1,217
77	East Windsor	1.85	0	0	0	0%	0	0	0	30	30	0%	0	16	0	16
78	East Windsor	2.42	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
79	East Windsor	1.13	691	1,586	895	130%	613	1,407	0	0	0	0%	0	0	613	1,407
Total	East Windsor	15.65	7,615	12,097	4,482	59%	487	773	848	1,403	555	65%	54	90	541	863
181	Ewing	14.14	24,952	29,749	4,797	19%	1,765	2,104	2,458	2,741	283	12%	174	194	1,939	2,298
182	Ewing	2.12	1,200	1,200	0	0%	565	565	50	50	0	0%	24	24	589	589
Total	Ewing	16.26	26,152	30,949	4,797	18%	1,608	1,903	2,508	2,791	283	11%	154	172	1,763	2,075
81	Hamilton	5.19	2,213	2,466	253	11%	427	475	0	93	93	0%	0	18	427	493
164	Hamilton	0.80	0	40	40	0%	0	50	50	103	53	106%	63	129	63	179
165	Hamilton	2.27	270	270	0	0%	119	119	196	196	0	0%	87	87	206	206
166	Hamilton	2.51	1,133	1,205	72	6%	451	480	50	50	0	0%	20	20	471	500
167	Hamilton	5.54	440	440	0	0%	79	79	0	0	0	0%	0	0	79	79
168	Hamilton	2.15	270	270	0	0%	126	126	100	194	94	94%	47	90	172	216
169	Hamilton	0.69	426	426	0	0%	616	616	0	0	0	0%	0	0	616	616
170	Hamilton	2.30	597	4,032	3,435	575%	260	1,756	250	267	17	7%	109	116	369	1,872
171	Hamilton	1.69	730	730	0	0%	432	432	550	550	0	0%	326	326	758	758
172	Hamilton	3.39	2,576	3,657	1,081	42%	759	1,078	1,221	1,270	49	4%	360	374	1,119	1,452
173	Hamilton	1.94	853	853	0	0%	439	439	1,893	1,933	40	2%	975	996	1,414	1,435
174	Hamilton	3.12	2,763	3,302	539	20%	885	1,058	124	134	10	8%	40	43	925	1,101
175	Hamilton	1.47	523	523	0	0%	357	357	523	544	21	4%	357	371	713	728
176	Hamilton	4.85	2,720	2,720	0	0%	561	561	0	510	510	0%	0	105	561	666
177	Hamilton	1.12	3,288	3,288	0	0%	2,926	2,926	538	570	32	6%	479	507	3,404	3,433
178	Hamilton	2.12	3,500	3,500	0	0%	1,647	1,647	128	154	26	20%	60	72	1,708	1,720
Total	Hamilton	41.15	22,302	27,722	5,420	24%	10,085	674	5,623	6,568	945	17%	137	160	10,221	833
74	Hightstown	0.50	1,742	2,554	812	47%	3,480	5,102	0	100	100	0%	0	200	3,480	5,301
75	Hightstown	0.76	313	1,126	813	260%	411	1,479	800	900	100	13%	1,051	1,183	1,462	2,662
Total	Hightstown	1.26	2,055	3,680	1,625	79%	3,891	2,917	800	1,000	200	25%	634	793	4,942	7,963
183	Hopewell Township	5.19	335	335	0	0%	65	65	0	200	200	0%	0	39	65	103
184	Hopewell Township	5.19	370	585	215	58%	71	113	0	0	0	0%	0	0	71	113
186	Hopewell Township	6.94	700	700	0	0%	101	101	98	98	0	0%	14	14	115	115
187	Hopewell Township	9.34	300	300	0	0%	32	32	0	0	0	0%	0	0	32	32
188	Hopewell Township	8.88	250	250	0	0%	28	28	0	0	0	0%	0	0	28	28
189	Hopewell Township	4.21	500	1,297	797	159%	119	308	30	30	0	0%	7	7	126	315
190	Hopewell Township	3.18	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0

Source: Douglas & Douglas, Inc.

MSM Land Use Changes 1988 - 2010

Zone	Growth Code	Municipality	Land Area Sq.Mi.	Non-Retail Employment 1988 Non-Retail Employment	2010 Non-Ret Employ't	Trend Non-Ret Growth	Percent Growth	Non-Retail Employment Density Jobs/Square Mile 1988	2010	Retail Employment 1988	2010	Retail Growth	Percent Growth Retail	Retail Employment Density Jobs/Square Mile 1988	2010	Total Employment Density Jobs/Square Mile 1988	2010
191		Hopewell Township	2.55	345	345	0	0%	135	135	0	0	0	0%	0	0	135	135
192		Hopewell Township	5.22	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
193		Hopewell Boro	0.68	499	614	115	23%	730	898	40	66	26	65%	58	97	788	994
194		Hopewell Township	3.02	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
195		Hopewell Township	3.55	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
202		Hopewell (W/C)	0.50	0	0	0	0%	0	0	0				0	0	0	0
203		Hopewell (W/C)	0.50	0	0	0	0%	0	0	0				0	0	0	0
Total		Hopewell Township	58.95	3,299	4,426	1,127	34%	56	75	168	394	226	135%	3	7	1,360	1,836
69		Lawrence	0.53	107	544	437	408%	202	1,028	1,150	1,150	0	0%	2,174	2,174	2,376	3,202
80		Lawrence	2.59	1,730	3,614	1,884	109%	669	1,397	350	393	43	12%	135	152	804	1,548
82		Lawrence	3.26	2,444	3,526	1,082	44%	749	1,081	0	0	0	0%	0	0	749	1,081
83		Lawrence	1.72	1,625	2,723	1,098	68%	946	1,586	2,561	3,081	520	20%	1,492	1,794	2,438	3,380
96		Lawrence	3.41	4,205	6,579	2,374	56%	1,234	1,931	0	0	0	0%	0	0	1,234	1,931
97		Lawrence	5.73	110	230	120	109%	19	40	25	25	0	0%	4	4	24	44
179		Lawrence	3.13	4,463	4,954	491	11%	1,425	1,582	2,531	2,531	0	0%	808	808	2,233	2,390
Total		Lawrence	20.37	14,684	22,170	7,486	51%	721	1,088	6,617	7,180	563	9%	325	353	9,858	13,578
185		Pennington	0.96	1,596	3,510	1,914	120%	1,660	3,651	40	40	0	0%	42	42	1,702	3,693
10		Princeton Township	1.36	73	73	0	0%	54	54	0	0	0	0%	0	0	54	54
11		Princeton Township	1.41	1,719	4,115	2,396	139%	1,218	2,915	25	25	0	0%	18	18	1,235	2,933
12		Princeton Township	1.53	1,230	3,626	2,396	195%	807	2,378	650	650	0	0%	426	426	1,233	2,804
13		Princeton Township	0.82	84	84	0	0%	102	102	0	0	0	0%	0	0	102	102
14		Princeton Township/	1.17	9,224	9,224	0	0%	7,881	7,881	100	100	0	0%	85	85	7,967	7,967
15		Princeton Boro	0.65	6,958	7,419	461	7%	10,643	11,348	772	962	190	25%	1,181	1,471	11,824	12,820
16		Princeton Township	3.02	343	343	0	0%	113	113	50	50	0	0%	17	17	130	130
17		Princeton Township	2.95	409	409	0	0%	139	139	0	0	0	0%	0	0	139	139
18		Princeton Township	2.11	200	200	0	0%	95	95	0	0	0	0%	0	0	95	95
19		Princeton Boro	0.66	200	200	0	0%	305	305	25	25	0	0%	38	38	343	343
20		Princeton Township	2.25	175	2,570	2,395	1369%	78	1,141	25	25	0	0%	11	11	89	1,153
Total		Princeton	17.94	20,615	28,263	7,648	37%	1,149	1,575	1,647	1,837	190	12%	92	102	23,210	28,538
180		Trenton	7.94	51,442	65,644	14,202	28%	6,479	8,268	3,405	4,256	851	25%	429	536	6,908	8,804
152		Washington	1.50	50	50	0	0%	33	33	75	75	0	0%	50	50	83	83
153		Washington	1.84	50	50	0	0%	27	27	0	0	0	0%	0	0	27	27
154		Washington	2.41	50	50	0	0%	21	21	0	0	0	0%	0	0	21	21
155		Washington	1.23	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
156		Washington	0.82	50	50	0	0%	61	61	50	50	0	0%	61	61	121	121
157		Washington	2.08	50	50	0	0%	24	24	50	50	0	0%	24	24	48	48
158		Washington	1.95	50	50	0	0%	26	26	25	25	0	0%	13	13	38	38
159		Washington	1.75	500	500	0	0%	286	286	25	25	0	0%	14	14	300	300
160		Washington	2.64	1	1,521	1,520	152000%	0	577	0	0	0	0%	0	0	0	577
161		Washington	1.58	225	225	0	0%	142	142	25	25	0	0%	16	16	158	158
162		Washington	0.26	350	386	36	10%	1,348	1,486	100	100	0	0%	385	385	1,733	1,871

Source: Douglas & Douglas, Inc.

MSM Land Use Changes 1988 - 2010

Zone	Growth Code / Municipality	Land Area Sq.Mi.	Non-Retail Employment 1988 Non-Retail Employment	2010 Non-Ret Employ't	Trend Non-Ret Growth	Percent Growth	Non-Retail Employment Density Jobs/Square Mile 1988	2010	Retail Employment 1988	2010	Retail Growth	Percent Growth Retail	Retail Employment Density Jobs/Square Mile 1988	2010	Total Employment Density Jobs/Square Mile 1988	2010
163	Washington	2.40	225	408	183	81%	94	170	150	250	100	67%	62	104	156	274
Total	Washington	20.48	1,601	3,340	1,739	109%	78	163	500	600	100	20%	24	29	2,686	3,519
29	West Windsor	0.68	1,500	1,500	0	0%	2,212	2,212	40	40	0	0%	59	59	2,271	2,271
30	West Windsor	1.44	949	1,322	373	39%	659	918	0	0	0	0%	0	0	659	918
31	West Windsor	0.97	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
32	West Windsor	1.34	1,172	2,080	908	77%	876	1,555	175	175	0	0%	131	131	1,007	1,686
47	West Windsor	3.46	506	506	0	0%	146	146	0	700	700	0%	0	202	146	348
48	West Windsor	1.95	183	183	0	0%	94	94	0	0	0	0%	0	0	94	94
49	West Windsor	2.99	285	285	0	0%	95	95	0	0	0	0%	0	0	95	95
50	West Windsor	2.86	579	579	0	0%	202	202	0	0	0	0%	0	0	202	202
51	West Windsor	4.19	34	34	0	0%	8	8	0	0	0	0%	0	0	8	8
54	West Windsor	2.58	112	112	0	0%	43	43	0	0	0	0%	0	0	43	43
84	West Windsor	0.38	56	3,646	3,590	6411%	147	9,602	0	0	0	0%	0	0	147	9,602
85	West Windsor	1.13	796	796	0	0%	702	702	800	1,178	378	47%	706	1,039	1,408	1,741
86	West Windsor	1.44	4,940	12,349	7,409	150%	3,427	8,566	25	25	0	0%	17	17	3,444	8,584
87	West Windsor	0.62	0	0	0	0%	0	0	10	10	0	0%	16	16	16	16
Total	West Windsor	26.04	11,112	23,392	12,280	111%	427	898	1,050	2,128	1,078	103%	40	82	467	980
	Mercer County	227.00	162,473	225,193	62,720	39%	716	992	23,206	28,197	4,991	22%	102	124	7,079	23,401
1	Franklin	2.87	13	13	0	0%	5	5	0	0	0	0%	0	0	5	5
2	Franklin	2.78	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
21	Franklin	0.56	281	281	0	0%	499	499	40	40	0	0%	71	71	570	570
22	Franklin	2.92	53	53	0	0%	18	18	160	160	0	0%	55	55	73	73
88	Franklin	6.99	145	145	0	0%	21	21	62	346	284	458%	9	49	30	70
89	Franklin	2.51	73	73	0	0%	29	29	50	50	0	0%	20	20	49	49
108	Franklin	7.41	9,834	10,090	256	3%	1,327	1,361	414	414	0	0%	56	56	1,382	1,417
109	Franklin	8.13	2,440	2,977	537	22%	300	366	213	213	0	0%	26	26	326	392
110	Franklin	2.81	2,428	4,001	1,573	65%	863	1,423	162	180	18	11%	58	64	921	1,487
111	Franklin	1.60	612	612	0	0%	382	382	89	89	0	0%	55	55	437	437
112	Franklin	2.97	1,541	1,541	0	0%	519	519	171	171	0	0%	58	58	576	576
113	Franklin	1.80	499	499	0	0%	278	278	92	92	0	0%	51	51	329	329
114	Franklin	0.68	700	700	0	0%	1,024	1,024	372	372	0	0%	544	544	1,568	1,568
115	Franklin	1.22	1,643	1,643	0	0%	1,345	1,345	143	143	0	0%	117	117	1,463	1,463
116	Franklin	0.94	1,593	1,593	0	0%	1,689	1,689	119	119	0	0%	126	126	1,815	1,815
201	Franklin (W/C)	0.50	0				0	0	0				0	0	0	0
Total	Franklin	46.70	21,855	24,221	2,366	11%	468	519	2,087	2,389	302	14%	45	51	513	570
98	Hillsborough	20.40	428	428	0	0%	21	21	100	208	108	108%	5	10	26	31
99	Hillsborough	3.18	381	924	543	143%	120	291	188	228	40	21%	59	72	179	363
100	Hillsborough	10.84	790	3,361	2,571	325%	73	310	62	62	0	0%	6	6	79	316
101	Hillsborough	3.99	267	1,248	981	367%	67	313	155	195	40	26%	39	49	106	361
102	Hillsborough	6.51	469	1,073	604	129%	72	165	425	465	40	9%	65	71	137	236
103	Hillsborough	9.77	974	2,277	1,303	134%	100	233	141	181	40	28%	14	19	114	252

Source: Douglas & Douglas, Inc.

MSM Land Use Changes 1988 - 2010

Zone	Municipality	Growth Code	Land Area Sq.Mi.	Non-Retail Employment 1988 Non-Retail Employment	2010 Non-Ret Employ't	Trend Non-Ret Growth	Percent Growth	Non-Retail Employment Density Jobs/Square Mile 1988	2010	Retail Employment 1988	2010	Retail Growth	Percent Growth Retail	Retail Employment Density Jobs/Square Mile 1988	2010	Total Employment Density Jobs/Square Mile 1988	2010
Total	Hillsborough		54.69	3,309	9,311	6,002	181%	61	170	1,071	1,339	268	25%	20	24	80	195
105	Manville		1.16	519	1,302	783	151%	447	1,122	209	209	0	0%	180	180	628	1,303
106	Manville		0.33	192	976	784	408%	580	2,946	33	33	0	0%	100	100	679	3,046
107	Manville		0.99	285	1,069	784	275%	289	1,082	41	41	0	0%	42	42	330	1,124
Total	Manville		2.48	996	3,347	2,351	236%	402	1,350	283	283	0	0%	114	114	516	1,464
104	Millstone		0.75	35	191	156	446%	47	255	19	19	0	0%	25	25	72	280
3	Montgomery/Rocky		1.44	1,943	2,841	898	46%	1,345	1,967	550	677	127	23%	381	469	1,726	2,436
4	Montgomery		7.29	304	304	0	0%	42	42	5	5	0	0%	1	1	42	42
5	Montgomery		2.59	200	826	626	313%	77	319	30	157	127	423%	12	61	89	379
6	Montgomery		14.08	4,644	5,026	382	8%	330	357	0	173	173	0%	0	12	330	369
7	Montgomery		4.67	44	44	0	0%	9	9	0	0	0	0%	0	0	9	9
8	Montgomery		2.03	250	920	670	268%	123	454	10	137	127	1270%	5	68	128	521
9	Montgomery		0.65	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
200	Montgomery(W/C)		0.50	0				0	0	0				0	0	0	0
Total	Montgomery		33.25	7,385	9,961	2,576	35%	222	300	595	1,149	554	93%	18	35	240	334
196	South Bound Brook		0.78	426	1,011	585	137%	547	1,299	69	69	0	0%	89	89	636	1,388
Somerset County (Part)			139	34,006	48,042	14,036	41%	245	347	4,124	5,248	1,124	27%	30	38	275	384
55	Cranbury		1.16	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
56	Cranbury		1.64	148	148	0	0%	90	90	0	0	0	0%	0	0	90	90
57	Cranbury		0.83	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
58	Cranbury		0.95	0	0	0	0%	0	0	25	25	0	0%	26	26	26	26
59	Cranbury		3.05	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
63	Cranbury		1.36	783	1,490	707	90%	575	1,094	0	0	0	0%	0	0	575	1,094
64	Cranbury		1.72	3,101	3,101	0	0%	1,799	1,799	25	291	266	1064%	15	169	1,813	1,968
66	Cranbury		1.77	2,621	2,621	0	0%	1,485	1,485	0	0	0	0%	0	0	1,485	1,485
67	Cranbury		0.95	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
Total	Cranbury		13.43	6,653	7,360	707	11%	495	548	50	316	266	532%	4	24	499	571
129	East Brunswick		3.95	4,811	5,746	935	19%	1,219	1,455	1,815	2,586	771	42%	460	655	1,678	2,110
133	East Brunswick		1.59	5,537	6,971	1,434	26%	3,485	4,387	1,097	1,865	768	70%	690	1,174	4,175	5,561
135	East Brunswick		4.51	86	86	0	0%	19	19	44	44	0	0%	10	10	29	29
136	East Brunswick		6.25	1,829	2,583	754	41%	293	413	488	1,332	844	173%	78	213	371	626
137	East Brunswick		1.51	689	689	0	0%	455	455	206	206	0	0%	136	136	591	591
138	East Brunswick		1.94	898	1,005	107	12%	463	518	313	313	0	0%	161	161	624	679
139	East Brunswick		1.36	2,028	2,090	62	3%	1,495	1,540	3,149	3,313	164	5%	2,321	2,442	3,816	3,982
140	East Brunswick		1.33	1,437	3,041	1,604	112%	1,078	2,281	892	892	0	0%	669	669	1,747	2,950
Total	East Brunswick		22.44	17,315	22,211	4,896	28%	772	990	8,004	10,551	2,547	32%	357	470	1,128	1,460
143	Helmetta		0.78	154	214	60	39%	197	274	11	11	0	0%	14	14	211	288

Source: Douglas & Douglas, Inc.

MSM Land Use Changes 1988 - 2010

Zone	Growth Code	Municipality	Land Area Sq.Mi.	Non-Retail Employment 1988 Non-Retail Employment	2010 Non-Ret Employ't	Trend Non-Ret Growth	Percent Growth	Non-Retail Employment Density Jobs/Square Mile 1988	2010	Retail Employment 1988	2010	Retail Growth	Percent Growth Retail	Retail Employment Density Jobs/Square Mile 1988	2010	Total Employment Density Jobs/Square Mile 1988	2010
145		Jamesburg	0.92	1,649	2,270	621	38%	1,797	2,474	433	433	0	0%	472	472	2,269	2,946
134		Milltown	1.44	2,415	2,615	200	8%	1,675	1,814	242	242	0	0%	168	168	1,843	1,982
144		Monroe	9.70	1	1,269	1,268	126800%	0	131	0	775	775	0%	0	80	0	211
146		Monroe	6.18	1,542	3,008	1,466	95%	250	487	0	840	840	0%	0	136	250	623
147		Monroe	1.43	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
148		Monroe	6.18	1	1,635	1,634	163400%	0	265	0	776	776	0%	0	126	0	390
149		Monroe	10.02	400	1,563	1,163	291%	40	156	0	0	0	0%	0	0	40	156
150		Monroe	6.76	1	1,275	1,274	127400%	0	189	0	0	0	0%	0	0	0	189
151		Monroe	1.81	1	1,163	1,162	116200%	1	642	0	0	0	0%	0	0	1	642
Total		Monroe	42.08	1,946	9,913	7,967	409%	46	236	0	2,391	2,391	0%	0	57	46	292
117		New Brunswick	1.48	3,332	3,805	473	14%	2,252	2,571	189	189	0	0%	128	128	2,379	2,699
118		New Brunswick	0.26	367	367	0	0%	1,406	1,406	62	62	0	0%	238	238	1,644	1,644
119		New Brunswick	0.23	1,177	1,411	234	20%	5,151	6,175	63	63	0	0%	276	276	5,426	6,450
120		New Brunswick	0.20	108	108	0	0%	544	544	47	47	0	0%	237	237	781	781
121		New Brunswick	0.21	1,483	1,483	0	0%	7,174	7,174	107	185	78	73%	518	895	7,692	8,069
122		New Brunswick	0.28	6,645	6,645	0	0%	23,646	23,646	319	397	78	24%	1,135	1,413	24,781	25,059
123		New Brunswick	0.15	3,597	4,497	900	25%	24,387	30,489	273	273	0	0%	1,851	1,851	26,238	32,339
124		New Brunswick	0.20	2,236	2,236	0	0%	11,413	11,413	95	95	0	0%	485	485	11,898	11,898
125		New Brunswick	0.77	10,111	10,111	0	0%	13,075	13,075	631	631	0	0%	816	816	13,891	13,891
126		New Brunswick	1.95	3,339	3,339	0	0%	1,708	1,708	1,071	1,071	0	0%	548	548	2,256	2,256
Total		New Brunswick	5.73	32,395	34,002	1,607	5%	5,657	5,937	2,857	3,013	156	5%	499	526	6,155	6,463
90		North Brunswick	2.87	1,630	3,369	1,739	107%	568	1,174	487	687	200	41%	170	239	738	1,414
92		North Brunswick	2.63	838	7,907	7,069	844%	319	3,012	0	298	298	0%	0	114	319	3,126
93		North Brunswick	2.42	585	2,121	1,536	263%	242	877	72	272	200	278%	30	112	272	989
94		North Brunswick	1.27	997	2,534	1,537	154%	787	1,999	112	312	200	179%	88	246	875	2,245
95		North Brunswick	2.79	9,106	10,643	1,537	17%	3,266	3,817	1,498	1,698	200	13%	537	609	3,803	4,426
127		North Brunswick	0.18	150	2,254	2,104	1403%	835	12,546	0	200	200	0%	0	1,113	835	13,660
128		North Brunswick	0.74	300	1,837	1,537	512%	408	2,496	0	200	200	0%	0	272	408	2,768
Total		North Brunswick	12.88	13,606	30,665	17,059	125%	1,056	2,380	2,169	3,667	1,498	69%	168	285	1,224	2,665
28		Plainsboro	1.22	60	10,257	10,197	16995%	49	8,392	685	745	60	9%	560	610	610	9,001
33		Plainsboro	1.28	980	3,883	2,903	296%	765	3,032	0	0	0	0%	0	0	765	3,032
34		Plainsboro	0.68	750	8,712	7,962	1062%	1,095	12,722	0	60	60	0%	0	88	1,095	12,809
35		Plainsboro	1.00	3,569	5,641	2,072	58%	3,581	5,659	0	60	60	0%	0	60	3,581	5,720
36		Plainsboro	0.74	210	210	0	0%	284	284	0	0	0	0%	0	0	284	284
43		Plainsboro	2.47	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
44		Plainsboro	0.77	81	2,258	2,177	2688%	105	2,925	350	410	60	17%	453	531	558	3,456
45		Plainsboro	1.70	147	1,086	939	639%	87	640	117	177	60	51%	69	104	156	744
46		Plainsboro	2.37	50	50	0	0%	21	21	0	0	0	0%	0	0	21	21
Total		Plainsboro	12.23	5,847	32,097	26,250	449%	478	2,624	1,152	1,452	300	26%	94	119	572	2,742

Source: Douglas & Douglas, Inc.

MSM Land Use Changes 1988 - 2010

Zone	Growth Code	Municipality	Land Area Sq.Mi.	Non-Retail Employment 1988 Non-Retail Employment	2010 Non-Ret Employ't	Trend Non-Ret Growth	Percent Growth	Non-Retail Employment Density Jobs/Square Mile 1988	2010	Retail Employment 1988	2010	Retail Growth	Percent Growth Retail	Retail Employment Density Jobs/Square Mile 1988	2010	Total Employment Density Jobs/Square Mile 1988	2010
23		South Brunswick	2.72	150	303	153	102%	55	111	205	294	89	43%	75	108	131	220
24		South Brunswick	2.95	38	38	0	0%	13	13	125	138	13	10%	42	47	55	60
25		South Brunswick	1.83	0	0	0	0%	0	0	130	686	556	428%	71	374	71	374
26		South Brunswick	1.29	227	524	297	131%	176	406	0	0	0	0%	0	0	176	406
27		South Brunswick	0.54	30	30	0	0%	55	55	30	30	0	0%	55	55	110	110
37		South Brunswick	1.82	2,606	6,549	3,943	151%	1,432	3,600	0	0	0	0%	0	0	1,432	3,600
38		South Brunswick	2.67	0	0	0	0%	0	0	184	184	0	0%	69	69	69	69
39		South Brunswick	1.14	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
40		South Brunswick	2.67	631	8,985	8,354	1324%	237	3,369	22	366	344	1564%	8	137	245	3,506
41		South Brunswick	2.98	1,895	2,145	250	13%	636	720	84	84	0	0%	28	28	664	748
42		South Brunswick	2.17	3,276	4,200	924	28%	1,510	1,936	0	19	19	0%	0	9	1,510	1,945
60		South Brunswick	2.08	0	0	0	0%	0	0	0	0	0	0%	0	0	0	0
61		South Brunswick	4.47	782	3,225	2,443	312%	175	722	0	0	0	0%	0	0	175	722
62		South Brunswick	7.56	2,035	15,093	13,058	642%	269	1,996	0	0	0	0%	0	0	269	1,996
91		South Brunswick	3.53	236	1,170	934	396%	67	331	0	0	0	0%	0	0	67	331
Total		South Brunswick	40.41	11,906	42,262	30,756	255%	295	1,046	780	1,801	1,021	131%	19	45	314	1,090
130		South River	0.93	1,122	1,460	338	30%	1,207	1,570	217	217	0	0%	233	233	1,440	1,804
131		South River	0.41	288	626	338	117%	698	1,518	119	119	0	0%	289	289	987	1,807
132		South River	1.51	404	743	339	84%	267	491	87	87	0	0%	57	57	324	548
Total		South River	2.86	1,814	2,829	1,015	56%	635	990	423	423	0	0%	148	148	783	1,139
141		Spotswood	1.55	784	1,178	394	50%	505	759	183	183	0	0%	118	118	623	877
142		Spotswood	0.82	936	1,330	394	42%	1,144	1,626	271	271	0	0%	331	331	1,475	1,957
Total		Spotswood	2.37	1,720	2,508	788	46%	726	1,058	454	454	0	0%	192	192	917	1,250
Middlesex Co. (part)			158	97,420	188,946	91,526	94%	618	1,199	16,575	24,754	8,179	49%	105	157	723	1,356
		MSM Region Total	523.22	293,899	462,181	168,282	57%	562	883	43,905	58,199	14,294	33%	84	111	646	995

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	1988 Dwelling Units	2010 Dwelling Units	Housing Growth DU's	Percent Growth DU's	Housing Density DU's/Square Mile 1988	2010	Univ. Students 1988	2010	1988 Productions HBW	HBO	NHB	Total Daily	1988 Attractions HBW	HBO	NHB
52		East Windsor	2,642	3,132	490	19%	1,342	1,591		0	6552	17543	900	24995	151	4521	900
53		East Windsor	108	598	490	454%	62	343		0	268	717	4105	5090	6821	1731	4105
70		East Windsor	2,648	3,138	490	19%	3,717	4,405		0	6567	17583	1950	26100	1503	7859	1950
71		East Windsor	56	546	490	875%	64	622		0	139	372	1395	1906	2310	605	1395
72		East Windsor	1,033	1,523	490	47%	878	1,294		0	2562	6859	371	9792	189	1068	371
73		East Windsor	1,169	1,658	489	42%	1,065	1,511		0	2899	7762	2720	13381	2380	14311	2720
76		East Windsor	381	871	490	129%	143	326		0	945	2530	868	4343	1293	685	868
77		East Windsor	176	665	489	278%	95	359		0	436	1169	44	1649	0	174	44
78		East Windsor	327	816	489	150%	135	337		0	811	2171	82	3064	0	324	82
79		East Windsor	126	615	489	388%	112	545		0	312	837	812	1961	1306	436	812
Total		East Windsor	8,666	13,562	4,896	56%	554	867	0	0	21492	57542	13248	92282	15953	31714	13248
181		Ewing	11,341	13,073	1,732	15%	802	925	3,000	3,000	28126	77824	39378	145328	53392	82010	39378
182		Ewing	1,200	1,439	239	20%	565	678		0	2976	7968	1802	12746	2360	2890	1802
Total		Ewing	12,541	14,512	1,971	16%	771	893	3,000	3,000	31102	85792	41180	158074	55752	84900	41180
81		Hamilton	3,021	3,587	566	19%	582	692		0	7492	20059	3256	30807	4183	3987	3256
164		Hamilton	1,226	1,792	566	46%	1,537	2,246		0	3040	8141	453	11634	92	2376	453
165		Hamilton	1,901	2,467	566	30%	839	1,089		0	4714	12623	1353	18690	871	6559	1353
166		Hamilton	104	670	566	544%	41	267		0	258	691	1452	2401	2233	1775	1452
167		Hamilton	336	902	566	168%	61	163		0	833	2231	581	3646	832	531	581
168		Hamilton	1,211	1,777	566	47%	565	828		0	3003	8041	900	11944	694	3644	900
169		Hamilton	642	1,208	566	88%	928	1,746		0	1592	4263	642	6497	805	827	642
170		Hamilton	1,545	2,111	566	37%	673	919		0	3832	10259	1791	15881	1588	7608	1791
171		Hamilton	2,091	2,657	566	27%	1,238	1,572		0	5186	13884	2954	22024	2392	15181	2954
172		Hamilton	3,102	3,668	566	18%	914	1,081		0	7693	20597	7252	35542	7115	32606	7252
173		Hamilton	1,973	2,539	566	29%	1,016	1,308		0	4893	13101	6985	24978	5095	46330	6985
174		Hamilton	4,413	4,979	566	13%	1,414	1,595		0	10944	29302	4588	44834	5450	8494	4588
175		Hamilton	3,264	3,830	566	17%	2,226	2,612		0	8095	21673	2934	32702	1951	15621	2934
176		Hamilton	2,695	3,262	567	21%	555	672		0	6684	17895	3747	28326	5141	3892	3747
177		Hamilton	2,095	2,662	567	27%	1,864	2,369		0	5196	13911	5810	24917	7204	16057	5810
178		Hamilton	1,717	2,283	566	33%	808	1,075		0	4258	11401	4758	20417	6851	6250	4758
Total		Hamilton	31,336	40,394	9,058	29%	762	982	0	0	77713	208071	49454	335239	52497	171737	49454
74		Hightstown	691	692	1	0%	1,380	1,382		0	1714	4588	2141	8443	3292	1468	2141
75		Hightstown	1,127	1,127	0	0%	1,481	1,481		0	2795	7483	2971	13250	2064	19849	2971
Total		Hightstown	1,818	1,819	1	0%	1,441	1,442	0	0	4509	12072	5113	21693	5356	21317	5113
183		Hopewell Township	420	490	70	17%	81	94		0	1042	2789	484	4314	633	567	484
184		Hopewell Township	460	541	81	18%	89	104		0	1141	3054	533	4728	699	622	533
186		Hopewell Township	310	353	43	14%	45	51		0	769	2058	1155	3982	1503	2899	1155
187		Hopewell Township	360	412	52	14%	39	44		0	893	2390	429	3712	567	491	429
188		Hopewell Township	410	524	114	28%	46	59		0	1017	2722	385	4124	473	518	385
189		Hopewell Township	310	524	214	69%	74	124		0	769	2058	730	3557	1000	1229	730
190		Hopewell Township	360	398	38	11%	113	125		0	893	2390	90	3373	0	356	90

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Zone	Growth Code / Municipality	1988 Dwelling Units	2010 Dwelling Units	Housing Growth DU's	Percent Growth DU's	Housing Density DU's/Square Mile 1988	2010	Univ. Students 1988	2010	1988 Productions HBW	HBO	NHB	Total Daily	1988 Attractions HBW	HBO	NHB
191	Hopewell Township	260	749	489	188%	102	293		0	645	1726	455	2826	652	413	455
192	Hopewell Township	360	1,375	1,015	282%	69	264		0	893	2390	90	3373	0	356	90
193	Hopewell Boro	803	1,083	280	35%	1,174	1,584		0	1991	5332	881	8205	1017	1949	881
194	Hopewell Township	310	349	39	13%	103	116		0	769	2058	78	2905	0	307	78
195	Hopewell Township	310	433	123	40%	87	122		0	769	2058	78	2905	0	307	78
202	Hopewell (W/C)	0				0	0			0	0	0	0	0	0	0
203	Hopewell (W/C)	0				0	0			0	0	0	0	0	0	0
Total	Hopewell Township	4,673	7,231	2,558	55%	79	123	0	0	11589	31029	5387	48004	6544	10015	5387
69	Lawrence	22	988	966	4391%	42	1,868		0	55	146	3484	3685	2318	26796	3484
80	Lawrence	978	1,182	204	21%	378	457		0	2425	6494	3221	12141	3914	9881	3221
82	Lawrence	692	970	278	40%	212	297		0	1716	4595	2935	9246	4619	1785	2935
83	Lawrence	627	1,243	616	98%	365	724		0	1555	4163	9471	15189	7783	60870	9471
96	Lawrence	898	898	0	0%	264	264		0	2227	5963	4976	13166	7947	2781	4976
97	Lawrence	2,558	2,671	113	4%	446	466		0	6344	16985	837	24166	254	3163	837
179	Lawrence	2,841	3,283	442	16%	907	1,048	3,000	3,000	7046	21384	14314	42744	14802	66071	14314
Total	Lawrence	8,616	11,235	2,619	30%	423	552	3,000	3,000	21368	59730	39239	120336	41638	171347	39239
185	Pennington	872	1,113	241	28%	907	1,158		0	2163	5790	2138	10091	3090	2511	2138
10	Princeton Township	203	668	465	229%	149	490		0	503	1348	133	1985	138	234	133
11	Princeton Township	365	831	466	128%	259	589		0	905	2424	2107	5436	3295	1716	2107
12	Princeton Township	1,725	2,191	466	27%	1,131	1,437		0	4278	11454	3719	19451	3521	17367	3719
13	Princeton Township	807	1,273	466	58%	984	1,552		0	2001	5358	297	7657	159	837	297
14	Princeton Township/	1,073	1,328	255	24%	917	1,135	4,245	4,245	2661	10691	12639	25990	20037	10976	12639
15	Princeton Boro	2,132	2,386	254	12%	3,261	3,650	650	650	5287	14702	10903	30893	14942	23710	10903
16	Princeton Township	727	1,193	466	64%	240	394		0	1803	4827	715	7346	740	2036	715
17	Princeton Township	375	841	466	124%	127	285		0	930	2490	556	3976	773	555	556
18	Princeton Township	449	915	466	104%	212	433		0	1114	2981	338	4433	378	535	338
19	Princeton Boro	576	831	255	44%	878	1,267	915	915	1428	4593	800	6822	946	1982	800
20	Princeton Township	372	838	466	125%	165	372	190	190	923	2630	438	3990	485	1182	438
Total	Princeton	8,804	13,295	4,491	51%	491	741	6,000	6,000	21834	63499	32645	117978	45413	61129	32645
180	Trenton	33,952	39,619	5,667	17%	4,276	4,990		0	84201	225441	76560	386202	103491	135894	76560
152	Washington	66	66	0	0%	44	44		0	164	438	292	894	233	1831	292
153	Washington	53	53	0	0%	29	29		0	131	352	70	553	95	75	70
154	Washington	57	57	0	0%	24	24		0	141	378	71	591	95	79	71
155	Washington	10	10	0	0%	8	8		0	25	66	3	94	0	10	3
156	Washington	66	66	0	0%	80	80		0	164	438	219	821	187	1250	219
157	Washington	124	246	122	98%	60	118		0	308	823	234	1364	187	1307	234
158	Washington	351	351	0	0%	180	180		0	870	2331	217	3418	141	951	217
159	Washington	554	757	203	37%	317	433		0	1374	3679	777	5829	991	1354	777
160	Washington	25	25	0	0%	9	9		0	62	166	7	235	2	25	7
161	Washington	65	246	181	278%	41	155		0	161	432	344	936	471	747	344
162	Washington	202	202	0	0%	778	778		0	501	1341	738	2580	846	2681	738

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163		Washington	677	2,080	1,403	207%	282	866		0	1679	4495	862	7036	701	4257	862
Total		Washington	2,250	4,159	1,909	85%	110	203	0	0	5580	14940	3832	24352	3946	14568	3832
29		West Windsor	250	250	0	0%	369	369		0	620	1660	1874	4154	2909	1852	1874
30		West Windsor	20	20	0	0%	14	14		0	50	133	1077	1260	1794	447	1077
31		West Windsor	8	1,775	1,767	22088%	8	1,823		0	20	53	2	75	0	8	2
32		West Windsor	600	600	0	0%	449	449		0	1488	3984	1985	7457	2537	5188	1985
47		West Windsor	466	865	399	86%	135	250		0	1156	3094	688	4938	956	689	688
48		West Windsor	781	1,127	346	44%	400	577		0	1937	5186	402	7525	346	856	402
49		West Windsor	484	1,179	695	144%	162	395		0	1200	3214	443	4857	539	607	443
50		West Windsor	80	537	457	571%	28	188		0	198	531	674	1404	1094	340	674
51		West Windsor	392	859	467	119%	93	205		0	972	2603	136	3711	64	403	136
54		West Windsor	420	861	441	105%	163	334		0	1042	2789	232	4062	212	466	232
84		West Windsor	5	5	0	0%	13	13		0	12	33	65	110	106	30	65
85		West Windsor	790	1,109	319	40%	697	978		0	1959	5246	3433	10638	2976	19732	3433
86		West Windsor	130	130	0	0%	90	90		0	322	863	5688	6873	9383	2933	5688
87		West Windsor	10	10	0	0%	16	16		0	25	66	32	123	18	242	32
Total		West Windsor	4,436	9,327	4,891	110%	170	358	0	0	11001	29455	16732	57188	22934	33794	16732
		Mercer County	117,964	156,266	38,302	32%	520	688	12,000	12,000	292551	793361	285527	1371439	356613	738925	285527
1		Franklin	223	816	593	266%	78	285		0	553	1481	70	2104	25	227	70
2		Franklin	138	731	593	430%	50	263		0	342	916	35	1293	0	137	35
21		Franklin	28	621	593	2118%	50	1,102		0	69	186	441	697	605	1084	441
22		Franklin	145	738	593	409%	50	253		0	360	963	563	1886	395	3886	563
88		Franklin	627	2,109	1,482	236%	90	302		0	1555	4163	502	6220	388	2127	502
89		Franklin	455	1,048	593	130%	181	417		0	1128	3021	342	4492	230	1645	342
108		Franklin	613	1,206	593	97%	83	163		0	1520	4070	12475	18065	19348	14654	12475
109		Franklin	342	935	593	173%	42	115		0	848	2271	3465	6584	5004	6387	3465
110		Franklin	310	904	594	192%	110	321		0	769	2058	3294	6121	4887	5164	3294
111		Franklin	601	1,195	594	99%	375	745		0	1490	3991	1102	6583	1320	2939	1102
112		Franklin	2,038	2,632	594	29%	686	886		0	5054	13532	2750	21337	3227	6685	2750
113		Franklin	1,957	2,551	594	30%	1,090	1,420		0	4853	12994	1322	19170	1112	4300	1322
114		Franklin	2,373	2,967	594	25%	3,472	4,341		0	5885	15757	2470	24112	2007	11310	2470
115		Franklin	2,309	2,903	594	26%	1,891	2,377		0	5726	15332	2851	23909	3368	6349	2851
116		Franklin	1,343	1,937	594	44%	1,424	2,054		0	3331	8918	2483	14731	3230	4812	2483
201		Franklin (W/C)	0				0	0	0		0	0	0	0	0	0	0
Total		Franklin	13,502	23,293	9,791	73%	289	499	0	0	33485	89653	34166	157304	45146	71704	34166
98		Hillsborough	1,062	1,699	637	60%	52	83		0	2634	7052	1041	10727	993	3568	1041
99		Hillsborough	2,654	3,885	1,231	46%	835	1,223		0	6582	17623	1643	25847	1066	7168	1643
100		Hillsborough	1,167	2,198	1,031	88%	108	203		0	2894	7749	1365	12009	1607	2952	1365
101		Hillsborough	1,526	2,164	638	42%	382	542		0	3784	10133	1136	15053	790	5233	1136
102		Hillsborough	1,017	1,655	638	63%	156	254		0	2522	6753	2025	11300	1668	11095	2025
103		Hillsborough	1,739	2,648	909	52%	178	271		0	4313	11547	1947	17807	2100	5437	1947

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Total		Hillsborough	9,165	14,249	5,084	55%	168	261	0	0	22729	60856	9158	92743	8225	35452	9158
105		Manville	1,679	1,768	89	5%	1,447	1,524		0	4164	11149	1617	16929	1365	6753	1617
106		Manville	1,055	1,143	88	8%	3,185	3,451		0	2616	7005	577	10199	424	1898	577
107		Manville	1,134	1,222	88	8%	1,148	1,237		0	2812	7530	725	11067	614	2204	725
Total		Manville	3,868	4,133	265	7%	1,560	1,667	0	0	9593	25684	2919	38195	2403	10854	2919
104		Millstone	180	187	7	4%	240	250		0	446	1195	140	1782	101	636	140
3		Montgomery/Rocky	653	700	47	7%	452	485		0	1619	4336	3965	9920	4684	14303	3965
4		Montgomery	795	1,895	1,100	138%	109	260		0	1972	5279	557	7807	584	1040	557
5		Montgomery	195	418	223	114%	75	161		0	484	1295	362	2141	433	980	362
6		Montgomery	958	1,180	222	23%	68	84		0	2376	6361	5487	14224	8777	3038	5487
7		Montgomery	185	407	222	120%	40	87		0	459	1228	96	1783	83	203	96
8		Montgomery	121	343	222	183%	60	169		0	300	803	342	1445	491	465	342
9		Montgomery	383	605	222	58%	594	938		0	950	2543	96	3589	0	379	96
200		Montgomery(W/C)	0				0	0			0	0	0	0	0	0	0
Total		Montgomery	3,290	5,548	2,258	69%	99	167	0	0	8159	21846	10905	40910	15052	20408	10905
196		South Bound Brook	1,502	1,669	167	11%	1,930	2,145		0	3725	9973	1058	14757	932	3282	1058
Somerset County (Part)			31,507	49,079	17,572	56%	227	354	0	0	78137	209206	58346	345689	71860	142336	58346
55		Cranbury	6	145	139	2317%	5	125		0	15	40	2	56	0	6	2
56		Cranbury	273	412	139	51%	166	251		0	677	1813	235	2725	280	337	235
57		Cranbury	14	153	139	993%	17	184		0	35	93	4	131	0	14	4
58		Cranbury	358	497	139	39%	378	525		0	888	2377	163	3427	46	935	163
59		Cranbury	96	235	139	145%	31	77		0	238	637	24	900	0	95	24
63		Cranbury	34	173	139	409%	25	127		0	84	226	893	1203	1480	386	893
64		Cranbury	102	241	139	136%	59	140		0	253	677	3603	4533	5907	2077	3603
66		Cranbury	15	154	139	927%	8	87		0	37	100	2965	3102	4954	1194	2965
67		Cranbury	15	155	140	933%	16	162		0	37	100	4	141	0	15	4
Total		Cranbury	913	2,165	1,252	137%	68	161	0	0	2264	6062	7892	16219	12666	5060	7892
129		East Brunswick	2,672	3,374	702	26%	677	855		0	6627	17742	11404	35773	12432	46991	11404
133		East Brunswick	838	838	0	0%	527	527		0	2078	5564	9670	17312	12483	28816	9670
135		East Brunswick	853	1,555	702	82%	189	345		0	2115	5664	439	8218	244	1906	439
136		East Brunswick	3,057	3,759	702	23%	489	601		0	7581	20298	4256	32136	4355	15191	4256
137		East Brunswick	1,627	2,329	702	43%	1,075	1,538		0	4035	10803	1787	16625	1681	6708	1787
138		East Brunswick	1,722	2,424	702	41%	887	1,249		0	4271	11434	2359	18064	2273	9383	2359
139		East Brunswick	1,166	1,869	703	60%	859	1,377		0	2892	7742	11778	22412	9627	75250	11778
140		East Brunswick	1,620	1,620	0	0%	1,215	1,215		0	4018	10757	4633	19408	4357	22981	4633
Total		East Brunswick	13,555	17,768	4,213	31%	604	792	0	0	33616	90005	46326	169948	47453	207224	46326
143		Helmetta	439	986	547	125%	562	1,263		0	1089	2915	316	4320	311	760	316

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145		Jamesburg	1,688	2,215	527	31%	1,840	2,414		0	4186	11208	3550	18944	3913	12476	3550
134		Milltown	2,412	3,000	588	24%	1,673	2,081		0	5982	16016	4039	26036	5010	9099	4039
144		Monroe	4,252	5,048	796	19%	438	520		0	10545	28233	1064	39842	2	4210	1064
146		Monroe	3,553	4,349	796	22%	575	704		0	8811	23592	2631	35034	2914	4211	2631
147		Monroe	52	848	796	1531%	36	593		0	129	345	13	487	0	51	13
148		Monroe	262	1,058	796	304%	42	171		0	650	1740	67	2456	2	260	67
149		Monroe	313	1,110	797	255%	31	111		0	776	2078	530	3385	756	490	530
150		Monroe	149	946	797	535%	22	140		0	370	989	38	1397	2	148	38
151		Monroe	59	856	797	1351%	33	473		0	146	392	16	554	2	59	16
Total		Monroe	8,640	14,215	5,575	65%	205	338	0	0	21427	57370	4359	83156	3678	9429	4359
117		New Brunswick	1,637	2,015	378	23%	1,106	1,362		0	4060	10870	4726	19656	6645	7512	4726
118		New Brunswick	1,511	1,889	378	25%	5,791	7,239		0	3747	10033	974	14754	808	3102	974
119		New Brunswick	817	1,195	378	46%	3,575	5,229		0	2026	5425	1718	9169	2340	2803	1718
120		New Brunswick	1,365	1,743	378	28%	6,880	8,785	500	500	3385	9484	796	13664	576	2897	796
121		New Brunswick	1,165	1,543	378	32%	5,636	7,464	500	500	2889	8156	2474	13519	3285	4712	2474
122		New Brunswick	437	815	378	86%	1,555	2,900		0	1084	2902	8550	12535	13146	10836	8550
123		New Brunswick	831	1,209	378	45%	5,634	8,197		0	2061	5518	5070	12648	7301	8786	5070
124		New Brunswick	2,027	2,405	378	19%	10,347	12,276		0	5027	13459	3311	21797	4401	5221	3311
125		New Brunswick	1,015	1,393	378	37%	1,313	1,801	5,500	5,500	2517	11360	15667	29544	23406	24674	15667
126		New Brunswick	1,877	2,254	377	20%	960	1,153	2,000	2,000	4655	14143	8150	26948	9421	29871	8150
Total		New Brunswick	12,682	16,461	3,779	30%	2,214	2,874	8,500	8,500	31451	91348	51434	174234	71328	100415	51434
90		North Brunswick	2,668	3,587	919	34%	930	1,250		0	6617	17716	3931	28263	3977	14693	3931
92		North Brunswick	1,129	4,129	3,000	266%	430	1,573		0	2800	7497	1229	11526	1584	1495	1229
93		North Brunswick	2,399	2,779	380	16%	992	1,149		0	5950	15929	1471	23350	1238	4312	1471
94		North Brunswick	1,211	1,211	0	0%	955	955		0	3003	8041	1756	12801	2090	4250	1756
95		North Brunswick	3,311	3,505	194	6%	1,187	1,257		0	8211	21985	15492	45688	19967	42189	15492
127		North Brunswick	7	7	0	0%	39	39		0	17	46	171	235	284	74	171
128		North Brunswick	5	5	0	0%	7	7		0	12	33	340	386	567	140	340
Total		North Brunswick	10,730	15,223	4,493	42%	833	1,182	0	0	26610	71247	24391	122248	29706	67153	24391
28		Plainsboro	551	1,513	962	175%	451	1,238		0	1366	3659	2206	7231	1374	16492	2206
33		Plainsboro	39	1,001	962	2467%	30	782		0	97	259	1117	1473	1852	480	1117
34		Plainsboro	10	10	0	0%	15	15		0	25	66	850	941	1418	347	850
35		Plainsboro	6	6	0	0%	6	6		0	15	40	4034	4089	6745	1612	4034
36		Plainsboro	224	1,186	962	429%	303	1,602		0	556	1487	293	2336	397	316	293
43		Plainsboro	27	989	962	3563%	11	401		0	67	179	7	253	0	27	7
44		Plainsboro	992	1,954	962	97%	1,285	2,531		0	2460	6587	1362	10409	797	9153	1362
45		Plainsboro	4,897	5,859	962	20%	2,886	3,453		0	12145	32516	1732	46393	493	7633	1732
46		Plainsboro	87	1,048	961	1105%	37	442		0	216	578	78	872	95	109	78
Total		Plainsboro	6,833	13,566	6,733	99%	559	1,109	0	0	16946	45371	11679	73996	13171	36168	11679

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23	South Brunswick	1,288	2,192	904	70%	474	806		0	3194	8552	1090	12837	661	6107	1090
24	South Brunswick	2,097	2,413	316	15%	711	819		0	5201	13924	932	20057	302	4998	932
25	South Brunswick	425	1,499	1,074	253%	232	818		0	1054	2822	486	4362	239	3442	486
26	South Brunswick	158	269	111	70%	122	209		0	392	1049	296	1737	429	259	296
27	South Brunswick	423	1,619	1,196	283%	777	2,974		0	1049	2809	227	4085	112	1129	227
37	South Brunswick	42	154	112	267%	23	85		0	104	279	2955	3338	4925	1214	2955
38	South Brunswick	707	855	148	21%	265	320		0	1753	4694	714	7162	339	4976	714
39	South Brunswick	82	1,131	1,049	1279%	72	996		0	203	544	21	768	0	81	21
40	South Brunswick	611	1,019	408	67%	229	382		0	1515	4057	930	6502	1233	1400	930
41	South Brunswick	1,669	2,469	800	48%	560	829		0	4139	11082	2804	18025	3736	4457	2804
42	South Brunswick	178	459	281	158%	82	212		0	441	1182	3746	5370	6192	1650	3746
60	South Brunswick	47	159	112	238%	23	76		0	117	312	12	440	0	47	12
61	South Brunswick	288	857	569	198%	64	192		0	714	1912	956	3582	1478	637	956
62	South Brunswick	137	249	112	82%	18	33		0	340	910	2334	3583	3846	1051	2334
91	South Brunswick	189	301	112	59%	54	85		0	469	1255	314	2038	446	293	314
Total	South Brunswick	8,341	15,645	7,304	88%	206	387	0	0	20686	55384	17817	93887	23938	31742	17817
130	South River	1,516	1,743	227	15%	1,630	1,875		0	3760	10066	2281	16106	2520	7049	2281
131	South River	1,174	1,401	227	19%	2,847	3,398		0	2912	7795	966	11673	763	4057	966
132	South River	2,133	2,360	227	11%	1,409	1,559		0	5290	14163	1244	20697	924	4315	1244
Total	South River	4,823	5,504	681	14%	1,689	1,927	0	0	11961	32025	4491	48476	4207	15422	4491
141	Spotswood	1,859	2,084	225	12%	1,198	1,343		0	4610	12344	1885	18839	1818	6446	1885
142	Spotswood	1,045	1,270	225	22%	1,277	1,552		0	2592	6939	2110	11641	2268	7754	2110
Total	Spotswood	2,904	3,354	450	15%	1,225	1,415	0	0	7202	19283	3995	30480	4086	14200	3995
Middlesex Co. (part)		73,960	110,102	36,142	49%	469	699	8,500	8,500	183421	498234	180289	861944	219467	509147	180289
	MSM Region Total	223,431	315,447	92,016	41%	427	603	20,500	20,500	554109	1500802	524161	2579072	647939	1390408	524161

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Zone	Growth Code	Municipality	1988 Daily Trips/Sq. Mi. Total Daily	1988 Daily Trips/Sq. Mi. HBW	1988 Daily Trips/Sq. Mi. Total	Trend Scenario 2010 Productions HBW	Trend Scenario 2010 Productions HBO	Trend Scenario 2010 Productions NHB	Trend Scenario Total Daily	Trend Scenario 2010 Attractions HBW	Trend Scenario 2010 Attractions HBO	Trend Scenario 2010 Attractions NHB	Trend Scenario Total Daily	2010 Daily Trips/Sq. Mi. HBW	2010 Daily Trips/Sq. Mi. Total	2010 Scen1 NREmp	Scenario 1 Change from Trend
52		East Windsor	5572	3405	15525	7329	18886	1068	27282	155	4787	1068	6009	3801	16909	0	0
53		East Windsor	12657	4061	10167	1399	3606	4800	9805	7577	2476	4800	14853	5142	14126	3,609	(400)
70		East Windsor	11312	11330	52523	7343	18922	2518	28783	2019	7908	2518	12444	13142	57878	587	(267)
71		East Windsor	4310	2790	7082	1278	3292	1969	6539	2986	1283	1969	6239	4859	14560	7,222	5,642
72		East Windsor	1628	2338	9705	3564	9184	1885	14632	945	9779	1885	12609	3832	23150	100	0
73		East Windsor	19411	4811	29881	3880	9998	3601	17479	2644	15900	3601	22145	5945	36107	722	0
76		East Windsor	2846	839	2695	2038	5252	3983	11273	6135	2388	3983	12506	3063	8913	684	(2,562)
77		East Windsor	218	235	1007	1556	4010	270	5836	57	1275	270	1602	870	4012	0	0
78		East Windsor	405	335	1433	1909	4920	204	7034	0	808	204	1012	789	3323	0	0
79		East Windsor	2554	1435	4005	1439	3708	1994	7141	2998	1354	1994	6345	3935	11960	6,691	5,105
Total		East Windsor	60914	2393	9789	31735	81779	22291	135805	25515	47958	22291	95764	3658	14797	19,615	7,518
181		Ewing	174780	5766	22644	30591	81350	48458	160399	63116	85709	48458	197284	6629	25302	24,952	(4,797)
182		Ewing	7052	2514	9326	3367	8677	1925	13970	2363	3017	1925	7304	2699	10021	1,200	0
Total		Ewing	181832	5342	20905	33958	90027	50384	174369	65479	88726	50384	204588	6116	23307	26,152	(4,797)
81		Hamilton	11425	2251	8143	8394	21630	4080	34103	4837	6622	4080	15539	2551	9571	2,213	(253)
164		Hamilton	2920	3927	18245	4193	10806	852	15851	270	3911	852	5033	5596	26180	0	(40)
165		Hamilton	8782	2466	12127	5773	14876	1610	22259	881	6599	1610	9090	2937	13839	270	0
166		Hamilton	5460	993	3132	1568	4040	1739	7347	2372	2258	1739	6368	1570	5465	1,133	(72)
167		Hamilton	1943	300	1008	2111	5439	736	8286	832	1100	736	2667	531	1976	440	0
168		Hamilton	5239	1724	8010	4158	10715	1431	16304	877	5875	1431	8182	2347	11415	270	0
169		Hamilton	2274	3465	12680	2827	7284	796	10907	805	1396	796	2997	5250	20100	426	0
170		Hamilton	10987	2360	11701	4940	12729	6131	23800	8125	9474	6131	23731	5690	20700	597	(3,435)
171		Hamilton	20526	4484	25182	6217	16022	3420	25659	2419	14282	3420	20120	5111	27093	730	0
172		Hamilton	46973	4364	24320	8583	22118	9566	40267	9312	31461	9566	50339	5274	26705	2,576	(1,081)
173		Hamilton	58410	5144	42946	5941	15310	8332	29583	5266	42657	8332	56254	5772	44208	853	0
174		Hamilton	18532	5253	20303	11651	30023	5540	47214	6494	9236	5540	21270	5814	21943	2,763	(539)
175		Hamilton	20506	6850	36282	8962	23095	3452	35509	2017	15222	3452	20691	7486	38322	523	0
176		Hamilton	12780	2437	8473	7633	19670	5740	33043	6105	14993	5740	26838	2832	12343	2,720	0
177		Hamilton	29071	11033	48038	6229	16052	6457	28738	7292	15900	6457	29649	12031	51953	3,288	0
178		Hamilton	17858	5229	18016	5342	13766	5165	24274	6906	7071	5165	19143	5765	20436	3,500	0
Total		Hamilton	273689	3164	14798	94522	243576	65047	403145	64808	188057	65047	317913	3872	17523	22,302	(5,420)
74		Hightstown	6902	10000	30651	1619	4173	3483	9275	5016	3941	3483	12440	13254	43376	1,742	(812)
75		Hightstown	24884	6384	50105	2637	6796	4711	14144	3829	20149	4711	28689	8496	56280	313	(813)
Total		Hightstown	31785	7819	42386	4256	10969	8194	23419	8845	24090	8194	41129	10384	51160	2,055	(1,625)
183		Hopewell Township	1683	323	1155	1147	2955	1205	5306	1011	4755	1205	6971	416	2365	335	0
184		Hopewell Township	1854	355	1269	1266	3262	814	5342	1106	811	814	2730	457	1557	9,370	8,785
186		Hopewell Township	5557	327	1374	826	2129	1240	4195	1508	2693	1240	5442	336	1388	700	0
187		Hopewell Township	1487	156	557	964	2484	451	3899	567	549	451	1567	164	585	300	0
188		Hopewell Township	1376	168	619	1226	3160	421	4807	473	636	421	1530	191	714	250	0
189		Hopewell Township	2959	420	1548	1226	3160	1740	6126	2508	1745	1740	5993	887	2878	500	(797)
190		Hopewell Township	446	281	1201	931	2400	100	3431	0	394	100	494	293	1234	0	0

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191		Hopewell Township	1520	508	1701	1753	4516	587	6857	652	904	587	2143	941	3523	345	0
192		Hopewell Township	446	171	732	3218	8291	344	11853	0	1361	344	1705	617	2600	0	0
193		Hopewell Boro	3847	4399	17624	2534	6530	1212	10277	1285	2718	1212	5215	5585	22654	499	(115)
194		Hopewell Township	384	255	1089	817	2104	87	3008	0	346	87	433	270	1139	0	0
195		Hopewell Township	384	217	926	1013	2611	108	3732	0	429	108	537	285	1202	0	0
202		Hopewell (W/C)	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
203		Hopewell (W/C)	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
Total		Hopewell Township	21946	308	1187	16921	43603	8309	68833	9110	17340	8309	34758	442	1757	12,359	7,933
69		Lawrence	32599	4486	68590	2312	5958	4869	13138	3202	24878	4869	32948	10423	87121	107	(437)
80		Lawrence	17016	2450	11267	2766	7127	5851	15745	7573	10949	5851	24374	3995	15503	1,730	(1,884)
82		Lawrence	9339	1942	5697	2270	5849	4333	12452	6664	2618	4333	13614	2739	7991	2,444	(1,082)
83		Lawrence	78124	5439	54349	2909	7495	14161	24564	10970	65856	14161	90986	8083	67300	10,625	7,902
96		Lawrence	15705	2987	8475	2101	5415	7856	15372	12434	3981	7856	24272	4267	11637	4,205	(2,374)
97		Lawrence	4254	1151	4957	6250	16106	1021	23378	482	3266	1021	4770	1174	4909	110	(120)
179		Lawrence	95187	6975	44038	7682	22316	16520	46519	15857	60046	16520	92423	7515	44360	4,463	(491)
Total		Lawrence	252223	3093	18291	26290	70267	54611	151168	57182	171593	54611	283385	4098	21335	23,684	1,514
185		Pennington	7739	5464	18547	2604	6711	4489	13804	6710	3574	4489	14772	9688	29724	1,596	(1,914)
10		Princeton Township	505	470	1826	1563	4028	252	5843	138	696	252	1085	1248	5081	73	0
11		Princeton Township	7118	2975	8892	1945	5011	5068	12023	7825	3271	5068	16163	6920	19966	1,719	(2,396)
12		Princeton Township	24607	5114	28890	5127	13212	7009	25348	8082	17237	7009	32328	8661	37820	1,230	(2,396)
13		Princeton Township	1292	2634	10912	2979	7676	416	11071	159	1300	416	1874	3826	15785	84	0
14		Princeton Township/	43651	19394	59503	3108	11574	13034	27716	20042	11144	13034	44221	19779	61464	9,224	0
15		Princeton Boro	49554	30943	123054	5583	14934	12794	33311	16211	26154	12794	55159	33336	135325	6,958	(461)
16		Princeton Township	3492	841	3583	2792	7194	870	10855	743	2370	870	3983	1168	4905	343	0
17		Princeton Township	1884	577	1986	1968	5071	685	7724	773	1025	685	2483	929	3459	409	0
18		Princeton Township	1251	706	2689	2141	5517	461	8119	378	1000	461	1839	1192	4711	200	0
19		Princeton Boro	3728	3620	16087	1945	5780	883	8607	947	2172	883	4002	4409	19229	200	0
20		Princeton Township	2105	625	2707	1961	5213	3352	10525	5013	2705	3352	11070	3097	9591	175	(2,395)
Total		Princeton	139187	3748	14334	31110	85209	44823	161142	60309	69074	44823	174207	5095	18691	20,615	(7,648)
180		Trenton	315944	23639	88431	92708	238903	100820	432431	132111	157579	100820	390510	28315	103645	81,465	15,821
152		Washington	2355	264	2162	154	398	335	887	236	1631	335	2202	260	2056	50	0
153		Washington	239	123	430	124	320	71	515	95	76	71	242	119	410	50	0
154		Washington	244	98	346	133	344	72	549	95	80	72	247	94	330	50	0
155		Washington	12	20	86	23	60	3	86	0	10	3	12	19	80	0	0
156		Washington	1655	425	3003	154	398	248	800	189	1117	248	1554	416	2855	50	0
157		Washington	1727	238	1487	576	1483	293	2352	189	1295	293	1777	368	1986	80	30
158		Washington	1309	518	2423	821	2117	233	3170	142	885	233	1259	494	2271	50	0
159		Washington	3122	1351	5114	1771	4565	856	7192	992	1498	856	3347	1579	6022	500	0
160		Washington	34	24	102	59	151	1771	1980	2875	740	1771	5385	1112	2792	9,000	7,479
161		Washington	1561	399	1577	576	1483	409	2468	473	863	409	1745	662	2659	225	0
162		Washington	4265	5185	26359	473	1218	845	2536	919	2437	845	4201	5357	25943	350	(36)

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Zone	Growth Code	Municipality	Total Daily	1988 Daily Trips/Sq. Mi. HBW	Total	Trend Scenario 2010 Productions HBW	HBO	NHB	Total Daily	Trend Scenario 2010 Attractions HBW	HBO	NHB	Total Daily	2010 Daily Trips/Sq. Mi. HBW	Total	2010 Scen1 NREmp	Scenario 1 Change from Trend
163		Washington	5820	991	5354	4867	12542	1861	19270	1244	7391	1861	10495	2545	12397	225	(183)
Total		Washington	22345	465	2280	9732	25079	6996	41807	7447	18023	6996	32466	839	3627	10,630	7,290
29		West Windsor	6635	5204	15912	585	1508	1941	4034	2911	1775	1941	6627	5155	15722	1,500	0
30		West Windsor	3318	1280	3179	47	121	1539	1706	2499	641	1539	4678	1768	4434	949	(373)
31		West Windsor	10	20	87	4154	10703	444	15301	0	1757	444	2201	4266	17974	0	0
32		West Windsor	9711	3010	12838	1404	3618	3170	8192	4262	5170	3170	12602	4237	15550	13,172	11,092
47		West Windsor	2334	610	2101	2024	5216	3232	10472	2279	15486	3232	20998	1244	9093	506	0
48		West Windsor	1603	1169	4674	2637	6796	494	9927	346	1202	494	2042	1527	6128	183	0
49		West Windsor	1589	582	2157	2759	7109	625	10494	539	1301	625	2465	1104	4337	285	0
50		West Windsor	2108	452	1227	1257	3238	806	5301	1094	804	806	2704	822	2797	579	0
51		West Windsor	604	247	1029	2010	5180	254	7444	64	866	254	1185	495	2058	34	0
54		West Windsor	909	486	1927	2015	5192	345	7552	212	905	345	1462	863	3494	112	0
84		West Windsor	201	311	818	12	30	4231	4272	6891	1719	4231	12840	18178	45065	56	(3,590)
85		West Windsor	26142	4354	32447	2595	6687	5288	14571	3731	25692	5288	34711	5581	43476	796	0
86		West Windsor	18003	6732	17256	304	784	14444	15532	23387	6447	14444	44278	16434	41489	4,940	(7,409)
87		West Windsor	292	70	673	23	60	37	121	19	216	37	272	69	636	0	0
Total		West Windsor	73459	1303	5018	21825	56242	36851	114918	48233	63980	36851	149063	2691	10139	23,112	(280)
		Mercer County	1381065	2860	12126	365662	952364	402814	1720840	485747	849994	402814	1738555	3751	15240	243,585	18,392
1		Franklin	322	201	846	1909	4920	219	7049	25	814	219	1058	675	2828	13	0
2		Franklin	171	123	527	1711	4408	183	6301	0	724	183	906	616	2595	0	0
21		Franklin	2130	1196	5015	1453	3745	620	5818	607	1569	620	2796	3654	15282	281	0
22		Franklin	4844	259	2308	1727	4450	801	6978	403	4045	801	5249	730	4194	53	0
88		Franklin	3017	278	1321	4935	12717	1896	19548	928	9270	1896	12094	839	4527	145	0
89		Franklin	2218	540	2668	2452	6319	520	9292	232	2100	520	2852	1068	4830	73	0
108		Franklin	46476	2815	8706	2822	7272	13442	23537	19853	14448	13442	47743	3059	9615	9,834	(256)
109		Franklin	14855	720	2637	2188	5638	4426	12252	6029	6704	4426	17159	1011	3618	2,440	(537)
110		Franklin	13346	2011	6923	2115	5451	5492	13058	7902	6476	5492	19870	3562	11710	11,428	7,427
111		Franklin	5361	1753	7447	2796	7206	1318	11320	1325	3301	1318	5943	2569	10763	612	0
112		Franklin	12662	2787	11442	6159	15871	3039	25069	3236	6846	3039	13120	3162	12852	1,541	0
113		Franklin	6734	3321	14422	5969	15383	1536	22888	1117	4652	1536	7304	3945	16810	499	0
114		Franklin	15788	11548	58379	6943	17891	2845	27678	2026	10915	2845	15785	13123	63594	700	0
115		Franklin	12568	7448	29873	6793	17505	3128	27426	3376	6586	3128	13090	8327	33179	1,643	0
116		Franklin	10525	6955	26777	4533	11680	2745	18958	3236	5113	2745	11094	8236	31860	1,593	0
201		Franklin (W/C)	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
Total		Franklin	151015	1684	6602	54506	140457	42209	237172	50293	83562	42209	176064	2244	8848	30,885	6,664
98		Hillsborough	5602	178	800	3976	10245	1643	15864	1202	6160	1643	9005	254	1219	428	0
99		Hillsborough	9877	2407	11243	9091	23427	2834	35352	2177	8968	2834	13980	3546	15526	9,381	8,457
100		Hillsborough	5924	415	1655	5143	13254	4663	23061	6469	5030	4663	16163	1071	3619	790	(2,571)
101		Hillsborough	7159	1146	5563	5064	13049	2665	20778	2727	6738	2665	12131	1951	8242	267	(981)
102		Hillsborough	14789	644	4009	3873	9980	3272	17124	2907	11703	3272	17882	1042	5380	469	(604)
103		Hillsborough	9484	657	2794	6196	15967	3931	26095	4646	7413	3931	15990	1110	4309	974	(1,303)

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Total		Hillsborough	52835	566	2662	33343	85921	19009	138273	20129	46013	19009	85150	978	4086	12,309	2,998
105		Manville	9735	4767	22986	4137	10661	2678	17476	2856	6659	2678	12193	6028	25576	519	(783)
106		Manville	2898	9177	39539	2675	6892	1532	11099	1907	2269	1532	5708	13831	50740	192	(784)
107		Manville	3543	3470	14795	2859	7369	1688	11916	2098	2555	1688	6341	5020	18487	285	(784)
Total		Manville	16176	4839	21935	9671	24922	5898	40491	6861	11483	5898	24242	6669	26115	996	(2,351)
104		Millstone	877	731	3550	438	1128	334	1899	397	666	334	1397	1114	4401	35	(156)
3		Montgomery/Rocky	22952	4365	22760	1638	4221	5820	11679	6649	15947	5820	28416	5738	27761	1,943	(898)
4		Montgomery	2181	351	1370	4434	11427	844	16705	584	2122	844	3549	688	2778	304	0
5		Montgomery	1776	354	1511	978	2521	1607	5106	1858	4030	1607	7495	1094	4863	200	(626)
6		Montgomery	17303	792	2239	2761	7115	6725	16602	9826	7087	6725	23639	894	2858	4,644	(382)
7		Montgomery	382	116	463	952	2454	153	3559	83	424	153	660	222	903	44	0
8		Montgomery	1298	390	1353	803	2068	1628	4499	1998	3589	1628	7215	1381	5777	280	(640)
9		Montgomery	475	1473	6300	1416	3648	151	5215	0	599	151	750	2195	9248	0	0
200		Montgomery(W/C)	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
Total		Montgomery	46366	698	2625	12982	33454	16929	63366	20998	33798	16929	71724	1022	4063	7,445	(2,516)
196		South Bound Brook	5273	5985	25740	3905	10064	1829	15799	2041	3546	1829	7417	7642	29834	426	(585)
Somerset County (Part)			272542	1082	4459	114845	295946	86209	497000	100718	179067	86209	365994	1555	6225	52,096	4,054
55		Cranbury	7	13	55	339	874	36	1250	0	144	36	180	293	1233	0	0
56		Cranbury	852	583	2181	964	2484	275	3723	280	477	275	1032	758	2899	148	0
57		Cranbury	17	42	179	358	923	38	1319	0	151	38	190	431	1815	0	0
58		Cranbury	1144	987	4830	1163	2997	211	4371	47	1006	211	1264	1279	5954	0	0
59		Cranbury	119	78	334	550	1417	59	2026	0	233	59	291	180	760	0	0
63		Cranbury	2759	1149	2910	405	1043	1772	3220	2816	872	1772	5459	2366	6375	783	(707)
64		Cranbury	11587	3573	9351	564	1453	4667	6684	6411	7679	4667	18757	4046	14759	3,131	30
66		Cranbury	9113	2827	6919	360	929	3079	4368	4954	1384	3079	9417	3010	7808	2,621	0
67		Cranbury	19	39	167	363	935	39	1336	0	153	39	192	380	1602	0	0
Total		Cranbury	25618	1112	3115	5066	13055	10175	28296	14508	12100	10175	36783	1457	4845	6,683	(677)
129		East Brunswick	70827	4828	27002	7895	20345	16482	44723	15747	59209	16482	91439	5989	34489	4,811	(935)
133		East Brunswick	50969	9164	42973	1961	5053	14767	21781	16700	42450	14767	73918	11744	60229	5,537	(1,434)
135		East Brunswick	2588	524	2398	3639	9377	641	13657	246	2485	641	3371	862	3779	86	0
136		East Brunswick	23801	1910	8950	8796	22667	8558	40021	7399	32321	8558	48279	2591	14127	1,829	(754)
137		East Brunswick	10176	3775	17701	5450	14044	2096	21590	1692	6865	2096	10653	4717	21295	689	0
138		East Brunswick	14015	3371	16525	5672	14617	2858	23147	2491	9307	2858	14656	4205	19473	898	(107)
139		East Brunswick	96655	9227	87755	4373	11270	14388	30031	10212	70948	14388	95547	10749	92554	2,028	(62)
140		East Brunswick	31971	6282	38540	3791	9769	7028	20587	7433	21373	7028	35834	8419	42322	1,437	(1,604)
Total		East Brunswick	301003	3613	20989	41577	107141	66819	215537	61920	244958	66819	373697	4613	26260	17,315	(4,896)
143		Helmetta	1387	1793	7308	2307	5946	533	8786	425	1303	533	2261	3499	14147	154	(60)

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	1988 Daily Trips/Sq. Mi. Total Daily	HBW	Total	Trend Scenario 2010 Productions HBW	HBO	NHB	Total Daily	Trend Scenario 2010 Attractions HBW	HBO	NHB	Total Daily	2010 Daily Trips/Sq. Mi. HBW	Total	2010 Scen1 NREmp	Scenario 1 Change from Trend
145		Jamesburg	19939	8827	42373	5183	13356	4689	23229	5109	12162	4689	21960	11216	49245	1,649	(621)
134		Milltown	18147	7625	30650	7020	18090	4623	29733	5400	9175	4623	19197	8616	33943	2,415	(200)
144		Monroe	5276	1087	4650	11812	30439	5423	47675	3863	21528	5423	30814	1616	8090	0	(1,269)
146		Monroe	9756	1898	7252	10177	26224	7491	43892	7273	22990	7491	37754	2825	13219	1,542	(1,466)
147		Monroe	64	90	386	1984	5113	212	7310	0	840	212	1052	1388	5848	0	0
148		Monroe	328	105	451	2476	6380	4854	13709	4557	17770	4854	27181	1138	6619	0	(1,635)
149		Monroe	1776	153	515	2597	6693	2091	11381	2954	1834	2091	6878	554	1822	400	(1,163)
150		Monroe	188	55	235	2214	5704	1716	9634	2410	1536	1716	5661	684	2262	0	(1,275)
151		Monroe	77	82	348	2003	5162	1563	8728	2198	1394	1563	5155	2320	7665	0	(1,163)
Total		Monroe	17466	597	2391	33263	85716	23350	142329	23255	67891	23350	114495	1343	6103	1,942	(7,971)
117		New Brunswick	18884	7234	26043	4715	12150	5573	22439	7549	7669	5573	20791	8287	29213	6,335	2,530
118		New Brunswick	4883	17456	75255	4420	11391	1113	16924	811	3317	1113	5241	20047	84944	3,370	3,003
119		New Brunswick	6861	19108	70150	2796	7206	2154	12156	2786	3142	2154	8081	24428	88561	4,180	2,769
120		New Brunswick	4268	19964	90387	4079	10930	919	15928	578	3148	919	4645	23471	103694	3,111	3,003
121		New Brunswick	10472	29867	116056	3611	9724	2943	16278	3438	6433	2943	12814	34095	140731	4,485	3,002
122		New Brunswick	32532	50637	160371	1907	4914	9290	16111	13309	12092	9290	34691	54148	180780	9,647	3,002
123		New Brunswick	21156	63469	229185	2829	7290	6466	16585	9015	8923	6466	24405	80302	277903	6,599	2,102
124		New Brunswick	12932	48123	177273	5628	14502	3525	23655	4406	5385	3525	13315	51214	188708	5,238	3,002
125		New Brunswick	63747	33522	120638	3260	13020	16412	32691	23437	23560	16412	63409	34523	124271	13,113	3,002
126		New Brunswick	47442	7201	38054	5274	15272	8933	29479	9475	27441	8933	45849	7545	38534	6,341	3,002
Total		New Brunswick	223177	17947	69393	38519	106400	57328	202246	74803	101110	57328	233241	19787	76041	62,419	28,417
90		North Brunswick	22600	3693	17731	8394	21630	7189	37212	7666	19259	7189	34114	5598	24864	1,630	(1,739)
92		North Brunswick	4308	1670	6032	9662	24898	11238	45798	15507	13931	11238	40677	9588	32943	9,838	1,931
93		North Brunswick	7021	2972	12557	6503	16757	4099	27359	4523	9340	4099	17962	4559	18738	585	(1,536)
94		North Brunswick	8097	4018	16486	2834	7302	4325	14461	5379	8805	4325	18508	6479	26009	997	(1,537)
95		North Brunswick	77647	10105	44231	8202	21135	19114	48451	23324	43383	19114	85822	11306	48153	9,106	(1,537)
127		North Brunswick	529	1675	4254	16	42	3310	3369	4638	5178	3310	13127	25908	91820	150	(2,104)
128		North Brunswick	1047	787	1947	12	30	2826	2868	3850	4980	2826	11656	5247	19734	300	(1,537)
Total		North Brunswick	121250	4371	18899	35622	91795	52102	179518	64887	104877	52102	221866	7801	31154	22,606	(8,059)
28		Plainsboro	20071	2242	22337	3540	9123	14862	27525	20794	21636	14862	57291	19908	69390	9,060	(1,197)
33		Plainsboro	3449	1522	3843	2342	6036	4755	13133	7339	2816	4755	14909	7559	21895	980	(2,903)
34		Plainsboro	2615	2106	5193	23	60	10317	10400	16579	5338	10317	32234	24244	62256	750	(7,962)
35		Plainsboro	12392	6782	16535	14	36	6753	6803	10775	3891	6753	21419	10824	28315	3,569	(2,072)
36		Plainsboro	1006	1286	4515	2775	7152	540	10467	397	1273	540	2210	4284	17122	210	0
43		Plainsboro	33	27	116	2314	5964	247	8525	0	979	247	1226	937	3950	0	0
44		Plainsboro	11311	4219	28134	4572	11783	4530	20885	5043	11425	4530	20998	12454	54252	81	(2,177)
45		Plainsboro	9858	7447	33149	13710	35330	3339	52379	2387	9950	3339	15676	9486	40105	147	(939)
46		Plainsboro	281	131	486	2452	6319	320	9092	95	1061	320	1476	1074	4457	50	0
Total		Plainsboro	61018	2462	11036	31744	81803	45662	159210	63408	58369	45662	167439	7778	26701	14,847	(17,250)

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	Total Daily	1988 Daily Trips/Sq. Mi. HBW	Total	Trend Scenario 2010 Productions HBW	HBO	NHB	Total Daily	Trend Scenario 2010 Attractions HBW	HBO	NHB	Total Daily	2010 Daily Trips/Sq. Mi. HBW	Total	2010 Scen1 NREmp	Scenario 1 Change from Trend
23		South Brunswick	7858	1418	7613	5129	13218	1920	20267	1128	8357	1920	11405	2302	11652	150	(153)
24		South Brunswick	6232	1867	8918	5646	14550	1126	21323	333	5244	1126	6703	2028	9508	38	0
25		South Brunswick	4167	706	4656	3508	9039	2755	15302	1297	15588	2755	19640	2623	19075	0	0
26		South Brunswick	984	636	2109	629	1622	675	2927	990	513	675	2178	1256	3957	227	(297)
27		South Brunswick	1469	2133	10203	3788	9763	544	14095	113	2234	544	2891	7168	31205	30	0
37		South Brunswick	9095	2764	6834	360	929	7635	8924	12378	3230	7635	23243	7001	17681	2,606	(3,943)
38		South Brunswick	6029	783	4938	2001	5156	852	8009	348	4629	852	5829	879	5180	0	0
39		South Brunswick	102	179	766	2647	6820	283	9749	0	1120	283	1402	2330	9817	0	0
40		South Brunswick	3563	1030	3774	2384	6145	11947	20476	17673	12757	11947	42377	7520	23565	12,631	3,646
41		South Brunswick	10997	2643	9740	5777	14888	3397	24062	4213	5180	3397	12789	3353	12367	1,895	(250)
42		South Brunswick	11588	3057	7816	1074	2768	5053	8895	7974	2819	5053	15846	4170	11403	3,276	(924)
60		South Brunswick	58	56	239	372	959	40	1371	0	157	40	197	179	753	30	30
61		South Brunswick	3071	491	1490	2005	5168	3955	11128	6095	2364	3955	12415	1814	5272	782	(2,443)
62		South Brunswick	7231	554	1430	583	1501	17570	19654	28526	7340	17570	53436	3850	9667	11,035	(4,058)
91		South Brunswick	1053	259	876	704	1815	1432	3952	2211	848	1432	4492	826	2392	236	(934)
Total		South Brunswick	73497	1104	4142	36609	94339	59185	190133	83279	72380	59185	214844	2966	10021	32,936	(9,326)
130		South River	11849	6754	30066	4079	10510	2882	17471	3170	6873	2882	12925	7795	32691	1,122	(338)
131		South River	5787	8912	42346	3278	8448	1489	13216	1408	4128	1489	7025	11366	49089	288	(338)
132		South River	6483	4103	17950	5522	14231	1754	21507	1569	4474	1754	7797	4683	19353	404	(339)
Total		South River	24119	5660	25416	12879	33189	6125	52194	6146	15475	6125	27747	6661	27987	1,814	(1,015)
141		Spotswood	10150	4143	18683	4877	12567	2522	19966	2572	6379	2522	11474	4801	20262	784	(394)
142		Spotswood	12132	5939	29056	2972	7658	2801	13431	3026	7454	2801	13281	7331	32648	936	(394)
Total		Spotswood	22281	4763	22264	7848	20225	5323	33396	5598	13833	5323	24755	5674	24538	1,720	(788)
Middlesex Co. (part)			908903	2557	11238	257639	671055	335914	1264608	408738	713633	335914	1458285	4229	17280	166,500	(22,446)
		MSM Region Total	2562509	2297	9827	738146	1919365	824937	3482449	995203	1742694	824937	3562834	3313	13465	462,181	0

Source: Douglas & Douglas, Inc.

Zone	Growth Code Municipality	% Chnge from Trend	Scen1 Retail Employme	Change from Trend	% Chnge from Trend	Scen1 2,010 DU's	Change from Trend	% Chnge from Trend	Scenario 1 2010 Productions HBW	HBO	NHB	Daily Total	Scenario 1 2010 Attractions HBW	HBO	NHB	Daily Total
52	East Windsor	0.0%	82	0	0.0%	2,642	(490)	-15.6%	6182	15931	945	23059	155	4302	945	5402
53	East Windsor	-10.0%	0	0	0.0%	108	(490)	-81.9%	253	651	4213	5117	6821	1803	4213	12838
70	East Windsor	-31.3%	214	0	0.0%	2,648	(490)	-15.6%	6196	15967	2086	24249	1514	7297	2086	10897
71	East Windsor	357.1%	550	550	0.0%	56	(490)	-89.7%	131	338	10300	10769	14689	14758	10300	39747
72	East Windsor	0.0%	0	(400)	-100.0%	1,033	(490)	-32.2%	2417	6229	374	9020	189	1070	374	1633
73	East Windsor	0.0%	552	(125)	-18.5%	1,169	(489)	-29.5%	2735	7049	3045	12830	2408	12846	3045	18299
76	East Windsor	-78.9%	0	0	0.0%	381	(490)	-56.3%	892	2297	889	4078	1293	699	889	2880
77	East Windsor	0.0%	0	(30)	-100.0%	176	(489)	-73.5%	412	1061	44	1517	0	174	44	218
78	East Windsor	0.0%	0	0	0.0%	327	(489)	-59.9%	765	1972	82	2819	0	324	82	405
79	East Windsor	321.9%	550	550	0.0%	6,126	5,511	896.1%	14335	36940	11202	62476	13685	20518	11202	45405
Total	East Windsor	62.1%	1,948	545	38.8%	14,666	1,104	8.1%	34318	88436	33179	155934	40754	63789	33179	137723
181	Ewing	-16.1%	2,458	(283)	-10.3%	11,341	(1,732)	-13.2%	26538	70906	41479	138923	53515	75922	41479	170915
182	Ewing	0.0%	50	0	0.0%	1,200	(239)	-16.6%	2808	7236	1866	11910	2363	2780	1866	7008
Total	Ewing	-15.5%	2,508	(283)	-10.1%	12,541	(1,971)	-13.6%	29346	78142	43344	150833	55877	78702	43344	177923
81	Hamilton	-10.3%	0	(93)	-100.0%	3,021	(566)	-15.8%	7069	18217	3322	28608	4183	4031	3322	11536
164	Hamilton	-100.0%	50	(53)	-51.5%	1,226	(566)	-31.6%	2869	7393	480	10742	95	2242	480	2816
165	Hamilton	0.0%	196	0	0.0%	1,901	(566)	-22.9%	4448	11463	1469	17380	881	6039	1469	8388
166	Hamilton	-6.0%	50	0	0.0%	104	(566)	-84.5%	243	627	1514	2384	2236	1663	1514	5413
167	Hamilton	0.0%	0	0	0.0%	336	(566)	-62.7%	786	2026	594	3407	832	539	594	1965
168	Hamilton	0.0%	100	(94)	-48.5%	1,211	(566)	-31.9%	2834	7302	963	11099	699	3382	963	5044
169	Hamilton	0.0%	0	0	0.0%	642	(566)	-46.9%	1502	3871	655	6028	805	836	655	2296
170	Hamilton	-85.2%	250	(17)	-6.4%	1,545	(566)	-26.8%	3615	9316	1946	14878	1601	6950	1946	10497
171	Hamilton	0.0%	550	0	0.0%	2,091	(566)	-21.3%	4893	12609	3278	20780	2419	13721	3278	19418
172	Hamilton	-29.6%	1,221	(49)	-3.9%	3,102	(566)	-15.4%	7259	18705	8001	33964	7176	29385	8001	44562
173	Hamilton	0.0%	1,893	(40)	-2.1%	1,973	(566)	-22.3%	4617	11897	8051	24565	5190	41274	8051	54516
174	Hamilton	-16.3%	124	(10)	-7.5%	4,413	(566)	-11.4%	10326	26610	4739	41675	5456	8217	4739	18412
175	Hamilton	0.0%	523	(21)	-3.9%	3,264	(566)	-14.8%	7638	19682	3237	30557	1977	14230	3237	19444
176	Hamilton	0.0%	0	(510)	-100.0%	2,695	(567)	-17.4%	6306	16251	3829	26386	5141	3946	3829	12916
177	Hamilton	0.0%	538	(32)	-5.6%	2,095	(567)	-21.3%	4902	12633	6205	23740	7231	14681	6205	28117
178	Hamilton	0.0%	128	(26)	-16.9%	1,717	(566)	-24.8%	4018	10354	4933	19305	6857	5977	4933	17767
Total	Hamilton	-19.6%	5,623	(945)	-14.4%	31,336	(9,058)	-22.4%	73326	188956	53216	315498	52778	157113	53216	263108
74	Hightstown	-31.8%	0	(100)	-100.0%	691	(1)	-0.1%	1617	4167	2193	7977	3292	1503	2193	6989
75	Hightstown	-72.2%	800	(100)	-11.1%	1,127	0	0.0%	2637	6796	3421	12854	2104	17711	3421	23235
Total	Hightstown	-44.2%	800	(200)	-20.0%	1,818	(1)	-0.1%	4254	10963	5614	20831	5396	19214	5614	30224
183	Hopewell Township	0.0%	0	(200)	-100.0%	420	(70)	-14.3%	983	2533	494	4009	633	573	494	1700
184	Hopewell Township	1501.7%	500	500	0.0%	3,260	2,719	502.6%	7628	19658	13419	40705	18654	17911	13419	49985
186	Hopewell Township	0.0%	98	0	0.0%	310	(43)	-12.2%	725	1869	1230	3824	1508	2651	1230	5389
187	Hopewell Township	0.0%	0	0	0.0%	360	(52)	-12.6%	842	2171	438	3451	567	497	438	1502
188	Hopewell Township	0.0%	0	0	0.0%	410	(114)	-21.8%	959	2472	393	3824	473	523	393	1388
189	Hopewell Township	-61.4%	30	0	0.0%	310	(214)	-40.8%	725	1869	762	3356	1002	1159	762	2922
190	Hopewell Township	0.0%	0	0	0.0%	360	(38)	-9.5%	842	2171	90	3103	0	356	90	446

Source: Douglas & Douglas, Inc.

Zone	Growth Code Municipality	% Chnge from Trend	Scen1 Retail Employme	Change from Trend	% Chnge from Trend	Scen1 2,010 DU's	Change from Trend	% Chnge from Trend	Scenario 1 2010 Productions HBW	HBO	NHB	Daily Total	Scenario 1 2010 Attractions HBW	HBO	NHB	Daily Total
191	Hopewell Township	0.0%	0	0	0.0%	260	(489)	-65.3%	608	1568	465	2641	652	420	465	1537
192	Hopewell Township	0.0%	0	0	0.0%	360	(1,015)	-73.8%	842	2171	90	3103	0	356	90	446
193	Hopewell Boro	-18.7%	40	(26)	-39.4%	803	(280)	-25.9%	1879	4842	918	7640	1019	1852	918	3789
194	Hopewell Township	0.0%	0	0	0.0%	310	(39)	-11.2%	725	1869	78	2672	0	307	78	384
195	Hopewell Township	0.0%	0	0	0.0%	310	(123)	-28.4%	725	1869	78	2672	0	307	78	384
202	Hopewell (W/C)	0.0%	200	200	0.0%	1,600	1,600	0.0%	3744	9648	1129	14521	435	5710	1129	7274
203	Hopewell (W/C)	0.0%	200	200	0.0%	1,600	1,600	0.0%	3744	9648	1129	14521	435	5710	1129	7274
Total	Hopewell Township	179.2%	1,068	674	171.1%	10,673	3,442	47.6%	24975	64358	20711	110044	25377	38333	20711	84421
69	Lawrence	-80.3%	1,150	0	0.0%	22	(966)	-97.8%	51	133	4120	4304	2376	23716	4120	30212
80	Lawrence	-52.1%	350	(43)	-10.9%	978	(204)	-17.3%	2289	5897	3466	11652	3931	8977	3466	16374
82	Lawrence	-30.7%	0	0	0.0%	692	(278)	-28.7%	1619	4173	3008	8800	4619	1834	3008	9461
83	Lawrence	290.2%	2,561	(520)	-16.9%	3,427	2,184	175.7%	8019	20665	22068	50752	24922	61041	22068	108031
96	Lawrence	-36.1%	0	0	0.0%	898	0	0.0%	2101	5415	5102	12619	7947	2865	5102	15915
97	Lawrence	-52.2%	25	0	0.0%	2,558	(113)	-4.2%	5986	15425	854	22264	255	3098	854	4207
179	Lawrence	-9.9%	2,531	0	0.0%	2,841	(442)	-13.5%	6648	19651	15840	42139	14929	59378	15840	90146
Total	Lawrence	6.8%	6,617	(563)	-7.8%	11,416	181	1.6%	26713	71358	54458	152530	58979	160909	54458	274346
185	Pennington	-54.5%	40	0	0.0%	872	(241)	-21.7%	2040	5258	2208	9507	3092	2436	2208	7736
10	Princeton Township	0.0%	0	0	0.0%	203	(465)	-69.6%	475	1224	135	1835	138	235	135	509
11	Princeton Township	-58.2%	25	0	0.0%	365	(466)	-56.1%	854	2201	2172	5227	3296	1683	2172	7151
12	Princeton Township	-66.1%	650	0	0.0%	1,725	(466)	-21.3%	4036	10402	4114	18552	3553	15650	4114	23317
13	Princeton Township	0.0%	0	0	0.0%	807	(466)	-36.6%	1888	4866	299	7054	159	838	299	1296
14	Princeton Township/	0.0%	100	0	0.0%	1,073	(255)	-19.2%	2511	10036	12971	25517	20042	10892	12971	43905
15	Princeton Boro	-6.2%	772	(190)	-19.8%	2,132	(254)	-10.6%	4989	13402	11537	29927	14980	21780	11537	48297
16	Princeton Township	0.0%	50	0	0.0%	727	(466)	-39.1%	1701	4384	753	6838	743	1909	753	3405
17	Princeton Township	0.0%	0	0	0.0%	375	(466)	-55.4%	878	2261	568	3707	773	563	568	1905
18	Princeton Township	0.0%	0	0	0.0%	449	(466)	-50.9%	1051	2707	344	4102	378	539	344	1261
19	Princeton Boro	0.0%	25	0	0.0%	576	(255)	-30.7%	1348	4242	820	6409	947	1919	820	3686
20	Princeton Township	-93.2%	25	0	0.0%	372	(466)	-55.6%	870	2403	457	3730	486	1118	457	2062
Total	Princeton	-27.1%	1,647	(190)	-10.3%	8,804	(4,491)	-33.8%	20601	58128	34169	112899	45495	57127	34169	136792
180	Trenton	24.1%	6,352	2,096	49.2%	53,359	13,740	34.7%	124860	321755	129881	576495	165974	221711	129881	517566
152	Washington	0.0%	75	0	0.0%	66	0	0.0%	154	398	335	887	236	1631	335	2202
153	Washington	0.0%	0	0	0.0%	53	0	0.0%	124	320	71	515	95	76	71	242
154	Washington	0.0%	0	0	0.0%	57	0	0.0%	133	344	72	549	95	80	72	247
155	Washington	0.0%	0	0	0.0%	10	0	0.0%	23	60	3	86	0	10	3	12
156	Washington	0.0%	50	0	0.0%	66	0	0.0%	154	398	248	800	189	1117	248	1554
157	Washington	60.0%	250	200	400.0%	1,724	1,478	600.8%	4034	10396	1391	15821	624	6884	1391	8899
158	Washington	0.0%	25	0	0.0%	351	0	0.0%	821	2117	233	3170	142	885	233	1259
159	Washington	0.0%	25	0	0.0%	554	(203)	-26.8%	1296	3341	805	5442	992	1297	805	3095
160	Washington	491.7%	500	500	0.0%	2,825	2,800	11200.0%	6611	17035	12881	36527	17955	17307	12881	48143
161	Washington	0.0%	25	0	0.0%	65	(181)	-73.6%	152	392	364	908	473	684	364	1521
162	Washington	-9.3%	100	0	0.0%	202	0	0.0%	473	1218	804	2494	851	2420	804	4074

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Zone	Growth Code	Municipality	% Chnge from Trend	Scen1 Retail Employme	Change from Trend	% Chnge from Trend	Scen1 2,010 DU's	Change from Trend	% Chnge from Trend	Scenario 1 2010 Productions HBW	HBO	NHB	Daily Total	Scenario 1 2010 Attractions HBW	HBO	NHB	Daily Total
163		Washington	-44.9%	150	(100)	-40.0%	677	(1,403)	-67.5%	1584	4082	951	6617	709	3860	951	5519
Total		Washington	218.3%	1,200	600	100.0%	6,650	2,491	59.9%	15561	40100	18157	73818	22359	36252	18157	76768
29		West Windsor	0.0%	40	0	0.0%	250	0	0.0%	585	1508	1941	4034	2911	1775	1941	6627
30		West Windsor	-28.2%	0	0	0.0%	20	0	0.0%	47	121	1106	1273	1794	466	1106	3365
31		West Windsor	0.0%	0	0	0.0%	8	(1,767)	-99.5%	19	48	2	69	0	8	2	10
32		West Windsor	533.3%	1,275	1,100	628.6%	6,600	6,000	1000.0%	15444	39798	21354	76596	27305	38939	21354	87597
47		West Windsor	0.0%	0	(700)	-100.0%	466	(399)	-46.1%	1090	2810	703	4604	956	699	703	2359
48		West Windsor	0.0%	0	0	0.0%	781	(346)	-30.7%	1828	4709	408	6945	346	859	408	1613
49		West Windsor	0.0%	0	0	0.0%	484	(695)	-58.9%	1133	2919	452	4503	539	613	452	1603
50		West Windsor	0.0%	0	0	0.0%	80	(457)	-85.1%	187	482	692	1361	1094	351	692	2137
51		West Windsor	0.0%	0	0	0.0%	392	(467)	-54.4%	917	2364	137	3418	64	404	137	606
54		West Windsor	0.0%	0	0	0.0%	420	(441)	-51.2%	983	2533	235	3750	212	468	235	915
84		West Windsor	-98.5%	0	0	0.0%	5	0	0.0%	12	30	66	108	106	31	66	203
85		West Windsor	0.0%	800	(378)	-32.1%	790	(319)	-28.8%	1849	4764	3897	10509	3016	17604	3897	24518
86		West Windsor	-60.0%	25	0	0.0%	130	0	0.0%	304	784	5850	6938	9384	2965	5850	18198
87		West Windsor	0.0%	10	0	0.0%	10	0	0.0%	23	60	37	121	19	216	37	272
Total		West Windsor	-1.2%	2,150	22	1.0%	10,436	1,109	11.9%	24420	62929	36879	124229	47745	65398	36879	150023
		Mercer County	8.2%	29,953	1,756	6.2%	162,571	6,305	4.0%	380416	990383	431818	1802618	523827	900984	431818	1856629
1		Franklin	0.0%	0	0	0.0%	223	(593)	-72.7%	522	1345	71	1937	25	227	71	322
2		Franklin	0.0%	0	0	0.0%	138	(593)	-81.1%	323	832	35	1190	0	137	35	171
21		Franklin	0.0%	40	0	0.0%	28	(593)	-95.5%	66	169	472	706	607	982	472	2061
22		Franklin	0.0%	160	0	0.0%	145	(593)	-80.4%	339	874	653	1867	403	3458	653	4514
88		Franklin	0.0%	62	(284)	-82.1%	627	(1,482)	-70.3%	1467	3781	540	5788	391	1964	540	2895
89		Franklin	0.0%	50	0	0.0%	455	(593)	-56.6%	1065	2744	372	4180	232	1513	372	2117
108		Franklin	-2.5%	414	0	0.0%	613	(593)	-49.2%	1434	3696	12997	18128	19369	13741	12997	46107
109		Franklin	-18.0%	213	0	0.0%	342	(593)	-63.4%	800	2062	3655	6518	5014	5865	3655	14534
110		Franklin	185.6%	662	482	267.8%	3,110	2,206	244.0%	7277	18753	16331	42362	22850	22061	16331	61242
111		Franklin	0.0%	89	0	0.0%	601	(594)	-49.7%	1406	3624	1169	6199	1325	2712	1169	5206
112		Franklin	0.0%	171	0	0.0%	2,038	(594)	-22.6%	4769	12289	2890	19948	3236	6258	2890	12384
113		Franklin	0.0%	92	0	0.0%	1,957	(594)	-23.3%	4579	11801	1387	17767	1117	4063	1387	6568
114		Franklin	0.0%	372	0	0.0%	2,373	(594)	-20.0%	5553	14309	2696	22558	2026	10327	2696	15049
115		Franklin	0.0%	143	0	0.0%	2,309	(594)	-20.5%	5403	13923	2979	22306	3376	5998	2979	12353
116		Franklin	0.0%	119	0	0.0%	1,343	(594)	-30.7%	3143	8098	2597	13837	3236	4525	2597	10357
201		Franklin (W/C)	0.0%	200	200	0.0%	1,600	1,600	0.0%	3744	9648	1129	14521	435	5710	1129	7274
Total		Franklin	27.5%	2,787	398	16.7%	17,902	(5,391)	-23.1%	41891	107949	49973	199813	63640	89540	49973	203153
98		Hillsborough	0.0%	100	(108)	-51.9%	1,062	(637)	-37.5%	2485	6404	1109	9998	998	3309	1109	5415
99		Hillsborough	915.3%	688	460	201.8%	5,454	1,569	40.4%	12762	32888	14633	60283	19030	23954	14633	57617
100		Hillsborough	-76.5%	62	0	0.0%	1,167	(1,031)	-46.9%	2731	7037	1423	11191	1610	2801	1423	5835
101		Hillsborough	-78.6%	155	(40)	-20.5%	1,526	(638)	-29.5%	3571	9202	1229	14002	798	4823	1229	6850
102		Hillsborough	-56.3%	425	(40)	-8.6%	1,017	(638)	-38.5%	2380	6133	2273	10785	1690	9965	2273	13928
103		Hillsborough	-57.2%	141	(40)	-22.1%	1,739	(909)	-34.3%	4069	10486	2054	16609	2107	5078	2054	9240

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Zone	Growth Code / Municipality	% Chnge from Trend	Scen1 Retail Employme	Change from Trend	% Chnge from Trend	Scen1 2,010 DU's	Change from Trend	% Chnge from Trend	Scenario 1 2010 Productions HBW	HBO	NHB	Daily Total	Scenario 1 2010 Attractions HBW	HBO	NHB	Daily Total
Total	Hillsborough	32.2%	1,571	232	17.3%	11,965	(2,284)	-16.0%	27998	72149	22721	122868	26233	49930	22721	98885
105	Manville	-60.1%	209	0	0.0%	1,679	(89)	-5.0%	3929	10124	1747	15800	1376	6203	1747	9326
106	Manville	-80.3%	33	0	0.0%	1,055	(88)	-7.7%	2469	6362	601	9431	425	1813	601	2839
107	Manville	-73.3%	41	0	0.0%	1,134	(88)	-7.2%	2654	6838	756	10248	616	2100	756	3472
Total	Manville	-70.2%	283	0	0.0%	3,868	(265)	-6.4%	9051	23324	3104	35480	2417	10116	3104	15638
104	Millstone	-81.7%	19	0	0.0%	180	(7)	-3.7%	421	1085	152	1658	102	585	152	839
3	Montgomery/Rocky	-31.6%	550	(127)	-18.8%	653	(47)	-6.7%	1528	3938	4326	9791	4712	12868	4326	21905
4	Montgomery	0.0%	5	0	0.0%	795	(1,100)	-58.0%	1860	4794	569	7223	584	1033	569	2185
5	Montgomery	-75.8%	30	(127)	-80.9%	195	(223)	-53.3%	456	1176	385	2017	435	904	385	1723
6	Montgomery	-7.6%	0	(173)	-100.0%	958	(222)	-18.8%	2242	5777	5627	13645	8777	3131	5627	17535
7	Montgomery	0.0%	0	0	0.0%	185	(222)	-54.5%	433	1116	97	1646	83	204	97	384
8	Montgomery	-69.6%	210	73	53.3%	1,721	1,378	401.7%	4027	10378	1484	15889	926	6153	1484	8563
9	Montgomery	0.0%	0	0	0.0%	383	(222)	-36.7%	896	2309	96	3301	0	379	96	475
200	Montgomery(W/C)	0.0%	200	200	0.0%	1,600	1,600	0.0%	3744	9648	1129	14521	435	5710	1129	7274
Total	Montgomery	-25.3%	995	(154)	-13.4%	6,490	942	17.0%	15187	39135	13711	68033	15952	30381	13711	60044
196	South Bound Brook	-57.9%	69	0	0.0%	1,502	(167)	-10.0%	3515	9057	1109	13681	936	3106	1109	5150
Somerset County (Part)		8.4%	5,724	476	9.1%	41,907	(7,172)	-14.6%	98062	252699	90770	441532	109280	183658	90770	383709
55	Cranbury	0.0%	0	0	0.0%	6	(139)	-95.9%	14	36	2	52	0	6	2	7
56	Cranbury	0.0%	0	0	0.0%	273	(139)	-33.7%	639	1646	240	2525	280	340	240	859
57	Cranbury	0.0%	0	0	0.0%	14	(139)	-90.8%	33	84	4	121	0	14	4	17
58	Cranbury	0.0%	25	0	0.0%	358	(139)	-28.0%	838	2159	176	3173	47	868	176	1092
59	Cranbury	0.0%	0	0	0.0%	96	(139)	-59.1%	225	579	24	828	0	95	24	119
63	Cranbury	-47.4%	0	0	0.0%	34	(139)	-80.3%	80	205	917	1201	1480	402	917	2798
64	Cranbury	1.0%	225	(66)	-22.7%	1,702	1,461	606.2%	3983	10263	4838	19084	6343	7783	4838	18964
66	Cranbury	0.0%	0	0	0.0%	15	(139)	-90.3%	35	90	3044	3170	4954	1247	3044	9245
67	Cranbury	0.0%	0	0	0.0%	15	(140)	-90.3%	35	90	4	129	0	15	4	19
Total	Cranbury	-9.2%	250	(66)	-20.9%	2,513	348	16.1%	5880	15153	9248	30282	13103	10769	9248	33120
129	East Brunswick	-16.3%	1,815	(771)	-29.8%	2,672	(702)	-20.8%	6252	16112	12547	34911	12523	42223	12547	67293
133	East Brunswick	-20.6%	1,097	(768)	-41.2%	838	0	0.0%	1961	5053	10439	17453	12538	25986	10439	48964
135	East Brunswick	0.0%	44	0	0.0%	853	(702)	-45.1%	1996	5144	466	7605	246	1790	466	2501
136	East Brunswick	-29.2%	488	(844)	-63.4%	3,057	(702)	-18.7%	7153	18434	4579	30166	4379	13919	4579	22878
137	East Brunswick	0.0%	206	0	0.0%	1,627	(702)	-30.1%	3807	9811	1921	15539	1692	6170	1921	9782
138	East Brunswick	-10.6%	313	0	0.0%	1,722	(702)	-29.0%	4029	10384	2558	16971	2289	8562	2558	13409
139	East Brunswick	-3.0%	3,149	(164)	-5.0%	1,166	(703)	-37.6%	2728	7031	13571	23330	9785	66851	13571	90206
140	East Brunswick	-52.7%	892	0	0.0%	1,620	0	0.0%	3791	9769	5167	18727	4402	20619	5167	30188
Total	East Brunswick	-22.0%	8,004	(2,547)	-24.1%	13,555	(4,213)	-23.7%	31719	81737	51248	164703	47853	186120	51248	285221
143	Helmetta	-28.0%	11	0	0.0%	439	(547)	-55.5%	1027	2647	327	4001	312	733	327	1372

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145		Jamesburg	-27.4%	433	0	0.0%	1,688	(527)	-23.8%	3950	10179	3837	17966	3935	11349	3837	19121
134		Milltown	-7.6%	242	0	0.0%	2,412	(588)	-19.6%	5644	14544	4244	24433	5022	8498	4244	17764
144		Monroe	-100.0%	0	(775)	-100.0%	4,252	(796)	-15.8%	9950	25640	1063	36652	0	4209	1063	5272
146		Monroe	-48.7%	0	(840)	-100.0%	3,553	(796)	-18.3%	8314	21425	2677	32416	2914	4242	2677	9834
147		Monroe	0.0%	0	0	0.0%	52	(796)	-93.9%	122	314	13	448	0	51	13	64
148		Monroe	-100.0%	0	(776)	-100.0%	262	(796)	-75.2%	613	1580	66	2258	0	259	66	325
149		Monroe	-74.4%	0	0	0.0%	313	(797)	-71.8%	732	1887	542	3162	756	498	542	1796
150		Monroe	-100.0%	0	0	0.0%	149	(797)	-84.2%	349	898	37	1284	0	148	37	185
151		Monroe	-100.0%	0	0	0.0%	59	(797)	-93.1%	138	356	15	509	0	58	15	73
Total		Monroe	-80.4%	0	(2,391)	-100.0%	8,640	(5,575)	-39.2%	20218	52099	4413	76730	3670	9466	4413	17549
117		New Brunswick	66.5%	484	295	156.1%	3,578	1,563	77.6%	8373	21575	9923	39870	12888	16471	9923	39281
118		New Brunswick	818.3%	357	295	475.8%	3,452	1,563	82.7%	8078	20816	6011	34904	7044	12341	6011	25396
119		New Brunswick	196.2%	358	295	468.3%	2,758	1,563	130.8%	6454	16631	6781	29865	8577	12056	6781	27413
120		New Brunswick	2780.6%	342	295	627.7%	3,306	1,563	89.7%	7736	20355	5817	33908	6811	12172	5817	24800
121		New Brunswick	202.4%	402	217	117.3%	3,106	1,563	101.3%	7268	19149	7569	33986	9521	13853	7569	30943
122		New Brunswick	45.2%	614	217	54.7%	2,378	1,563	191.8%	5565	14339	13916	33819	19393	19512	13916	52821
123		New Brunswick	46.7%	568	295	108.1%	2,772	1,563	129.3%	6486	16715	10319	33520	13546	17524	10319	41388
124		New Brunswick	134.3%	389	294	309.5%	3,968	1,563	65.0%	9285	23927	8418	41630	10635	14388	8418	33441
125		New Brunswick	29.7%	925	294	46.6%	2,955	1,562	112.1%	6915	22439	21305	50658	29667	32562	21305	83533
126		New Brunswick	89.9%	1,365	294	27.5%	3,817	1,563	69.3%	8932	24697	13826	47455	15704	36444	13826	65974
Total		New Brunswick	83.6%	5,804	2,791	92.6%	32,090	15,629	94.9%	75091	200643	103883	379617	133786	187321	103883	424991
90		North Brunswick	-51.6%	487	(200)	-29.1%	2,668	(919)	-25.6%	6243	16088	4248	26579	4001	13420	4248	21669
92		North Brunswick	24.4%	500	202	67.8%	3,929	(200)	-4.8%	9194	23692	14129	47015	19539	18794	14129	52462
93		North Brunswick	-72.4%	72	(200)	-73.5%	2,399	(380)	-13.7%	5614	14466	1528	21608	1242	4130	1528	6900
94		North Brunswick	-60.7%	112	(200)	-64.1%	1,211	0	0.0%	2834	7302	1848	11984	2096	3970	1848	7914
95		North Brunswick	-14.4%	1,498	(200)	-11.8%	3,311	(194)	-5.5%	7748	19965	16589	44302	20042	38357	16589	74987
127		North Brunswick	-93.3%	0	(200)	-100.0%	7	0	0.0%	16	42	176	234	284	77	176	537
128		North Brunswick	-83.7%	0	(200)	-100.0%	5	0	0.0%	12	30	349	391	567	146	349	1062
Total		North Brunswick	-26.3%	2,669	(998)	-27.2%	13,530	(1,693)	-11.1%	31660	81586	38867	152113	47770	78894	38867	165531
28		Plainsboro	-11.7%	1,185	440	59.1%	3,351	1,838	121.5%	7841	20207	15459	43507	19363	31939	15459	66762
33		Plainsboro	-74.8%	0	0	0.0%	39	(962)	-96.1%	91	235	1147	1473	1852	499	1147	3498
34		Plainsboro	-91.4%	0	(60)	-100.0%	10	0	0.0%	23	60	872	956	1418	362	872	2652
35		Plainsboro	-36.7%	0	(60)	-100.0%	6	0	0.0%	14	36	4142	4192	6745	1683	4142	12570
36		Plainsboro	0.0%	0	0	0.0%	224	(962)	-81.1%	524	1351	300	2174	397	320	300	1017
43		Plainsboro	0.0%	0	0	0.0%	27	(962)	-97.3%	63	163	7	233	0	27	7	33
44		Plainsboro	-96.4%	350	(60)	-14.6%	992	(962)	-49.2%	2321	5982	1556	9860	815	8216	1556	10587
45		Plainsboro	-86.5%	117	(60)	-33.9%	4,897	(962)	-16.4%	11459	29529	1801	42789	499	7323	1801	9622
46		Plainsboro	0.0%	0	0	0.0%	87	(961)	-91.7%	204	525	80	808	95	110	80	284
Total		Plainsboro	-53.7%	1,652	200	13.8%	9,633	(3,933)	-29.0%	22541	58087	25363	105991	31183	50480	25363	107026

Source: Douglas & Douglas, Inc.

Zone	Growth Code / Municipality	% Chnge from Trend	Scen1 Retail Employme	Change from Trend	% Chnge from Trend	Scen1 2,010 DU's	Change from Trend	% Chnge from Trend	Scenario 1 2010 Productions HBW	HBO	NHB	Daily Total	Scenario 1 2010 Attractions HBW	HBO	NHB	Daily Total
23	South Brunswick	-50.5%	205	(89)	-30.3%	1,288	(904)	-41.2%	3014	7767	1207	11988	671	5560	1207	7439
24	South Brunswick	0.0%	125	(13)	-9.4%	2,097	(316)	-13.1%	4907	12645	1002	18554	308	4664	1002	5974
25	South Brunswick	0.0%	130	(556)	-81.0%	425	(1,074)	-71.6%	994	2563	557	4115	246	3094	557	3897
26	South Brunswick	-56.7%	0	0	0.0%	158	(111)	-41.3%	370	953	303	1625	429	263	303	995
27	South Brunswick	0.0%	30	0	0.0%	423	(1,196)	-73.9%	990	2551	245	3785	113	1050	245	1408
37	South Brunswick	-60.2%	0	0	0.0%	42	(112)	-72.7%	98	253	3033	3385	4925	1266	3033	9225
38	South Brunswick	0.0%	184	0	0.0%	707	(148)	-17.3%	1654	4263	815	6733	348	4483	815	5646
39	South Brunswick	0.0%	0	0	0.0%	82	(1,049)	-92.7%	192	494	21	707	0	81	21	102
40	South Brunswick	40.6%	1,122	756	206.6%	6,611	5,592	548.8%	15470	39864	20198	75532	25993	35550	20198	81741
41	South Brunswick	-11.7%	84	0	0.0%	1,669	(800)	-32.4%	3905	10064	2907	16876	3740	4270	2907	10917
42	South Brunswick	-22.0%	0	(19)	-100.0%	178	(281)	-61.2%	417	1073	3845	5335	6192	1716	3845	11752
60	South Brunswick	0.0%	200	200	0.0%	1,647	1,488	935.8%	3854	9931	1141	14926	435	5757	1141	7332
61	South Brunswick	-75.8%	0	0	0.0%	288	(569)	-66.4%	674	1737	979	3390	1478	653	979	3110
62	South Brunswick	-26.9%	500	500	0.0%	2,937	2,688	1079.5%	6873	17710	15270	39853	21801	18374	15270	55445
91	South Brunswick	-79.8%	0	0	0.0%	189	(112)	-37.2%	442	1140	321	1903	446	298	321	1065
Total	South Brunswick	-22.1%	2,580	779	43.3%	18,741	3,096	19.8%	43854	113008	51844	208706	67125	87078	51844	206047
130	South River	-23.2%	217	0	0.0%	1,516	(227)	-13.0%	3547	9141	2434	15122	2531	6490	2434	11454
131	South River	-54.0%	119	0	0.0%	1,174	(227)	-16.2%	2747	7079	1041	10867	769	3744	1041	5554
132	South River	-45.6%	87	0	0.0%	2,133	(227)	-9.6%	4991	12862	1304	19157	928	4090	1304	6322
Total	South River	-35.9%	423	0	0.0%	4,823	(681)	-12.4%	11286	29083	4778	45146	4228	14324	4778	23330
141	Spotswood	-33.4%	183	0	0.0%	1,859	(225)	-10.8%	4350	11210	2009	17569	1828	5971	2009	9808
142	Spotswood	-29.6%	271	0	0.0%	1,045	(225)	-17.7%	2445	6301	2287	11034	2281	7046	2287	11615
Total	Spotswood	-31.4%	454	0	0.0%	2,904	(450)	-13.4%	6795	17511	4297	28603	4109	13018	4297	21423
Middlesex Co. (part)		-11.9%	22,522	(2,232)	-9.0%	110,968	866	0.8%	259665	676277	302348	1238291	362097	658051	302348	1322496
	MSM Region Total	0.0%	58,199	0	0.0%	315,446	(1)	-0.0%	738144	1919359	824937	3482440	995203	1742693	824937	3562833

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	Scenario 1 Daily Trips/Sq. Mi. HBW	Total	Const Code Scen1	Daily Trip Ends - Scenario 1 Reduced by Construct Impact HBW	HBO	NHB	Total	Change in Total Daily Trip Ends	2010 Percent Change in Daily Trip Ends Scenario 1 vs. Trend HBW	HBO	NHB	TOTAL
52		East Windsor	3219	14455		6337	20233	1890	28460	-4831	-15.3%	-14.5%	-11.5%	-14.5%
53		East Windsor	4052	10286		7074	2454	8427	17955	-6703	-21.2%	-59.6%	-12.2%	-27.2%
70		East Windsor	10824	49341		7710	23265	4171	35146	-6081	-17.6%	-13.3%	-17.2%	-14.7%
71		East Windsor	16887	57561	T	10507	12526	13802	36834	24056	146.4%	173.8%	250.4%	188.3%
72		East Windsor	2215	9053		2606	7299	749	10653	-16587	-42.2%	-61.5%	-80.1%	-60.9%
73		East Windsor	4687	28365		5143	19895	6090	31129	-8495	-21.2%	-23.2%	-15.4%	-21.4%
76		East Windsor	819	2608		2184	2996	1777	6958	-16822	-73.3%	-60.8%	-77.7%	-70.7%
77		East Windsor	222	936		412	1236	88	1735	-5703	-74.5%	-76.6%	-83.7%	-76.7%
78		East Windsor	316	1332		765	2296	164	3224	-4822	-59.9%	-59.9%	-59.9%	-59.9%
79		East Windsor	24850	95674	T	18174	47320	15010	80504	67018	309.6%	834.7%	276.5%	496.9%
Total		East Windsor	4797	18765		60913	139519	52168	252599	21030	6.4%	7.5%	17.0%	9.1%
181		Ewing	5663	21918		80053	146828	82958	309838	-47845	-14.6%	-12.1%	-14.4%	-13.4%
182		Ewing	2436	8911		5171	10016	3731	18918	-2357	-9.8%	-14.3%	-3.1%	-11.1%
Total		Ewing	5241	20219		85223	156844	86689	328756	-50201	-14.3%	-12.3%	-14.0%	-13.2%
81		Hamilton	2169	7740		11252	22248	6645	40144	-9498	-15.0%	-21.3%	-18.6%	-19.1%
164		Hamilton	3715	16996		2963	9635	960	13558	-7326	-33.6%	-34.5%	-43.6%	-35.1%
165		Hamilton	2353	11375		5329	17502	2937	25768	-5581	-19.9%	-18.5%	-8.8%	-17.8%
166		Hamilton	988	3107		2479	2291	3028	7797	-5918	-37.1%	-63.6%	-12.9%	-43.1%
167		Hamilton	292	969		1618	2566	1189	5372	-5581	-45.0%	-60.8%	-19.2%	-51.0%
168		Hamilton	1647	7526		3533	10684	1926	16143	-8343	-29.8%	-35.6%	-32.7%	-34.1%
169		Hamilton	3336	12033		2307	4707	1309	8324	-5581	-36.5%	-45.8%	-17.8%	-40.1%
170		Hamilton	2272	11051		5216	16266	3893	25375	-22156	-60.1%	-26.7%	-68.3%	-46.6%
171		Hamilton	4327	23790		7312	26330	6556	40198	-5581	-15.3%	-13.1%	-4.1%	-12.2%
172		Hamilton	4254	23144		14435	48091	16001	78527	-12080	-19.3%	-10.2%	-16.4%	-13.3%
173		Hamilton	5051	40728		9807	53171	16103	79081	-6756	-12.5%	-8.3%	-3.4%	-7.9%
174		Hamilton	5057	19252		15783	34827	9477	60087	-8397	-13.0%	-11.3%	-14.5%	-12.3%
175		Hamilton	6556	34096		9615	33912	6475	50002	-6198	-12.4%	-11.5%	-6.2%	-11.0%
176		Hamilton	2359	8101		11447	20197	7658	39302	-20580	-16.7%	-41.7%	-33.3%	-34.4%
177		Hamilton	10796	46142	)	12133	27314	12409	51856	-6531	-10.3%	-14.5%	-3.9%	-11.2%
178		Hamilton	5119	17450		10875	16330	9867	37072	-6345	-11.2%	-21.6%	-4.5%	-14.6%
Total		Hamilton	3065	14061		126104	346070	106432	578606	-142451	-20.9%	-19.8%	-18.2%	-19.8%
74		Hightstown	9806	29894		4909	5670	4387	14966	-6749	-26.0%	-30.1%	-37.0%	-31.1%
75		Hightstown	6229	47419		4741	24507	6842	36089	-6744	-26.7%	-9.0%	-27.4%	-15.7%
Total		Hightstown	7649	40465		9650	30176	11229	51055	-13493	-26.3%	-13.9%	-31.5%	-20.9%
183		Hopewell Township	311	1100		1616	3106	987	5709	-6568	-25.1%	-59.7%	-59.0%	-53.5%
184		Hopewell Township	5069	17490	S	19254	31737	19055	70047	61975	711.9%	679.3%	1070.7%	767.8%
186		Hopewell Township	322	1327		2234	4520	2459	9213	-424	-4.3%	-6.3%	-0.9%	-4.4%
187		Hopewell Township	151	530		1409	2668	876	4954	-513	-7.9%	-12.0%	-2.9%	-9.4%
188		Hopewell Township	161	587		1432	2996	785	5213	-1124	-15.7%	-21.1%	-6.8%	-17.7%
189		Hopewell Township	410	1491	ZW	1727	3028	1523	6278	-5840	-53.7%	-38.3%	-56.2%	-48.2%
190		Hopewell Township	265	1116		842	2527	180	3550	-375	-9.5%	-9.5%	-9.5%	-9.5%

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Zone	Growth Code	Municipality	Scenario 1 Daily Trips/Sq. Mi. HBW	Total	Const Code Scen1	Daily Trip Ends - Scenario 1 Reduced by Construct Impact HBW	HBO	NHB	Total	Change in Total Daily Trip Ends	2010 Percent Change in Daily Trip Ends Scenario 1 vs. Trend HBW	HBO	NHB	TOTAL
191		Hopewell Township	493	1636		1260	1987	930	4178	-4822	-47.6%	-63.3%	-20.8%	-53.6%
192		Hopewell Township	162	681		842	2527	180	3550	-10008	-73.8%	-73.8%	-73.8%	-73.8%
193		Hopewell Boro	4237	16712		2898	6694	1837	11429	-4063	-24.1%	-27.6%	-24.2%	-26.2%
194		Hopewell Township	240	1012	ZW	725	2176	155	3057	-385	-11.2%	-11.2%	-11.2%	-11.2%
195		Hopewell Township	204	861		725	2176	155	3057	-1213	-28.4%	-28.4%	-28.4%	-28.4%
202		Hopewell (W/C)	8357	43589	W	3274	13208	1716	18198	18198	N/A	N/A	N/A	N/A
203		Hopewell (W/C)	8357	43589	W	3274	13208	1716	18198	18198	N/A	N/A	N/A	N/A
Total		Hopewell Township	854	3299		41514	92559	32555	166628	63037	59.5%	51.9%	95.9%	60.9%
69		Lawrence	4588	65249	B	1986	17910	6263	26159	-19927	-64.0%	-41.9%	-35.7%	-43.2%
80		Lawrence	2403	10830	B	4894	12218	5268	22380	-17739	-52.7%	-32.4%	-55.0%	-44.2%
82		Lawrence	1912	5598	B	4970	5256	4572	14798	-11268	-44.4%	-37.9%	-47.2%	-43.2%
83		Lawrence	19186	92480	S	24224	69243	31337	124805	9254	74.6%	-5.6%	10.6%	8.0%
96		Lawrence	2950	8376		10049	8280	10205	28534	-11110	-30.9%	-11.9%	-35.1%	-28.0%
97		Lawrence	1089	4617		6241	18523	1708	26471	-1676	-7.3%	-4.4%	-16.4%	-6.0%
179		Lawrence	6889	42235		21577	79029	31680	132285	-6656	-8.3%	-4.0%	-4.1%	-4.8%
Total		Lawrence	4207	20958		73940	210459	91032	375431	-59122	-11.4%	-13.0%	-16.7%	-13.6%
185		Pennington	5339	17935		5133	7694	4416	17243	-11334	-44.9%	-25.2%	-50.8%	-39.7%
10		Princeton Township	450	1719		613	1459	271	2343	-4585	-64.0%	-69.1%	-46.2%	-66.2%
11		Princeton Township	2940	8768		4150	3884	4344	12379	-15808	-57.5%	-53.1%	-57.1%	-56.1%
12		Princeton Township	4977	27454		7590	26052	8227	41868	-15808	-42.5%	-14.4%	-41.3%	-27.4%
13		Princeton Township	2496	10182		2047	5705	598	8350	-4595	-34.8%	-36.4%	-28.0%	-35.5%
14		Princeton Township/	19270	59315		22553	20928	25941	69422	-2514	-2.6%	-7.9%	-0.5%	-3.5%
15		Princeton Boro	30545	119653		19969	35182	23073	78224	-10246	-8.4%	-14.4%	-9.8%	-11.6%
16		Princeton Township	808	3386		2444	6293	1506	10243	-4595	-30.9%	-34.2%	-13.4%	-31.0%
17		Princeton Township	559	1902		1651	2825	1136	5612	-4595	-39.8%	-53.7%	-17.0%	-45.0%
18		Princeton Township	676	2537		1429	3246	689	5363	-4595	-43.3%	-50.2%	-25.3%	-46.1%
19		Princeton Boro	3499	15395		2295	6161	1639	10095	-2514	-20.6%	-22.5%	-7.2%	-19.9%
20		Princeton Township	603	2572		1357	3521	914	5792	-15803	-80.5%	-55.5%	-86.4%	-73.2%
Total		Princeton	3684	13917		66097	115255	68339	249691	-85658	-27.7%	-25.3%	-23.8%	-25.5%
180		Trenton	36629	137791		290834	543466	259761	1094061	271120	29.4%	37.1%	28.8%	32.9%
152		Washington	260	2056		391	2029	670	3089	-0	0.0%	0.0%	0.0%	-0.0%
153		Washington	119	410		219	396	143	757	0	-0.0%	0.0%	0.0%	0.0%
154		Washington	94	330		228	424	145	796	-0	0.0%	0.0%	0.0%	-0.0%
155		Washington	19	80		23	70	5	99	-0	0.0%	0.0%	0.0%	-0.0%
156		Washington	416	2855		343	1515	496	2354	-0	0.0%	0.0%	0.0%	-0.0%
157		Washington	2241	11892	W	3668	14861	2115	20643	16514	379.7%	434.9%	260.9%	400.0%
158		Washington	494	2271		963	3002	465	4430	0	0.0%	0.0%	0.0%	0.0%
159		Washington	1308	4878		2289	4638	1611	8537	-2002	-17.2%	-23.5%	-5.9%	-19.0%
160		Washington	9314	32101	S	18027	29020	18291	65339	57974	514.6%	3159.3%	416.5%	787.2%
161		Washington	394	1533		625	1076	728	2429	-1785	-40.4%	-54.1%	-11.1%	-42.4%
162		Washington	5095	25294		1323	3639	1607	6569	-168	-4.9%	-0.5%	-4.9%	-2.5%

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	Scenario 1 Daily Trips/Sq. Mi. HBW	Total	Const Code Scen1	Daily Trip Ends - Scenario 1 Reduced by Construct Impact HBW	HBO	NHB	Total	Change in Total Daily Trip Ends	2010 Percent Change in Daily Trip Ends Scenario 1 vs. Trend HBW	HBO	NHB	TOTAL
163		Washington	955	5055		2293	7942	1902	12137	-17629	-62.5%	-60.2%	-48.9%	-59.2%
Total		Washington	1852	7354		30391	68610	28176	127177	52904	76.9%	59.2%	101.4%	71.2%
29		West Windsor	5155	15722	B	2814	2733	2951	8498	-2163	-19.5%	-16.7%	-24.0%	-20.3%
30		West Windsor	1278	3222		1840	586	2212	4639	-1746	-27.7%	-23.0%	-28.1%	-27.3%
31		West Windsor	19	81	B	14	51	3	68	-17434	-99.7%	-99.6%	-99.7%	-99.6%
32		West Windsor	31968	122785	T	28498	64954	28614	122066	101272	403.0%	639.2%	351.3%	487.0%
47		West Windsor	591	2012		2047	3509	1407	6963	-24507	-52.4%	-83.0%	-78.2%	-77.9%
48		West Windsor	1113	4381		2173	5569	815	8557	-3412	-27.1%	-30.4%	-17.5%	-28.5%
49		West Windsor	559	2043		1671	3532	903	6106	-6853	-49.3%	-58.0%	-27.8%	-52.9%
50		West Windsor	448	1223		1282	834	1383	3499	-4506	-45.5%	-79.4%	-14.2%	-56.3%
51		West Windsor	234	960		982	2768	275	4024	-4605	-52.7%	-54.2%	-45.9%	-53.4%
54		West Windsor	463	1808		1194	3001	470	4665	-4348	-46.3%	-50.8%	-31.9%	-48.2%
84		West Windsor	310	820		118	61	132	311	-16801	-98.3%	-96.5%	-98.4%	-98.2%
85		West Windsor	4292	30900	B	3823	17633	5923	27380	-21902	-39.6%	-45.5%	-44.0%	-44.4%
86		West Windsor	6720	17436	B	7917	2952	8891	19761	-40049	-66.6%	-59.2%	-69.2%	-67.0%
87		West Windsor	69	636		42	276	74	393	0	0.0%	0.0%	0.0%	-0.0%
Total		West Windsor	2772	10533		54415	108459	54054	216928	-47053	-22.3%	-9.8%	-26.7%	-17.8%
		Mercer County	3983	16120		844215	1819111	794850	3458176	-1220	-0.8%	0.9%	-1.3%	-0.0%
1		Franklin	191	788		546	1572	142	2260	-5847	-71.7%	-72.6%	-67.7%	-72.1%
2		Franklin	116	490		323	969	69	1361	-5847	-81.1%	-81.1%	-81.1%	-81.1%
21		Franklin	1193	4909		672	1151	944	2767	-5847	-67.4%	-78.3%	-23.9%	-67.9%
22		Franklin	254	2188		742	4332	1306	6380	-5847	-65.2%	-49.0%	-18.5%	-47.8%
88		Franklin	266	1242	ZW	1858	5744	1080	8683	-22959	-68.3%	-73.9%	-71.5%	-72.6%
89		Franklin	516	2504		1297	4256	744	6297	-5847	-51.7%	-49.4%	-28.5%	-48.1%
108		Franklin	2806	8665	B	16929	13743	19756	50428	-20851	-25.3%	-36.7%	-26.5%	-29.3%
109		Franklin	715	2590		5814	7927	7310	21051	-8360	-29.2%	-35.8%	-17.4%	-28.4%
110		Franklin	10714	36844	S	22159	34504	23190	79854	46925	121.2%	189.3%	111.1%	142.5%
111		Franklin	1703	7111		2731	6337	2338	11406	-5857	-33.7%	-39.7%	-11.3%	-33.9%
112		Franklin	2694	10881		8005	18547	5781	32332	-5857	-14.8%	-18.4%	-4.9%	-15.3%
113		Franklin	3172	13549		5696	15864	2775	24335	-5857	-19.6%	-20.8%	-9.7%	-19.4%
114		Franklin	11089	55025		7579	24636	5392	37607	-5857	-15.5%	-14.5%	-5.2%	-13.5%
115		Franklin	7189	28383		8779	19921	5959	34659	-5857	-13.7%	-17.3%	-4.7%	-14.5%
116		Franklin	6762	25651		6378	12623	5193	24195	-5857	-17.9%	-24.8%	-5.4%	-19.5%
201		Franklin (W/C)	8357	43589	W	3274	13208	1716	18198	18198	N/A	N/A	N/A	N/A
Total		Franklin	2260	8629		92784	185335	83693	361812	-51424	-11.5%	-17.3%	-0.9%	-12.4%
98		Hillsborough	171	755		3483	9712	2218	15413	-9455	-32.7%	-40.8%	-32.5%	-38.0%
99		Hillsborough	10006	37105	S	23079	47986	20779	91844	42512	104.8%	48.1%	266.6%	86.2%
100		Hillsborough	401	1571		4341	9838	2847	17026	-22198	-62.6%	-46.2%	-69.5%	-56.6%
101		Hillsborough	1094	5222		4368	14025	2458	20851	-12057	-43.9%	-29.1%	-53.9%	-36.6%
102		Hillsborough	625	3798		4069	16098	4546	24713	-10293	-40.0%	-25.8%	-30.5%	-29.4%
103		Hillsborough	632	2646		6177	15565	4108	25849	-16236	-43.0%	-33.4%	-47.8%	-38.6%

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	Scenario 1 Daily Trips/Sq. Mi. HBW	Total	Const Code Scen1	Daily Trip Ends - Scenario 1 Reduced by Construct Impact HBW	HBO	NHB	Total	Change in Total Daily Trip Ends	2010 Percent Change in Daily Trip Ends Scenario 1 vs. Trend HBW	HBO	NHB	TOTAL
Total		Hillsborough	992	4055		45517	113224	36955	195697	-27727	-14.9%	-14.2%	-2.8%	-12.4%
105		Manville	4573	21661		5305	16328	3494	25126	-4542	-24.1%	-5.7%	-34.8%	-15.3%
106		Manville	8736	37044		2894	8175	1202	12271	-4537	-36.8%	-10.8%	-60.8%	-27.0%
107		Manville	3311	13893		3270	8938	1513	13720	-4537	-34.0%	-9.9%	-55.2%	-24.8%
Total		Manville	4627	20622		11468	33440	6209	51117	-13616	-30.6%	-8.1%	-47.4%	-21.0%
104		Millstone	699	3334		523	1671	303	2497	-799	-37.3%	-6.8%	-54.7%	-24.2%
3		Montgomery/Rocky	4320	21946		6240	16805	8651	31696	-8399	-24.7%	-16.7%	-25.7%	-20.9%
4		Montgomery	335	1291	ZW	2444	5827	1137	9408	-10846	-51.3%	-57.0%	-32.6%	-53.5%
5		Montgomery	344	1444		891	2080	770	3740	-8861	-68.6%	-68.3%	-76.1%	-70.3%
6		Montgomery	783	2214		11019	8908	11253	31180	-9061	-12.5%	-37.3%	-16.3%	-22.5%
7		Montgomery	110	434		516	1319	195	2030	-2189	-50.2%	-54.2%	-36.3%	-51.9%
8		Montgomery	2443	12059	W	3934	14216	2255	20406	8692	40.5%	151.3%	-30.7%	74.2%
9		Montgomery	1389	5855		896	2689	192	3776	-2189	-36.7%	-36.7%	-36.7%	-36.7%
200		Montgomery(W/C)	8357	43589	W	3274	13208	1716	18198	18198	N/A	N/A	N/A	N/A
Total		Montgomery	936	3852		29215	65052	26169	120435	-14655	-14.0%	-3.3%	-22.7%	-10.8%
196		South Bound Brook	5719	24200		4450	12163	2218	18831	-4384	-25.2%	-10.6%	-39.4%	-18.9%
Somerset County (Part)			1495	5952		183958	410884	155547	750390	-112605	-14.7%	-13.5%	-9.8%	-13.0%
55		Cranbury	12	51		14	42	3	59		-95.9%	-95.9%	-95.9%	-95.9%
56		Cranbury	560	2063		919	1986	480	3384	-1371	-26.2%	-32.9%	-12.7%	-28.8%
57		Cranbury	39	166		33	98	7	138	-1371	-90.8%	-90.8%	-90.8%	-90.8%
58		Cranbury	935	4506		885	3027	353	4265	-1371	-26.9%	-24.4%	-16.5%	-24.3%
59		Cranbury	74	310		225	674	48	947	-1371	-59.1%	-59.1%	-59.1%	-59.1%
63		Cranbury	1145	2938		1559	607	1834	4000	-4679	-51.6%	-68.3%	-48.3%	-53.9%
64		Cranbury	5990	22071	W	8775	15519	7354	31649	6207	25.8%	69.9%	-21.2%	24.4%
66		Cranbury	2826	7031		4989	1337	6088	12414	-1371	-6.1%	-42.2%	-1.1%	-9.9%
67		Cranbury	37	155		35	105	8	148	-1380	-90.3%	-90.3%	-90.3%	-90.3%
Total		Cranbury	1413	4720		17433	23396	16174	57003	-8076	-10.9%	-7.0%	-20.5%	-12.4%
129		East Brunswick	4756	25888		18776	58335	25094	102204	-33957	-20.6%	-26.7%	-23.9%	-24.9%
133		East Brunswick	9125	41800		14499	31039	20878	66417	-29283	-22.3%	-34.7%	-29.3%	-30.6%
135		East Brunswick	498	2243		2242	6933	931	10106	-6922	-42.3%	-41.5%	-27.4%	-40.6%
136		East Brunswick	1845	8487		11533	32353	9159	53044	-35256	-28.8%	-41.2%	-46.5%	-39.9%
137		East Brunswick	3632	16724		5499	15981	3842	25321	-6922	-23.0%	-23.6%	-8.4%	-21.5%
138		East Brunswick	3255	15650		6318	18946	5117	30381	-7422	-22.6%	-20.8%	-10.5%	-19.6%
139		East Brunswick	9222	83679		12513	73882	27142	113537	-12042	-14.2%	-10.1%	-5.7%	-9.6%
140		East Brunswick	6145	36691		8193	30387	10334	48914	-7507	-27.0%	-2.4%	-26.5%	-13.3%
Total		East Brunswick	3546	20052		79572	267856	102496	449924	-139310	-23.1%	-23.9%	-23.3%	-23.6%
143		Helmetta	1715	6880		1339	3380	653	5373	-5674	-51.0%	-53.4%	-38.7%	-51.4%

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Zone	Growth Code	Municipality	Scenario 1 Daily Trips/Sq. Mi. HBW	Total	Const Code Scen1	Daily Trip Ends - Scenario 1 Reduced by Construct Impact HBW	HBO	NHB	Total	Change in Total Daily Trip Ends	2010 Percent Change in Daily Trip Ends Scenario 1 vs. Trend HBW	HBO	NHB	TOTAL
145		Jamesburg	8593	40416		7885	21527	7675	37087	-8103	-23.4%	-15.6%	-18.2%	-17.9%
134		Milltown	7399	29272		10666	23043	8488	42197	-6734	-14.1%	-15.5%	-8.2%	-13.8%
144		Monroe	1025	4321		9950	29849	2126	41925	-36565	-36.5%	-42.6%	-80.4%	-46.6%
146		Monroe	1818	6840		11228	25667	5354	42249	-39397	-35.7%	-47.8%	-64.3%	-48.3%
147		Monroe	85	359		122	365	26	513	-7849	-93.9%	-93.9%	-93.9%	-93.9%
148		Monroe	99	418		613	1839	131	2583	-38307	-91.3%	-92.4%	-98.7%	-93.7%
149		Monroe	149	495		1488	2385	1085	4958	-13301	-73.2%	-72.0%	-74.1%	-72.8%
150		Monroe	52	217		349	1046	75	1469	-13825	-92.5%	-85.6%	-97.8%	-90.4%
151		Monroe	76	321		138	414	30	582	-13301	-96.7%	-93.7%	-99.1%	-95.8%
Total		Monroe	568	2241		23888	61566	8825	94279	-162545	-57.7%	-59.9%	-81.1%	-63.3%
117		New Brunswick	14367	53487		21260	38046	19845	79152	35922	73.4%	92.0%	78.0%	83.1%
118		New Brunswick	57951	231091		15122	33157	12022	60301	38135	189.1%	125.4%	440.0%	172.0%
119		New Brunswick	65774	250651		15031	28686	13561	57278	37040	169.3%	177.2%	214.8%	183.0%
120		New Brunswick	73323	295909		14547	32527	11634	58708	38135	212.4%	131.0%	532.9%	185.4%
121		New Brunswick	81219	314098		16789	33002	15138	64930	35838	138.2%	104.3%	157.2%	123.2%
122		New Brunswick	88812	308311		24958	33851	27831	86641	35838	64.0%	99.0%	49.8%	70.5%
123		New Brunswick	135813	507863		20032	34239	20638	74909	33919	69.1%	111.2%	59.6%	82.7%
124		New Brunswick	101680	383191		19920	38315	16836	75071	38101	98.5%	92.7%	138.8%	103.1%
125		New Brunswick	47305	173528		36582	55000	42609	134191	38091	37.0%	50.4%	29.8%	39.6%
126		New Brunswick	12603	58025		24636	61140	27653	113429	38101	67.0%	43.1%	54.8%	50.6%
Total		New Brunswick	36473	140495		208877	387964	207767	804608	369121	84.3%	87.0%	81.2%	84.8%
90		North Brunswick	3571	16819	B	7838	25027	6456	39322	-32004	-51.2%	-38.8%	-55.1%	-44.9%
92		North Brunswick	10946	37896	S	20998	35876	20064	76937	-9538	-16.6%	-7.6%	-10.7%	-11.0%
93		North Brunswick	2834	11787	B	5116	16551	2323	23990	-21331	-53.6%	-36.6%	-71.7%	-47.1%
94		North Brunswick	3889	15697	B	3787	9769	2809	16365	-16604	-53.9%	-39.4%	-67.5%	-50.4%
95		North Brunswick	9966	42779		27789	58322	33178	119289	-14984	-11.9%	-9.6%	-13.2%	-11.2%
127		North Brunswick	1669	4292		300	120	352	771	-15725	-93.6%	-97.7%	-94.7%	-95.3%
128		North Brunswick	786	1975		579	176	699	1453	-13071	-85.0%	-96.5%	-87.6%	-90.0%
Total		North Brunswick	6165	24654		66408	145840	65879	278127	-123257	-33.9%	-25.8%	-36.8%	-30.7%
28		Plainsboro	22257	90214	S	19933	44122	21952	86007	1190	-18.1%	43.4%	-26.1%	1.4%
33		Plainsboro	1517	3881	B	1585	593	1743	3921	-24121	-83.6%	-93.3%	-81.7%	-86.0%
34		Plainsboro	2104	5269	B	1179	328	1326	2834	-39801	-92.9%	-93.9%	-93.6%	-93.4%
35		Plainsboro	6782	16817	B	5541	1296	6295	13133	-15090	-48.6%	-67.0%	-53.4%	-53.5%
36		Plainsboro	1244	4311		921	1671	599	3191	-9485	-71.0%	-80.2%	-44.5%	-74.8%
43		Plainsboro	26	108		63	190	14	266	-9485	-97.3%	-97.3%	-97.3%	-97.3%
44		Plainsboro	4062	26485		3136	14198	3113	20447	-21437	-67.4%	-38.8%	-65.6%	-51.2%
45		Plainsboro	7047	30886		11958	36852	3602	52411	-15643	-25.7%	-18.6%	-46.1%	-23.0%
46		Plainsboro	126	461		298	634	160	1092	-9475	-88.3%	-91.4%	-75.1%	-89.7%
Total		Plainsboro	4392	17413		44615	99883	38803	183302	-143347	-53.1%	-28.7%	-57.5%	-43.9%

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	Scenario 1 Daily Trips/Sq. Mi. HBW	Total	Const Code Scen1	Daily Trip Ends - Scenario 1 Reduced by Construct Impact HBW	HBO	NHB	Total	Change in Total Daily Trip Ends	2010 Percent Change in Daily Trip Ends Scenario 1 vs. Trend HBW	HBO	NHB	TOTAL
23		South Brunswick	1356	7147		3685	13327	2415	19427	-12245	-41.1%	-38.2%	-37.1%	-38.7%
24		South Brunswick	1769	8321		5215	17309	2004	24528	-3498	-12.8%	-12.6%	-11.0%	-12.5%
25		South Brunswick	677	4373		1240	5656	1115	8011	-26930	-74.2%	-77.0%	-79.8%	-77.1%
26		South Brunswick	619	2031		799	1216	606	2620	-2484	-50.7%	-43.0%	-55.1%	-48.7%
27		South Brunswick	2027	9540		1103	3600	489	5193	-11793	-71.7%	-70.0%	-55.0%	-69.4%
37		South Brunswick	2761	6931		5024	1520	6067	12610	-19558	-60.6%	-63.5%	-60.3%	-60.8%
38		South Brunswick	750	4634		2002	8746	1630	12379	-1459	-14.7%	-10.6%	-4.3%	-10.5%
39		South Brunswick	169	712		192	576	41	809	-10343	-92.7%	-92.7%	-92.7%	-92.7%
40		South Brunswick	15545	58965	T	27582	62195	27065	116843	53989	37.5%	229.1%	13.3%	85.9%
41		South Brunswick	2566	9327		7646	14334	5814	27794	-9058	-23.5%	-28.6%	-14.4%	-24.6%
42		South Brunswick	3046	7875		6608	2789	7689	17087	-7653	-27.0%	-50.1%	-23.9%	-30.9%
60		South Brunswick	2059	10688	W	3359	13492	1734	18584	17016	802.8%	1108.7%	2080.7%	1085.4%
61		South Brunswick	482	1455		2152	2389	1958	6499	-17044	-73.4%	-68.3%	-75.2%	-72.4%
62		South Brunswick	3792	12604	S	21093	30494	21683	73271	180	-27.5%	244.9%	-38.3%	0.2%
91		South Brunswick	252	841		888	1438	642	2968	-5475	-69.5%	-46.0%	-77.6%	-64.8%
Total		South Brunswick	2746	10263		110979	200087	103687	414753	9776	-7.4%	20.0%	-12.4%	2.4%
130		South River	6537	28583		6078	15631	4867	26576	-3820	-16.1%	-10.1%	-15.6%	-12.6%
131		South River	8528	39825		3516	10823	2081	16421	-3820	-25.0%	-13.9%	-30.1%	-18.9%
132		South River	3909	16827		5919	16952	2608	25479	-3825	-16.5%	-9.4%	-25.7%	-13.1%
Total		South River	5431	23973		15514	43407	9556	68476	-11465				
141		Spotswood	3981	17644		6178	17181	4018	27377	-4062	-17.1%	-9.3%	-20.3%	-12.9%
142		Spotswood	5777	27682		4727	13348	4575	22649	-4062	-21.2%	-11.7%	-18.3%	-15.2%
Total		Spotswood	4601	21110		10904	30529	8593	50026	-8125	-18.9%	-10.4%	-19.3%	-14.0%
Middlesex Co. (part)			3946	16251		598080	1308478	578596	2485155	-237738	-10.2%	-5.5%	-13.9%	-8.7%
		MSM Region Total	3313	13465		1626253	3538473	1528994	6693720	-351563	-6.2%	-3.4%	-7.3%	-5.0%

Source: Douglas & Douglas, Inc.

Growth Code / Zone	Municipality	Job/Housing Ratios 1988	2010 Trend	2010 Scen1	Percent Change in J/H Ratios '88-T	'88-S1	T-S1
52	East Windsor	0.03	0.03	0.03	-15.6%	0.0%	18.5%
53	East Windsor	33.42	6.70	33.42	-79.9%	0.0%	398.5%
70	East Windsor	0.30	0.34	0.30	12.5%	0.0%	-11.1%
71	East Windsor	21.82	2.89	138.79	-86.7%	536.0%	4696.0%
72	East Windsor	0.10	0.33	0.10	239.1%	0.0%	-70.5%
73	East Windsor	1.09	0.84	1.09	-22.6%	0.0%	29.2%
76	East Windsor	1.80	3.73	1.80	107.6%	0.0%	-51.8%
77	East Windsor	0.00	0.05	0.00	0.0%	0.0%	-100.0%
78	East Windsor	0.00	0.00	0.00	0.0%	0.0%	0.0%
79	East Windsor	5.48	2.58	1.18	-53.0%	-78.4%	-54.2%
Total	East Windsor	0.98	1.00	1.47	1.9%	50.6%	47.7%
181	Ewing	2.42	2.49	2.42	2.8%	0.0%	-2.8%
182	Ewing	1.04	0.87	1.04	-16.6%	0.0%	19.9%
Total	Ewing	2.29	2.32	2.29	1.7%	0.0%	-1.7%
81	Hamilton	0.73	0.71	0.73	-2.6%	0.0%	2.7%
164	Hamilton	0.04	0.08	0.04	95.7%	0.0%	-48.9%
165	Hamilton	0.25	0.19	0.25	-22.9%	0.0%	29.8%
166	Hamilton	11.38	1.87	11.38	-83.5%	0.0%	507.3%
167	Hamilton	1.31	0.49	1.31	-62.7%	0.0%	168.5%
168	Hamilton	0.31	0.26	0.31	-14.5%	0.0%	17.0%
169	Hamilton	0.66	0.35	0.66	-46.9%	0.0%	88.2%
170	Hamilton	0.55	2.04	0.55	271.5%	0.0%	-73.1%
171	Hamilton	0.61	0.48	0.61	-21.3%	0.0%	27.1%
172	Hamilton	1.22	1.34	1.22	9.7%	0.0%	-8.9%
173	Hamilton	1.39	1.10	1.39	-21.2%	0.0%	26.8%
174	Hamilton	0.65	0.69	0.65	5.5%	0.0%	-5.2%
175	Hamilton	0.32	0.28	0.32	-13.1%	0.0%	15.0%
176	Hamilton	1.01	0.99	1.01	-1.9%	0.0%	1.9%
177	Hamilton	1.83	1.45	1.83	-20.6%	0.0%	26.0%
178	Hamilton	2.11	1.60	2.11	-24.3%	0.0%	32.0%
Total	Hamilton	0.89	0.85	0.89	-4.7%	0.0%	5.0%
74	Hightstown	2.52	3.84	2.52	52.1%	0.0%	-34.3%
75	Hightstown	0.99	1.80	0.99	82.0%	0.0%	-45.1%
Total	Hightstown	1.57	2.57	1.57	63.8%	0.0%	-39.0%
183	Hopewell Township	0.80	1.09	0.80	36.9%	0.0%	-26.9%
184	Hopewell Township	0.80	1.08	3.03	34.4%	276.4%	180.0%
186	Hopewell Township	2.57	2.26	2.57	-12.2%	0.0%	13.9%
187	Hopewell Township	0.83	0.73	0.83	-12.6%	0.0%	14.4%
188	Hopewell Township	0.61	0.48	0.61	-21.8%	0.0%	27.8%
189	Hopewell Township	1.71	2.53	1.71	48.1%	0.0%	-32.5%
190	Hopewell Township	0.00	0.00	0.00	0.0%	0.0%	0.0%

Source: Douglas & Douglas, Inc.

Zone	Growth Code / Municipality	Job/Housing Ratios 1988	2010 Trend	2010 Scen1	Percent Change in J/H Ratios '88-T	'88-S1	T-S1
191	Hopewell Township	1.33	0.46	1.33	-65.3%	0.0%	188.1%
192	Hopewell Township	0.00	0.00	0.00	0.0%	0.0%	0.0%
193	Hopewell Boro	0.67	0.63	0.67	-6.5%	0.0%	6.9%
194	Hopewell Township	0.00	0.00	0.00	0.0%	0.0%	0.0%
195	Hopewell Township	0.00	0.00	0.00	0.0%	0.0%	0.0%
202	Hopewell (W/C)			0.14	0.0%	0.0%	0.0%
203	Hopewell (W/C)			0.14	0.0%	0.0%	0.0%
Total	Hopewell Township	0.74	0.67	1.26	-10.2%	69.6%	88.7%
69	Lawrence	57.14	1.71	57.14	-97.0%	0.0%	3232.4%
80	Lawrence	2.13	3.39	2.13	59.4%	0.0%	-37.3%
82	Lawrence	3.53	3.64	3.53	2.9%	0.0%	-2.8%
83	Lawrence	6.68	4.67	3.85	-30.1%	-42.4%	-17.6%
96	Lawrence	4.68	7.33	4.68	56.5%	0.0%	-36.1%
97	Lawrence	0.05	0.10	0.05	80.9%	0.0%	-44.7%
179	Lawrence	2.46	2.28	2.46	-7.4%	0.0%	8.0%
Total	Lawrence	2.47	2.61	2.65	5.7%	7.4%	1.6%
185	Pennington	1.88	3.19	1.88	70.0%	0.0%	-41.2%
10	Princeton Township	0.36	0.11	0.36	-69.6%	0.0%	229.1%
11	Princeton Township	4.78	4.98	4.78	4.3%	0.0%	-4.1%
12	Princeton Township	1.09	1.95	1.09	79.1%	0.0%	-44.2%
13	Princeton Township	0.10	0.07	0.10	-36.6%	0.0%	57.7%
14	Princeton Township/	8.69	7.02	8.69	-19.2%	0.0%	23.8%
15	Princeton Boro	3.63	3.51	3.63	-3.1%	0.0%	3.2%
16	Princeton Township	0.54	0.33	0.54	-39.1%	0.0%	64.1%
17	Princeton Township	1.09	0.49	1.09	-55.4%	0.0%	124.3%
18	Princeton Township	0.45	0.22	0.45	-50.9%	0.0%	103.8%
19	Princeton Boro	0.39	0.27	0.39	-30.7%	0.0%	44.3%
20	Princeton Township	0.54	3.10	0.54	476.0%	0.0%	-82.6%
Total	Princeton	2.53	2.26	2.53	-10.5%	0.0%	11.7%
180	Trenton	1.62	1.76	1.65	9.2%	1.9%	-6.7%
152	Washington	1.89	1.89	1.89	0.0%	0.0%	0.0%
153	Washington	0.94	0.94	0.94	0.0%	0.0%	0.0%
154	Washington	0.88	0.88	0.88	0.0%	0.0%	0.0%
155	Washington	0.00	0.00	0.00	0.0%	0.0%	0.0%
156	Washington	1.52	1.52	1.52	0.0%	0.0%	0.0%
157	Washington	0.81	0.41	0.19	-49.6%	-76.3%	-52.9%
158	Washington	0.21	0.21	0.21	0.0%	0.0%	0.0%
159	Washington	0.95	0.69	0.95	-26.8%	0.0%	36.6%
160	Washington	0.04	60.84	3.36	152000.0%	8307.1%	-94.5%
161	Washington	3.85	1.02	3.85	-73.6%	0.0%	278.5%
162	Washington	2.23	2.41	2.23	8.0%	0.0%	-7.4%

Source: Douglas & Douglas, Inc.

Zone	Growth Code / Municipality	Job/Housing Ratios 1988	2010 Trend	2010 Scen1	Percent Change in J/H Ratios '88-T	'88-S1	T-S1
163	Washington	0.55	0.32	0.55	-42.9%	0.0%	75.1%
Total	Washington	0.93	0.95	1.78	1.5%	90.5%	87.8%
29	West Windsor	6.16	6.16	6.16	0.0%	0.0%	0.0%
30	West Windsor	47.45	66.10	47.45	39.3%	0.0%	-28.2%
31	West Windsor	0.00	0.00	0.00	0.0%	0.0%	0.0%
32	West Windsor	2.25	3.76	2.19	67.4%	-2.5%	-41.8%
47	West Windsor	1.09	1.39	1.09	28.4%	0.0%	-22.1%
48	West Windsor	0.23	0.16	0.23	-30.7%	0.0%	44.3%
49	West Windsor	0.59	0.24	0.59	-58.9%	0.0%	143.6%
50	West Windsor	7.24	1.08	7.24	-85.1%	0.0%	571.3%
51	West Windsor	0.09	0.04	0.09	-54.4%	0.0%	119.1%
54	West Windsor	0.27	0.13	0.27	-51.2%	0.0%	105.0%
84	West Windsor	11.20	729.20	11.20	6410.7%	0.0%	-98.5%
85	West Windsor	2.02	1.78	2.02	-11.9%	0.0%	13.5%
86	West Windsor	38.19	95.18	38.19	149.2%	0.0%	-59.9%
87	West Windsor	1.00	1.00	1.00	0.0%	0.0%	0.0%
Total	West Windsor	2.74	2.74	2.42	-0.2%	-11.7%	-11.5%
	Mercer County	1.57	1.62	1.68	3.0%	6.9%	3.8%
1	Franklin	0.06	0.02	0.06	-72.7%	0.0%	265.9%
2	Franklin	0.00	0.00	0.00	0.0%	0.0%	0.0%
21	Franklin	11.46	0.52	11.46	-95.5%	0.0%	2117.9%
22	Franklin	1.47	0.29	1.47	-80.4%	0.0%	409.0%
88	Franklin	0.33	0.23	0.33	-29.5%	0.0%	41.8%
89	Franklin	0.27	0.12	0.27	-56.6%	0.0%	130.3%
108	Franklin	16.72	8.71	16.72	-47.9%	0.0%	91.9%
109	Franklin	7.76	3.41	7.76	-56.0%	0.0%	127.4%
110	Franklin	8.35	4.63	3.89	-44.6%	-53.5%	-15.9%
111	Franklin	1.17	0.59	1.17	-49.7%	0.0%	98.8%
112	Franklin	0.84	0.65	0.84	-22.6%	0.0%	29.1%
113	Franklin	0.30	0.23	0.30	-23.3%	0.0%	30.4%
114	Franklin	0.45	0.36	0.45	-20.0%	0.0%	25.0%
115	Franklin	0.77	0.62	0.77	-20.5%	0.0%	25.7%
116	Franklin	1.27	0.88	1.27	-30.7%	0.0%	44.2%
201	Franklin (W/C)			0.14			
Total	Franklin	1.77	1.14	1.88	-35.6%	6.1%	64.6%
98	Hillsborough	0.50	0.37	0.50	-24.7%	0.0%	32.8%
99	Hillsborough	0.21	0.30	1.85	38.3%	761.1%	522.6%
100	Hillsborough	0.73	1.56	0.73	113.3%	0.0%	-53.1%
101	Hillsborough	0.28	0.67	0.28	141.1%	0.0%	-58.5%
102	Hillsborough	0.88	0.93	0.88	5.7%	0.0%	-5.4%
103	Hillsborough	0.64	0.93	0.64	44.8%	0.0%	-30.9%

Source: Douglas & Douglas, Inc.

Zone	Growth Code	Municipality	Job/Housing Ratios 1988	2010 Trend	2010 Scen1	Percent Change in J/H Ratios '88-T	'88-S1	T-S1
Total		Hillsborough	0.48	0.75	1.16	56.4%	142.7%	55.2%
105		Manville	0.43	0.85	0.43	97.1%	0.0%	-49.3%
106		Manville	0.21	0.88	0.21	313.9%	0.0%	-75.8%
107		Manville	0.29	0.91	0.29	216.0%	0.0%	-68.4%
Total		Manville	0.33	0.88	0.33	165.6%	0.0%	-62.4%
104		Millstone	0.30	1.12	0.30	274.3%	0.0%	-73.3%
3		Montgomery/Rocky	3.82	5.03	3.82	31.6%	0.0%	-24.0%
4		Montgomery	0.39	0.16	0.39	-58.0%	0.0%	138.4%
5		Montgomery	1.18	2.35	1.18	99.4%	0.0%	-49.8%
6		Montgomery	4.85	4.41	4.85	-9.1%	0.0%	10.0%
7		Montgomery	0.24	0.11	0.24	-54.5%	0.0%	120.0%
8		Montgomery	2.15	3.08	0.28	43.4%	-86.7%	-90.8%
9		Montgomery	0.00	0.00	0.00	0.0%	0.0%	0.0%
200		Montgomery(W/C)			0.14			
Total		Montgomery	2.43	2.00	1.30	-17.4%	-46.4%	-35.1%
196		South Bound Brook	0.33	0.65	0.33	96.4%	0.0%	-49.1%
Somerset County (Part)			1.21	1.09	1.38	-10.3%	14.0%	27.1%
55		Cranbury	0.00	0.00	0.00	0.0%	0.0%	0.0%
56		Cranbury	0.54	0.36	0.54	-33.7%	0.0%	50.9%
57		Cranbury	0.00	0.00	0.00	0.0%	0.0%	0.0%
58		Cranbury	0.07	0.05	0.07	-28.0%	0.0%	38.8%
59		Cranbury	0.00	0.00	0.00	0.0%	0.0%	0.0%
63		Cranbury	23.03	8.61	23.03	-62.6%	0.0%	167.4%
64		Cranbury	30.65	14.07	1.97	-54.1%	-93.6%	-86.0%
66		Cranbury	174.73	17.02	174.73	-90.3%	0.0%	926.7%
67		Cranbury	0.00	0.00	0.00	0.0%	0.0%	0.0%
Total		Cranbury	7.34	3.55	2.76	-51.7%	-62.4%	-22.2%
129		East Brunswick	2.48	2.47	2.48	-0.4%	0.0%	0.4%
133		East Brunswick	7.92	10.54	7.92	33.2%	0.0%	-24.9%
135		East Brunswick	0.15	0.08	0.15	-45.1%	0.0%	82.3%
136		East Brunswick	0.76	1.04	0.76	37.4%	0.0%	-27.2%
137		East Brunswick	0.55	0.38	0.55	-30.1%	0.0%	43.1%
138		East Brunswick	0.70	0.54	0.70	-22.7%	0.0%	29.3%
139		East Brunswick	4.44	2.89	4.44	-34.9%	0.0%	53.6%
140		East Brunswick	1.44	2.43	1.44	68.9%	0.0%	-40.8%
Total		East Brunswick	1.87	1.84	1.87	-1.3%	0.0%	1.3%
143		Helmetta	0.38	0.23	0.38	-39.3%	0.0%	64.7%

Source: Douglas & Douglas, Inc.

Zone	Growth Code / Municipality	Job/Housing Ratios 1988	2010 Trend	2010 Scen1	Percent Change in J/H Ratios '88-T	'88-S1	T-S1
145	Jamesburg	1.23	1.22	1.23	-1.1%	0.0%	1.1%
134	Milltown	1.10	0.95	1.10	-13.5%	0.0%	15.7%
144	Monroe	0.00	0.40	0.00	172068.9%	-100.0%	-100.0%
146	Monroe	0.43	0.88	0.43	103.9%	0.0%	-50.9%
147	Monroe	0.00	0.00	0.00	0.0%	0.0%	0.0%
148	Monroe	0.00	2.28	0.00	59605.3%	-100.0%	-100.0%
149	Monroe	1.28	1.41	1.28	10.2%	0.0%	-9.2%
150	Monroe	0.01	1.35	0.00	19981.9%	-100.0%	-100.0%
151	Monroe	0.02	1.36	0.00	7916.0%	-100.0%	-100.0%
Total	Monroe	0.23	0.87	0.22	284.3%	-0.2%	-74.0%
117	New Brunswick	2.15	1.98	1.91	-7.8%	-11.4%	-3.9%
118	New Brunswick	0.28	0.23	1.08	-20.0%	280.3%	375.4%
119	New Brunswick	1.52	1.23	1.65	-18.7%	8.4%	33.4%
120	New Brunswick	0.11	0.09	1.04	-21.7%	819.8%	1074.5%
121	New Brunswick	1.36	1.08	1.57	-20.8%	15.3%	45.5%
122	New Brunswick	15.94	8.64	4.31	-45.8%	-72.9%	-50.1%
123	New Brunswick	4.66	3.95	2.59	-15.3%	-44.5%	-34.5%
124	New Brunswick	1.15	0.97	1.42	-15.7%	23.3%	46.3%
125	New Brunswick	10.58	7.71	4.75	-27.1%	-55.1%	-38.4%
126	New Brunswick	2.35	1.96	2.02	-16.7%	-14.1%	3.2%
Total	New Brunswick	2.78	2.25	2.13	-19.1%	-23.5%	-5.5%
90	North Brunswick	0.79	1.13	0.79	42.5%	0.0%	-29.8%
92	North Brunswick	0.74	1.99	2.63	167.7%	254.5%	32.4%
93	North Brunswick	0.27	0.86	0.27	214.4%	0.0%	-68.2%
94	North Brunswick	0.92	2.35	0.92	156.6%	0.0%	-61.0%
95	North Brunswick	3.20	3.52	3.20	9.9%	0.0%	-9.0%
127	North Brunswick	21.43	350.57	21.43	1536.0%	0.0%	-93.9%
128	North Brunswick	60.00	407.40	60.00	579.0%	0.0%	-85.3%
Total	North Brunswick	1.47	2.26	1.87	53.4%	27.1%	-17.2%
28	Plainsboro	1.35	7.27	3.06	437.8%	126.1%	-58.0%
33	Plainsboro	25.13	3.88	25.13	-84.6%	0.0%	547.8%
34	Plainsboro	75.00	877.20	75.00	1069.6%	0.0%	-91.5%
35	Plainsboro	594.83	950.17	594.83	59.7%	0.0%	-37.4%
36	Plainsboro	0.94	0.18	0.94	-81.1%	0.0%	429.5%
43	Plainsboro	0.00	0.00	0.00	0.0%	0.0%	0.0%
44	Plainsboro	0.43	1.37	0.43	214.3%	0.0%	-68.2%
45	Plainsboro	0.05	0.22	0.05	299.9%	0.0%	-75.0%
46	Plainsboro	0.57	0.05	0.57	-91.7%	0.0%	1104.6%
Total	Plainsboro	1.02	2.47	1.71	141.4%	67.2%	-30.7%

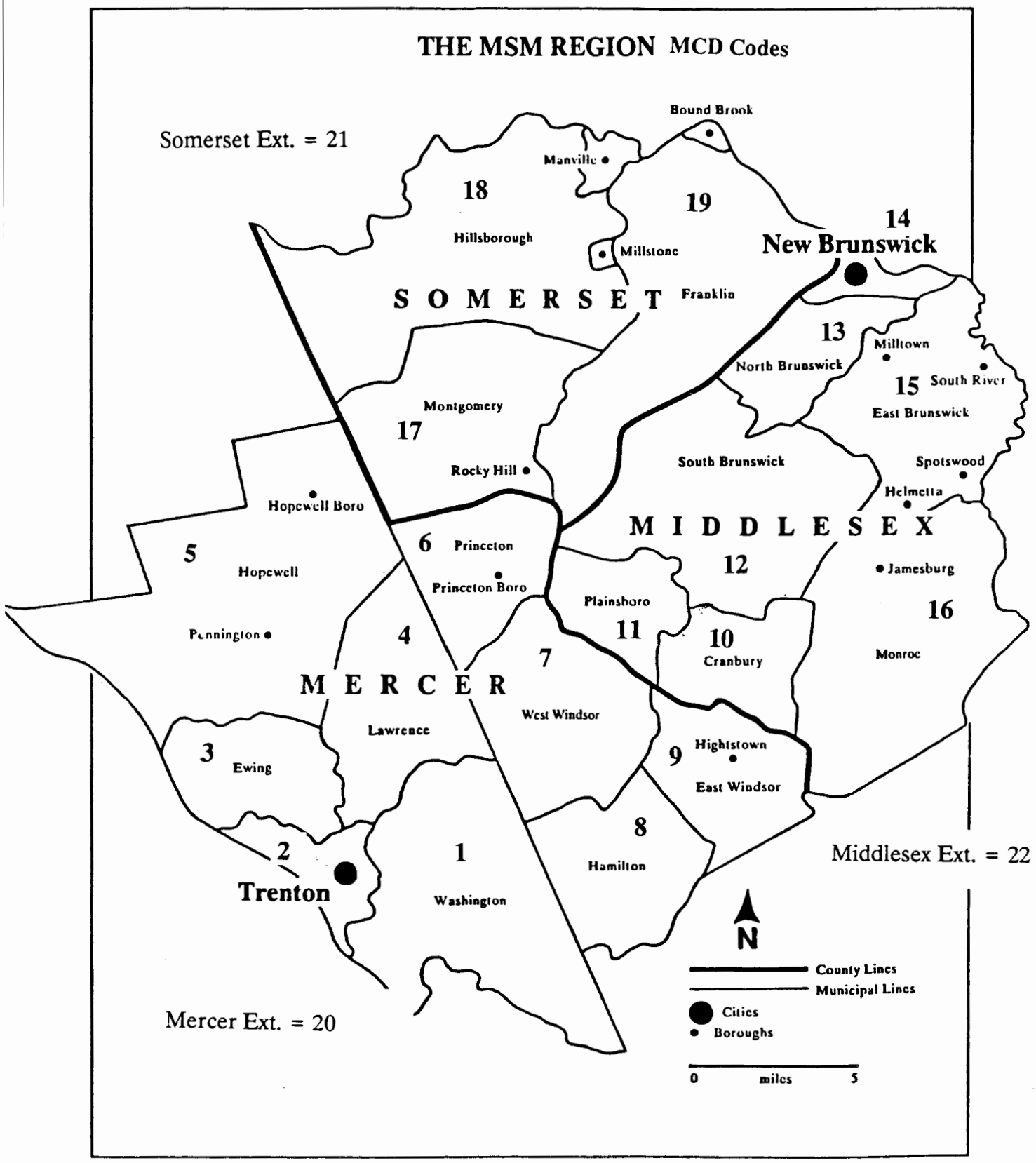
Source: Douglas & Douglas, Inc.

Zone	Growth Code / Municipality	Job/Housing Ratios 1988	2010 Trend	2010 Scen1	Percent Change in J/H Ratios '88-T	'88-S1	T-S1
23	South Brunswick	0.28	0.27	0.28	-1.2%	0.0%	1.2%
24	South Brunswick	0.08	0.07	0.08	-6.2%	0.0%	6.6%
25	South Brunswick	0.31	0.46	0.31	49.6%	0.0%	-33.2%
26	South Brunswick	1.44	1.95	1.44	35.6%	0.0%	-26.2%
27	South Brunswick	0.14	0.04	0.14	-73.9%	0.0%	282.7%
37	South Brunswick	62.05	42.53	62.05	-31.5%	0.0%	45.9%
38	South Brunswick	0.26	0.22	0.26	-17.3%	0.0%	20.9%
39	South Brunswick	0.00	0.00	0.00	0.0%	0.0%	0.0%
40	South Brunswick	1.07	9.18	2.08	758.6%	94.7%	-77.3%
41	South Brunswick	1.19	0.90	1.19	-23.9%	0.0%	31.3%
42	South Brunswick	18.40	9.19	18.40	-50.1%	0.0%	100.2%
60	South Brunswick	0.00	0.00	0.14	0.0%	0.0%	0.0%
61	South Brunswick	2.72	3.76	2.72	38.6%	0.0%	-27.8%
62	South Brunswick	14.85	60.61	3.93	308.1%	-73.6%	-93.5%
91	South Brunswick	1.25	3.89	1.25	211.3%	0.0%	-67.9%
Total	South Brunswick	1.52	2.82	1.90	85.2%	24.6%	-32.7%
130	South River	0.88	0.96	0.88	8.9%	0.0%	-8.2%
131	South River	0.35	0.53	0.35	53.4%	0.0%	-34.8%
132	South River	0.23	0.35	0.23	52.8%	0.0%	-34.5%
Total	South River	0.46	0.59	0.46	27.4%	0.0%	-21.5%
141	Spotswood	0.52	0.65	0.52	25.5%	0.0%	-20.3%
142	Spotswood	1.16	1.26	1.16	9.1%	0.0%	-8.4%
Total	Spotswood	0.75	0.88	0.75	18.0%	0.0%	-15.2%
Middlesex Co. (part)		1.54	1.94	1.70	25.9%	10.5%	-12.2%
	MSM Region Total	1.51	1.65	1.65	9.1%	9.1%	0.0%

Source: Douglas & Douglas, Inc.

Appendix F

Vehicle Trips, Speeds, and Vehicle Miles of Travel for Study Area Municipalities: 1988, 2010 Trend, Scenario 1, Scenario 2


THE MSM REGION MCD Codes
Somerset Ext. = 21
Bound Brook
Manville
18
Hillsborough
19
Millstone
14
New Brunswick
S O M E R S E T
Franklin
13
Milltown
North Brunswick
15
South River
East Brunswick
Montgomery
17
Rocky Hill
South Brunswick
Spotswood
Helmetta
Hopewell Boro
M I D D L E S E X
5
Hopewell
6
Princeton
Princeton Boro
12
Jamesburg
Plainsboro
11
16
Pennington
4
10
Cranbury
Monroe
7
M E R C E R
West Windsor
Lawrence
3
Ewing
9
Hightstown
East Windsor
8
2
1
Hamilton
Middlesex Ext. = 22
Trenton
Washington
N
County Lines
Municipal Lines
Cities
Boroughs
0
miles
5
Mercer Ext. = 20

Vehicle Miles Summary

	Jurisdiction	Calb Veh Mile	Tmd Veh Mile	Scen1 Veh Mile	Scen2 Veh Mile
1	Washington	91,926	109,419	106,211	102,221
2	Trenton	101,186	112,092	148,313	127,922
3	Ewing	51,551	55,055	57,756	50,929
4	Lawrence	74,658	96,545	102,519	99,980
5	Hopewell	25,494	32,276	33,776	37,927
6	Princeton	39,966	56,184	42,992	43,845
7	W.Windsor	45,731	72,124	59,708	65,460
8	Hamilton	34,764	45,624	47,844	51,608
9	E.Windsor	25,986	36,666	35,761	41,203
10	Crabury	40,201	53,285	45,217	48,301
11	Plainsboro	19,634	37,605	21,786	24,772
12	S.Brunswick	71,936	134,703	104,437	118,289
13	N.Brunswick	35,178	54,081	50,225	48,668
14	New Brunswick	34,454	37,147	52,020	40,194
15	E. Brunswick	77,835	88,530	77,480	76,117
16	Monroe	31,246	50,256	32,738	33,026
17	Montgomery	27,441	39,015	30,887	34,152
18	Hillsborough	32,948	46,970	37,555	40,980
19	Franklin	56,065	72,939	63,207	67,221
20	Mercer Ext	22,152	23,761	26,809	23,856
21	Somerset Ext	8,340	9,990	8,655	8,042
22	Middlesex Ext	40,975	42,893	41,438	40,603

County Summary (Excluding Ext.)

Jurisdiction	Calb Veh Mile	Tmd Veh Mile	Scen1 Veh Mile	Scen2 Veh Mile
Mercer	491,263	615,986	634,881	621,094
Somerset	310,482	455,607	383,903	389,367
Middlesex	116,454	158,924	131,649	142,353
Total	918,198	1,230,517	1,150,433	1,152,814

County Summary (Including Ext.)

Jurisdiction	Calb Veh Mile	Tmd Veh Mile	Scen1 Veh Mile	Scen2 Veh Mile
Mercer	513,414	639,747	661,689	644,950
Somerset	318,822	465,597	392,558	397,408
Middlesex	157,429	201,817	173,087	182,956
Total	989,665	1,307,161	1,227,335	1,225,315

Source: Douglas & Douglas, Inc.

Vehicle Miles Summary

		Difference						Difference Ratio					
	Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
1	Washington	17492	14285	-3208	10294	-7198	-3990	19.0%	15.5%	-2.9%	11.2%	-6.6%	-3.8%
2	Trenton	10906	47127	36220	26736	15830	-20390	10.8%	46.6%	32.3%	26.4%	14.1%	-13.7%
3	Ewing	3504	6205	2702	-622	-4126	-6828	6.8%	12.0%	4.9%	-1.2%	-7.5%	-11.8%%
4	Lawrence	21886	27861	5975	25322	3435	-2540	29.3%	37.3%	6.2%	33.9%	3.6%	-2.5%
5	Hopewell	6782	8282	1500	12433	5651	4151	26.6%	32.5%	4.6%	48.8%	17.5%	12.3%
6	Princeton	16218	3026	-13192	3879	-12339	853	40.6%	7.6%	-23.5%	9.7%	-22.0%	2.0%
7	W.Windsor	26394	13977	-12416	19730	-6664	5752	57.7%	30.6%	-17.2%	43.1%	-9.2%	9.6%
8	Hamilton	10860	13080	2219	16844	5983	3764	31.2%	37.6%	4.9%	48.5%	13.1%	7.9%
9	E.Windsor	10680	9775	-905	15217	4537	5442	41.1%	37.6%	-2.5%	58.6%	12.4%	15.2%
10	Crabury	13085	5016	-8068	8100	-4984	3084	32.5%	12.5%	-15.1%	20.2%	-9.4%	6.8%
11	Plainsboro	17972	2153	-15819	5138	-12834	2985	91.5%	11.0%	-42.1%	26.2%	-34.1%	13.7%
12	S.Brunswick	62767	32501	-30266	46354	-16414	13852	87.3%	45.2%	-22.5%	64.4%	-12.2%	13.3%
13	N.Brunswick	18903	15047	-3856	13490	-5413	-1557	53.7%	42.8%	-7.1%	38.3%	-10.0%	-3.1%
14	New Brunswick	2693	17567	14873	5741	3047	-11826	7.8%	51.0%	40.0%	16.7%	8.2%	-22.7%
15	E. Brunswick	10695	-355	-11050	-1718	-12413	-1363	13.7%	-0.5%	-12.5%	-2.2%	-14.0%	-1.8%
16	Monroe	19010	1493	-17517	1780	-17230	287	60.8%	4.8%	-34.9%	5.7%	-34.3%	0.9%
17	Montgomery	11574	3446	-8128	6711	-4863	3265	42.2%	12.6%	-20.8%	24.5%	-12.5%	10.6%
18	Hillsborough	14022	4607	-9415	8032	-5990	3425	42.6%	14.0%	-20.0%	24.4%	-12.8%	9.1%
19	Franklin	16875	7142	-9733	11156	-5719	4014	30.1%	12.7%	-13.3%	19.9%	-7.8%	6.4%
20	Mercer Ext	1610	4657	3047	1704	95	-2953	7.3%	21.0%	12.8%	7.7%	0.4%	-11.0%
21	Somerset Ext	1650	316	-1335	-298	-1948	-613	19.8%	3.8%	-13.4%	-3.6%	-19.5%	-7.1%
22	Middlesex Ext	1918	463	-1455	-372	-2290	-835	4.7%	1.1%	-3.4%	-0.9%	-5.3%	-2.0%

County Summary (Excluding Ext.)

	Difference						Difference Ratio					
Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
Mercer	124723	143618	18895	129832	5109	-13786	25.4%	29.2%	3.1%	26.4%	0.8%	-2.2%
Somerset	145125	73421	-71704	78884	-66241	5463	46.7%	23.6%	-15.7%	25.4%	-14.5%	1.4%
Middlesex	42470	15195	-27275	25899	-16571	10704	36.5%	13.0%	-17.2%	22.2%	-10.4%	8.1%
Total	312318	232235	-80084	234615	-77703	2381	34.0%	25.3%	-6.5%	25.6%	-6.3%	0.2%

County Summary (Including Ext.)

	Difference						Difference Ratio					
Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
Mercer	126333	148275	21942	131536	5203	-16739	24.6%	28.9%	3.4%	25.6%	0.8%	-2.5%
Somerset	146775	73737	-73039	78587	-68189	4850	46.0%	23.1%	-15.7%	24.6%	-14.6%	1.2%
Middlesex	44388	15658	-28730	25527	-18861	9869	28.2%	9.9%	-14.2%	16.2%	-9.3%	5.7%
Total	317497	237670	-79826	235650	-81846	-2020	32.1%	24.0%	-6.1%	23.8%	-6.3%	-0.2%

Source: Douglas & Douglas, Inc.

Vehicle Minutes Summary

	Jurisdiction	Calb Veh Min	Trnd Veh Min	Scen1 Veh Min	Scen2 Veh Min
1	Washington	187,404	214,849	193,563	192,672
2	Trenton	475,827	530,091	1,262,744	778,741
3	Ewing	253,058	301,650	265,206	203,020
4	Lawrence	125,680	185,458	185,864	168,581
5	Hopewell	44,966	59,492	64,337	76,233
6	Princeton	165,878	236,602	172,901	190,643
7	W.Windsor	85,344	241,125	118,129	142,297
8	Hamilton	43,983	61,178	63,073	69,337
9	E.Windsor	53,100	76,750	78,907	98,322
10	Crabury	54,467	76,032	60,521	64,811
11	Plainsboro	40,351	118,028	47,364	63,374
12	S.Brunswick	129,393	381,204	216,929	321,286
13	N.Brunswick	73,928	136,191	108,273	117,800
14	New Brunswick	133,415	167,799	865,640	168,922
15	E. Brunswick	216,182	268,745	215,810	212,109
16	Monroe	76,501	133,951	79,485	79,150
17	Montgomery	50,962	88,626	59,201	67,154
18	Hillsborough	125,204	321,775	146,884	278,466
19	Franklin	179,020	250,563	205,342	238,193
20	Mercer Ext	25,610	26,588	29,442	26,687
21	Somerset Ext	14,123	16,872	15,252	12,782
22	Middlesex Ext	85,541	95,862	96,273	94,513

County Summary (Excluding Ext.)

Jurisdiction	Calb Veh Min	Trnd Veh Min	Scen1 Veh Min	Scen2 Veh Min
Mercer	1,435,240	1,907,195	2,404,725	1,919,847
Somerset	724,238	1,281,951	1,594,022	1,027,454
Middlesex	355,186	660,965	411,426	583,813
Total	2,514,664	3,850,110	4,410,173	3,531,114

County Summary (Including Ext.)

Jurisdiction	Calb Veh Min	Trnd Veh Min	Scen1 Veh Min	Scen2 Veh Min
Mercer	1,460,850	1,933,783	2,434,167	1,946,533
Somerset	738,361	1,298,822	1,609,274	1,040,235
Middlesex	440,728	756,827	507,699	678,327
Total	2,639,939	3,989,433	4,551,140	3,665,095

Source: Douglas & Douglas, Inc.

Vehicle Minutes Summary

		Difference						Difference Ratio					
	Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
1	Washington	27445	6158	-21286	5267	-22177	-891	14.6%	3.3%	-9.9%	2.8%	-10.3%	-0.5%
2	Trenton	54263	786917	732653	302914	248651	-484002	11.4%	165.4%	138.2%	63.7%	46.9%	-38.3%
3	Ewing	48592	12148	-36444	-50038	-98630	-62186	19.2%	4.8%	-12.1%	-19.8%	-32.7%	-23.4%
4	Lawrence	59779	60185	406	42901	-16877	-17283	47.6%	47.9%	0.2%	34.1%	-9.1%	-9.3%
5	Hopewell	14526	19372	4845	31268	16742	11896	32.3%	43.1%	8.1%	69.5%	28.1%	18.5%
6	Princeton	70724	7024	-63700	24766	-45958	17742	42.6%	4.2%	-26.9%	14.9%	-19.4%	10.3%
7	W.Windsor	155782	32785	-122996	56953	-98828	24168	182.5%	38.4%	-51.0%	66.7%	-41.0%	20.5%
8	Hamilton	17194	19089	1895	25353	8159	6264	39.1%	43.4%	3.1%	57.6%	13.3%	9.9%
9	E.Windsor	23650	25807	2157	45222	21571	19414	44.5%	48.6%	2.8%	85.2%	28.1%	24.6%
10	Crabury	21565	6054	-15511	10344	-11221	4290	39.6%	11.1%	-20.4%	19.0%	-14.8%	7.1%
11	Plainsboro	77677	7013	-70663	23023	-54653	16010	192.5%	17.4%	-59.9%	57.1%	-46.3%	33.8%
12	S.Brunswick	251811	87536	-164275	191893	-59918	104357	194.6%	67.7%	-43.1%	148.3%	-15.7%	48.1%
13	N.Brunswick	62263	34345	-27918	43872	-18390	9527	84.2%	46.5%	-20.5%	59.3%	-13.5%	8.8%
14	New Brunswick	34384	732225	697841	35507	1123	-696718	25.8%	548.8%	415.9%	26.6%	0.7%	-80.5%
15	E. Brunswick	52564	-372	-52936	-4073	-56636	-3701	24.3%	-0.2%	-19.7%	-1.9%	-21.1%	-1.7%
16	Monroe	57450	2984	-54466	2649	-54801	-335	75.1%	3.9%	-40.7%	3.5%	-40.9%	-0.4%
17	Montgomery	37664	8238	-29426	16192	-21472	7954	73.9%	16.2%	-33.2%	31.8%	-24.2%	13.4%
18	Hillsborough	196572	21681	-174891	153263	-43309	131582	157.0%	17.3%	-54.4%	122.4%	-13.5%	89.6%
19	Franklin	71543	26321	-45222	59173	-12370	32852	40.0%	14.7%	-18.0%	33.1%	-4.9%	16.0%
20	Mercer Ext	978	3832	2854	1076	98	-2756	3.8%	15.0%	10.7%	4.2%	0.4%	-9.4%
21	Somerset Ext	2749	1129	-1620	-1341	-4090	-2470	19.5%	8.0%	-9.6%	-9.5%	-24.2%	-16.2%
22	Middlesex Ext	10321	10731	410	8972	-1349	-1759	12.1%	12.5%	0.4%	10.5%	-1.4%	-1.8%

County Summary (Excluding Ext.)

	Difference						Difference Ratio					
Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
Mercer	471955	969485	497530	484607	12652	-484878	32.9%	67.5%	26.1%	33.8%	0.7%	-20.2%
Somerset	557713	869784	312072	303216	-254497	-566569	77.0%	120.1%	24.3%	41.9%	-19.9%	-35.5%
Middlesex	305779	56240	-249539	228627	-77151	172387	86.1%	15.8%	-37.8%	64.4%	-11.7%	41.9%
Total	1335447	1895510	560063	1016450	-318997	-879060	53.1%	75.4%	14.5%	40.4%	-8.3%	-19.9%

County Summary (Including Ext.)

	Difference						Difference Ratio					
Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
Mercer	472933	973317	500384	485683	12750	-487634	32.4%	66.6%	25.9%	33.2%	0.7%	-20.0%
Somerset	560461	870913	310452	301874	-258587	-569039	75.9%	118.0%	23.9%	40.9%	-19.9%	-35.4%
Middlesex	316100	66971	-249128	237599	-78501	170628	71.7%	15.2%	-32.9%	53.9%	-10.4%	33.6%
Total	1349494	1911201	561707	1025156	-324338	-886045	51.1%	72.4%	14.1%	38.8%	-8.1%	-19.5%

Source: Douglas & Douglas, Inc.

Speed Summary (MPH)

		Difference						Difference Ratio					
	Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
1	Washington	1.1	3.5	2.4	2.4	1.3	-1.1	3.8%	11.9%	7.7%	8.2%	4.2%	-3.3%
2	Trenton	-0.1	-5.7	-5.6	-2.9	-2.8	2.8	-0.6%	-44.8%	-44.5%	-22.8%	-22.3%	39.9%
3	Ewing	-1.3	0.8	2.1	2.8	4.1	2.0	-10.4%	6.9%	19.3%	23.1%	37.4%	15.2%
4	Lawrence	-4.4	-2.5	1.9	-0.1	4.3	2.5	-12.4%	-7.1%	6.0%	-0.2%	13.9%	7.5%
5	Hopewell	-1.5	-2.5	-1.1	-4.2	-2.7	-1.6	-4.3%	-7.4%	-3.2%	-12.3%	-8.3%	-5.2%
6	Princeton	-0.2	0.5	0.7	-0.7	-0.4	-1.1	-1.4%	3.2%	4.7%	-4.5%	-3.1%	-7.5%
7	W.Windsor	-14.2	-1.8	12.4	-4.5	9.7	-2.7	-44.2%	-5.7%	69.0%	-14.1%	53.8%	-9.0%
8	Hamilton	-2.7	-1.9	0.8	-2.8	-0.1	-0.9	-5.6%	-4.0%	1.7%	-5.8%	-0.2%	-1.9%
9	E.Windsor	-0.7	-2.2	-1.5	-4.2	-3.5	-2.0	-2.4%	-7.4%	-5.1%	-14.4%	-12.3%	-7.5%
10	Crabury	-2.2	0.5	2.8	0.4	2.7	-0.1	-5.0%	1.2%	6.6%	1.0%	6.3%	-0.3%
11	Plainsboro	-10.1	-1.6	8.5	-5.7	4.3	-4.1	-34.5%	-5.5%	44.4%	-19.7%	22.7%	-15.0%
12	S.Brunswick	-12.2	-4.5	7.7	-11.3	0.9	-6.8	-36.4%	-13.4%	36.2%	-33.8%	4.2%	-23.5%
13	N.Brunswick	-4.7	-0.7	4.0	-3.8	1.0	-3.0	-16.5%	-2.5%	16.8%	-13.2%	4.0%	-10.9%
14	New Brunswick	-2.2	-11.9	-9.7	-1.2	1.0	10.7	-14.3%	-76.7%	-72.9%	-7.9%	7.5%	295.9%
15	E. Brunswick	-1.8	-0.1	1.8	-0.1	1.8	-0.0	-8.5%	-0.3%	9.0%	-0.3%	8.9%	-0.0%
16	Monroe	-2.0	0.2	2.2	0.5	2.5	0.3	-8.1%	0.8%	9.8%	2.2%	11.2%	1.3%
17	Montgomery	-5.9	-1.0	4.9	-1.8	4.1	-0.8	-18.2%	-3.1%	18.5%	-5.6%	15.5%	-2.5%
18	Hillsborough	-7.0	-0.4	6.6	-7.0	0.1	-6.5	-44.5%	-2.8%	75.2%	-44.1%	0.8%	-42.4%
19	Franklin	-1.3	-0.3	1.0	-1.9	-0.5	-1.5	-7.0%	-1.7%	5.7%	-9.9%	-3.1%	-8.3%
20	Mercer Ext	1.7	2.7	1.0	1.7	0.0	-1.0	3.3%	5.3%	1.9%	3.4%	0.0%	-1.8%
21	Somerset Ext	0.1	-1.4	-1.5	2.3	2.2	3.7	0.3%	-3.9%	-4.2%	6.6%	6.3%	10.9%
22	Middlesex Ext	-1.9	-2.9	-1.0	-3.0	-1.1	-0.0	-6.6%	-10.1%	-3.8%	-10.3%	-4.0%	-0.2%

County Summary (Excluding Ext.)

	Difference						Difference Ratio					
Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
Mercer	-1.2	-4.7	-3.5	-1.1	0.0	3.6	-5.6%	-22.9%	-18.3%	-5.5%	0.2%	22.5%
Somerset	-4.4	-11.3	-6.9	-3.0	1.4	8.3	-17.1%	-43.8%	-32.2%	-11.6%	6.6%	57.4%
Middlesex	-5.2	-0.5	4.8	-5.0	0.2	-4.6	-26.7%	-2.4%	33.1%	-25.6%	1.4%	-23.8%
Total	-2.7	-6.3	-3.5	-2.3	0.4	3.9	-12.5%	-28.6%	-18.4%	-10.6%	2.1%	25.2%

County Summary (Including Ext.)

	Difference						Difference Ratio					
Jurisdiction	Trnd-Calb	Scn1-Calb	Scn1-Trnd	Scn2-Cal	Scn2-Trnd	Scn2-Scn1	T-C/C	S1-C/C	S1-T/T	S2-C/C	S2-T/T	S2-S1/S1
Mercer	-1.2	-4.8	-3.5	-1.2	0.0	3.6	-5.9%	-22.7%	-17.8%	-5.7%	0.2%	21.9%
Somerset	-4.4	-11.3	-6.9	-3.0	1.4	8.3	-17.0%	-43.5%	-32.0%	-11.5%	6.6%	56.6%
Middlesex	-5.4	-1.0	4.5	-5.2	0.2	-4.3	-25.3%	-4.6%	27.8%	-24.5%	1.1%	-20.9%
Total	-2.8	-6.3	-3.5	-2.4	0.4	3.9	-12.6%	-28.1%	-17.7%	-10.8%	2.0%	24.0%

Source: Douglas & Douglas, Inc.

Speed Summary (MPH)

	Jurisdiction	Calb Ave Speed	Trnd Ave Speed	Scen1 Ave Speed	Scen2 Ave Speed
1	Washington	29.4	30.6	32.9	31.8
2	Trenton	12.8	12.7	7.0	9.9
3	Ewing	12.2	11.0	13.1	15.1
4	Lawrence	35.6	31.2	33.1	35.6
5	Hopewell	34.0	32.6	31.5	29.9
6	Princeton	14.5	14.2	14.9	13.8
7	W.Windsor	32.2	17.9	30.3	27.6
8	Hamilton	47.4	44.7	45.5	44.7
9	E.Windsor	29.4	28.7	27.2	25.1
10	Crabury	44.3	42.0	44.8	44.7
11	Plainsboro	29.2	19.1	27.6	23.5
12	S.Brunswick	33.4	21.2	28.9	22.1
13	N.Brunswick	28.6	23.8	27.8	24.8
14	New Brunswick	15.5	13.3	3.6	14.3
15	E. Brunswick	21.6	19.8	21.5	21.5
16	Monroe	24.5	22.5	24.7	25.0
17	Montgomery	32.3	26.4	31.3	30.5
18	Hillsborough	15.8	8.8	15.3	8.8
19	Franklin	18.8	17.5	18.5	16.9
20	Mercer Ext	51.9	53.6	54.6	53.6
21	Somerset Ext	35.4	35.5	34.0	37.8
22	Middlesex Ext	28.7	26.8	25.8	25.8

County Summary (Excluding Ext.)

Jurisdiction	Calb Ave Speed	Trnd Ave Speed	Scen1 Ave Speed	Scen2 Ave Spd
Mercer	20.5	19.4	15.8	19.4
Somerset	25.7	21.3	14.5	22.7
Middlesex	19.7	14.4	19.2	14.6
Total	21.9	19.2	15.7	19.6

County Summary (Including Ext.)

Jurisdiction	Calb Ave Speed	Trnd Ave Speed	Scen1 Ave Speed	Scen2 Ave Spd
Mercer	21.1	19.8	16.3	19.9
Somerset	25.9	21.5	14.6	22.9
Middlesex	21.4	16.0	20.5	16.2
Total	22.5	19.7	16.2	20.1

Source: Douglas & Douglas, Inc.

Appendix G

Suburban Mixed-Use Centers and Transportation:

Current Research and Issues

A technical report submitted to the Steering Committee of the MSM Land Use/Transportation Project

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1. Introduction

Faced with the task of finding solutions to the burgeoning traffic in present-day suburbia, transportation professionals and policy-makers have been considering both old and new strategies. Planning wisdom of the 1980's has suggested that building mixed-use centers, in concert with the use of "demand management" techniques, is one of the most effective ways of mitigating traffic growth. Afterall, before the American love affair with automobile began, people actually lived in settlements dense enough to support mass transit and mixed enough to allow errands to be completed using the power of shoe leather. Furthermore, the mixed-use approach is even stronger when considered within the current context of "no new taxes," ergo, no new highways. The intent of this study is to determine if the introduction of new suburban land use patterns will reduce the growth in traffic congestion on the regional network compared to what would occur if current trends were to continue.

While the mixed-use solution seems sensible, we are still faced with many questions about how (and if) it can be effectively implemented in various suburban regions. To begin to identify, and perhaps answer, some of the pertinent questions, we will examine what others have learned in their analyses of existing and emerging suburban mixed-use centers throughout the United States and elsewhere. This technical report is intended to serve as both a catalyst for discussion and a foundation for the "center" design and evaluation procedures to be carried out in the second phase of this project. Note: For the purposes of this report "centers" will refer to suburban activity centers in which housing, retail, and commercial activity is located.

Summary of Issues and Current Research

The literature search has revealed that, generally speaking, there are no hard and fast rules which can be applied to land use guaranteeing the achievement of our traffic growth reduction objectives. We do, however, have some evidence that certain approaches are more effective than others and that a combination of strategies can produce a whole that is greater than the sum of the parts. We are proposing that a built environment and policy approach be created that encourages carpooling and vanpooling, living closer or taking transit to work. The following is a summary of what we have learned to date from the literature:

1. **Suburban Demographics** - Suburban areas have received the lion's share of the population and employment growth over the past several decades. The characteristics of the new suburban population have great implications for the future of land use and the transportation system. For example, travel patterns are significantly affected by the increasing entry of women into the workforce, the decline in the traditional married couple family and the growing proportion of unmarried people. More people must make daycare stops on the way to work or need to choose housing somewhere between the workplaces of the husband and wife.

New demographic patterns contribute to the fact that, on average, most people old enough to drive a vehicle, have one. Auto accessibility is the single strongest indicator of what mode someone will choose to get to work or shopping. In addition, suburban origins and destinations are too dispersed to support frequent public transportation service.

Female and clerical workers are more likely to stop on the way to and from work, while managerial/professional workers are more likely than non-management workers to make midday trips. The most frequently cited reason for stopping on the way to work is to drop children at child-care or school; on the trip home, shopping is the most common reason for interrupting the trip. Conversely, non-management workers are also more likely to rideshare than professional employees.

2. **Density and Scale** - Large, dense suburban activity centers tend to have a higher rate of ridesharing and transit use and increased pedestrian activities. It is not clear, however, if there is some minimum density and size threshold, although it has been suggested (without much substantiation) that a floor-area-ratio (FAR) of at least 2.0 is necessary to achieve transportation benefits. We have found that expressing density in terms of FAR alone is not adequate. Measures such as employees per acre and commercial space per acre may be more enlightening. In addition, these large, dense centers also have associated roadway congestion and may compete for capacity with through traffic on the highway arteries where the centers are located.

3. **Land Use Mix** - While the predominate activity in suburban centers tends to be office use, there is some correlation between providing on-site retail and services and an increased rate of ridesharing. If the services are well-integrated into the overall design, midday pedestrian travel is enhanced. The land use mix should also accommodate other workforce needs like daycare and household shopping. Case studies show that more home-bound intermediate trips will be captured on-site if the center offers adequate shops and services, and is located in a relatively isolated place with no adjacent shopping opportunities.

4. **Jobs-Housing Mismatch** - A major factor contributing to traffic congestion on the regional system is the spatial mismatch of jobs and affordable housing. While providing housing within the center might be considered desirable, it has often been the case that few people both live and work within the center. Case studies have shown, however, that those who own their own homes within the center are more likely to work within the center than those who rent. Housing that is appropriately priced and phased will better accommodate the center's workforce. A jobs-housing ratio of 1.5 has been suggested as an optimal balance within a community, although having adequate housing within a three-to-five-mile radius of the workplace has also been proposed as being sufficient.

5. **Designing for Pedestrians and Transit** - An important element in designing the centers is the clustering of the buildings on the site. The reason for doing so is that people, on average, will only walk a maximum of 1000 feet to take transit or do midday shopping. In addition, transit will be able to service the site much more effectively if the activities are concentrated rather than dispersed. Pathways should be established so that pedestrian travel can take place safely and with minimal disruption en route.

   Case studies have shown that a substantial retail component (900,000+ square feet) within 2,000 feet of a sizable office component (2 million+ square feet) will generate anywhere from 6 to 17 percent of midday trips on foot, depending upon the quality of pedestrian connections. It has been suggested that moderate bus service can only be supported with a minimum of 10 million square feet within less than a square mile at the work destination and a density greater than 7 dwelling units per acre at the origin.

6. **Transportation Management** - Transportation management strategies like ridesharing, flextime, and parking regulations can be effective ways to reduce the demand on the road system during peak periods. It has been found that charging for parking is one of the most effective ways to get people to rideshare and take transit. The optimal combination of factors for a successful transportation management program is: frequent transit service, a limited supply of moderate-to-high-priced parking, preferential HOV (High-Occupancy Vehicles) spaces, and an on-site transportation coordinator who promotes transportation management strategies and provides a custom carpool matching service.

7. **Trip Generation Rates** - There is some evidence that the ITE (Institute of Transportation Engineers) trip generation rates are not applicable for every use within a mixed-use center. One study shows that observed rates for regional malls, hotels, and office space per square foot were lower than ITE, while office rates per employee and residential rates per resident were higher. Another study concluded that peak hour rates should be reduced by 2.5 percent when applied to mixed use centers.

8. **Route 1 Corridor Region** - Growth in this region's economy through the end of the century will take place in business and health services, and trade. The types of jobs which are expected to be created are either "high tech," computer-oriented positions or skilled service jobs like nursing and maintenance. Any growth seen in the labor force supply to fill these jobs will be comprised mostly of women and minorities; if the potential labor shortage situation is critical enough, the "young elderly" will be enticed to stay in the labor force longer. These factors must be considered when designing future centers so that appropriate housing, services, corporate

facilities, and transportation management strategies are provided to accommodate the lifestyles of the workforce in addition to encouraging more desirable travel behavior.

9. **Proposed Center Prototype** - Given what we have learned in our study of the literature and the previous analytical and consensus-building efforts which went into the REGIONAL FORUM effort, we propose the FORUM's "regional center" standards as a starting point for development of prototype "centers" for testing in the Land/Use Transportation Project. These standards are:

Acreage	400+
Employment	9,000+ jobs
Population	5,700+
Housing Units	2,700+
Net DU's/Acre	8-11
Net Nonres. FAR	1.10
Jobs/Housing	3.5
Height Range	4-10 stories

It is the purpose of the Land Use/Transportation Project to determine appropriate densities, scales, location, and demand management policies for central New Jersey. It must be strongly emphasized, however, that these standards alone are probably inadequate for achieving our transportation goals without the consideration and incorporation of the elements set forth in items 1 through 8 above. Further, additional analysis may lead us to modify any or all of the REGIONAL FORUM figures. The remainder of this report describes research projects which have focused on the relationship between various aspects of land use and travel patterns.

2. Reality Rolls Around - Demographics on Wheels

To better understand the commuting dynamics in question, it is important to consider what has actually gone on in suburbia in recent years. One of the richest, most often quoted sources of information on suburban trends is *Commuting in America*, (ENO Foundation for Transportation, 1987). We will draw on this source to provide some fundamental information about the people and patterns we intend to change. First, we offer several facts about recent suburban demographics:

1. Most of the population growth (86 percent) occurring since 1950 has been in the suburbs. Correspondingly, from 1960 to 1980, two-thirds of metropolitan region job growth took place in the suburbs.

2. The female labor force participation rate has grown from about 33 percent in 1950 to 60 percent in 1980. This trend is expected to continue through the end of the century.

3. The growth in households has been far greater than the growth in population. This is due to a rapidly declining household size resulting from a decreasing proportion of traditional married couple families.

4. Vehicle ownership is estimated to be approximately one per licensed driver.

What does this tell us? First it tells us that the suburbs are filling up with people who both live and work there. This is borne out by the fact that the suburb-to-suburb commute now represents the largest segment of all types of commuter flows. Second, a large portion of the households no longer has the woman free to run errands and look after children during the day. In addition, housing decisions are being made based on the workplace locations of two wage-earners rather than just one. This has some major implications for travel patterns.

Prevedouros and Schofer (1988) have examined the lifestyle implications of the increasing population of unmarried people. Single people tend to spend their money on vehicles and real estate, and are more mobile. This has contributed to the decrease in average household size and the increase in the number of households. More housing units are demanded than would have been needed if these individuals had merged households by marrying. This, of course, has land use ramifications.

Finally, the force that is perhaps the strongest influence on travel behavior is that, in the aggregate, everyone who is old enough to drive, has a vehicle. This is related to the rise in personal income in the last several decades and the increase in the need for more cars per household resulting from the growth of the number of women in the workforce. Because auto ownership is a key factor in whether or not someone drives to work or shopping, the current suburban accessibility to autos has removed a once built-in factor in controlling traffic congestion (Ducca, 1989.)

What this adds up to is a lot of people driving their cars all over the suburbs to get to work, childcare, entertainment and shopping. We need to look at how this plays out in terms of commuting patterns. The following are additional relevant facts from *Commuting in America:*

5. Since about 1960, the portion of work trips made with a private automobile has grown from 70 percent to over 85 percent. Transit use has fallen correspondingly.

6. Vehicle availability to workers has increased to 1.34 vehicles per worker from .85 in 1960.

7. Average commuting auto occupancy is 1.15 nationwide and falling, with little variation from region to region. This trend is linked to increased vehicle availability and the dispersed suburban pattern of origins and destinations.

8. There are indications that both commuting times and distances are getting longer.

American suburbia appears wedded to the single-occupancy vehicle commute. Ken Orski has very poignantly described the traffic effects of this suburban auto-orientation. He identified the phenomenon of congestion spreading across space. The traffic jams frequently associated with the CBD and close-by suburbs have spread to the outlying suburban fringes of metropolitan regions. While previously, commuters in the 'burbs could "take the backroads," there aren't any free backroads left -- all the roads are crowded. In addition, in many areas the "rush hour" lasts all day (Orski, 1987).

In the past, the suburban areas served as bedroom communities with commuters jumping on the radial, CBD-bound transit system to get to work. Today, the suburb-to-suburb commute pattern is characterized by a wide dispersion of origins ("o's") and destinations ("d's") with commuters criss-crossing all over the region. This is a situation that traditional transit services have been unsuccessful in dealing with. Because of the dispersed nature of the o's and d's, Orski has pointed out that "there simply is not enough **mass** to make mass transit work effectively (Orski, 1987).

3. Fashioning a Suburban Prototype

In this section, important elements of project development density and scale, land use mix, pedestrian and transit-friendly features are discussed in terms of their effects on travel behavior.

A. Density and Size

As mentioned earlier, in the suburb-to-suburb trip, both the origins and destinations are often dispersed in low density development throughout a region. Table 3.1 compares the densities of 120 suburban office developments with those in various central business districts.

Table 3.1: Comparison of Office Density Characteristics

	Suburban Office Complexes[a]				Approximate Difference Ratio
	Average	Low	High	CBD Range[b]	of Suburbs to CBD
Floor area ratio[c]	0.29	0.06	1.48	5.0-10.0 (varies widely)	0.04:1
Floor space per employee (gross ft^2)	380	140	970	175-200	2:1
Total land per employee (ft^2)	1,410	230	3,360	35-50	33:1

[a] Based on a national survey of 120 suburban office developments.

[b] See Reference 8 and 9 for sources.

[c] Floor area ratio represents gross floor space of all buildings divided by the total land area of the office development.

Source: Cervero, 1986A.

Not only is land used much less intensively in the suburbs, floor utilization is much less intense as well. We might assume that without a critical mass of people working within a short distance of each other, it is difficult to fulfill the objective of transit utilization and ridesharing.

Cervero concluded several things about suburban density in his study of 57 "suburban employment centers (SECs)." The densest projects in Cervero's study which exhibited the highest incidence of ridesharing also tended to be somewhat large. These centers contained from 3.6 million sq. ft. to 25.3 million sq. ft. of commercial/industrial space, with acreages ranging from 330 to 19,700. They employed from 5,000 to 59,500 individuals (Cervero, 1988). He found that high densities were positively correlated with increased pedestrian activities, transit usage, and ridesharing. Through analyzing various centers, Cervero suggested that a floor area ratio of at least 2.0 is required for successful ridesharing and transit usage.

However, he also stressed a dilemma associated with the density issue. While large, dense agglomerations may in fact support the establishment of ridesharing and transit, they also generate more total trips than parcels developed at low densities (Cervero, 1988). A study of the Atlanta region found that its suburban centers compete with through traffic on the highway system adjacent to the centers. The network is often inadequate to handle both flows (Atlanta

Regional Commission, 1985). The challenge is to design and locate centers so that a higher proportion of generated trips are intra-site, the total number of trips are more concentrated in the immediate vicinity of the center rather than dispersed throughout the region, and the center is not placed at a point on the network which is already overburdened.

Intensifying the use of land often requires removing the height restrictions which are typically three to four stories maximum in many suburban areas. This is often politically unpopular in these communities. The tallest buildings in the centers discussed above range from 6 to 28 stories (Cervero, 1988). Height restrictions, in concert with lot coverage limitations and large set-back requirements, have the effect of spreading centers out in a low density, horizontal fashion. This exacerbates dependence on the automobile and discourages pedestrian trips because of long walking distances between activities (Cervero, 1986B). Design and scale are important factors in solving this problem.

What can be concluded from this information is that the prototypical center should be somewhat large and dense. However, because of the wide disparity in the sizes and densities of the centers studied and the inherent positive and negative traffic effects associated with high density development, it is not clear what the minimum criteria should be. Furthermore, as we proceed through the other design and policy considerations, it will become apparent that adequate size and density are necessary but not sufficient conditions for achieving our transportation objectives.

B. Land Use Mix

Along with density and size, Cervero cited the land use mix as being a major factor in employee travel behavior at the 57 centers he considered. Because much of the suburban job growth explosion has been due to the relocation of back-office, information-handling functions, the centers Cevero studied tended to be dominated by office space. However, unlike the centers comprised exclusively of office space, those with a substantial retail component tended to have a higher rate of ridesharing (Cervero, 1988). This correlation appears to support the idea that providing shops and services on-site will entice employees to carpool or vanpool.

Increased ridesharing is only one potential benefit of providing a mix of uses within the suburban center. In the case of a retail/restaurant component, there is also the possibility that those who do drive alone to work will take care of personal business on foot at lunch-time, or at the very least, more of the non-work auto trips will be confined to the center rather than the regional network during peak hours. Of course, there are other factors to be considered in providing retail, such as supplying businesses appropriate for the type of workforce present in the center and ensuring that the overall design of the project provides reasonable walking distances and amenities to promote pedestrian activities. (This will be discussed in more detail in a later section.)

Determining the optimal amount of each use is somewhat difficult. An initial determination must be made about the primary use to be located at the site -- is it office space, residential, manufacturing or retail? Then, a variety of other factors come into play such as physical characteristics of the site, the market potential for the various uses, and the financing position of the developers.

Phasing is also an issue. If a major component of the project is a large build-to-suit complex, then it is easier to construct the retail uses earlier in the project because there is a guaranteed level of demand once the client company's workforce moves in (Urban Land Institute, 1987). However, phasing becomes more difficult when the primary use is developed over an extended period of time to allow for incremental market absorption. When looking at some case studies later in this report, we will be able to see examples of various use mixes in existing centers.

Perhaps the most difficult element to grapple with in discussing the importance of mixing uses is the inclusion of housing. One of the major forces contributing to the congestion on suburban roads is the jobs-housing mismatch. It seems logical that if given a choice, people will not choose a long commute. However, it is often the case that there is little choice in places to live once a particular job is secured. This is because of a spatial mismatch of jobs and housing, often the result of fiscal and exclusionary zoning practices. Towns frequently prefer to zone for more commercial development than residential because of perceived tax benefits. In addition, exclusionary zoning means that only expensive, large-lot residential projects are allowed, restricting the supply of affordable housing available for those who will work in the nearby employment centers (Cervero, 1989). The net result of the jobs-housing mismatch is an acute regional labor shortage and many workers with long commutes. This adds trips to parts of the regional network which wouldn't be there if a better balance of jobs and housing existed within communities.

Robert Cervero conducted a regression analysis of the relationship between providing on-site housing and traffic congestion at 26 suburban centers. His findings confirmed those in his previous study. Large, dense, and in this case, housing-free centers tend to have the worst local traffic congestion. He also concluded from a similar analysis that a better balance of jobs-to-housing provides marginal increases in pedestrian and bicycle travel (Cervero, 1989).

Basing his calculations on recent figures showing that 90 percent of the adult population lives in cohabitant households and that 70 percent of these households are comprised of at least two wage earners, Cervero concluded that 1.5 is the maximum jobs/housing ratio required for achieving a balanced community. However, he found that, in many cases, even where housing was provided on-site, most of those occupying the units did not work within the center. This may again be related to a lack of units affordable to over 40 percent of the workforce, employed in clerical and non-professional jobs. Cervero suggests that having adequate housing within a three-to-five-mile radius of the workplace is sufficient (Cervero, 1989).

Thus, the challenge we are facing when determining the character of our mixed-use center prototype is to provide an appropriate supply of housing near the job sites. This means understanding the kind of workforce to be accommodated so that the right types of units will be furnished. To do so requires an analysis of both current and future economic development trends, and occupational and income information.

The Association of Bay Area Governments in California established a comprehensive program for achieving a jobs-housing balance to mitigate traffic in the region. In the first phase, an assessment of the regional labor force and housing needs was conducted, and a model for

predicting future needs was developed. A series of measures to be promoted by local governments was then developed:

1. Increase the supply of housing close to employment centers;
2. Encourage production of affordable housing;
3. Phase housing construction with job growth;
4. Improve access to transit for home-to-work trips;
5. Encourage developers to locate near existing affordable housing; and,
6. Increase employment of local residents in the new jobs.

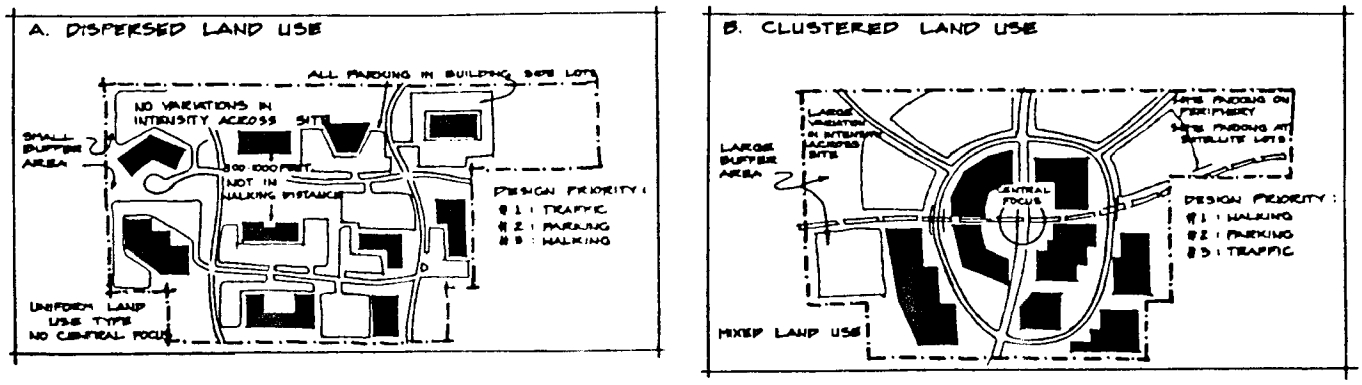
Each of these measures is promoted with specific suggestions on how to carry it out (ABAG, 1985). Strategies like these should be considered when designing the suburban prototype to be tested in our region.

C. Pedestrian Encouragement

One of the primary objectives in designing a prototype center is to induce people to walk more and drive their automobiles less. To do this we must provide certain physical amenities. Earlier we mentioned providing on-site retail, services and housing. However, merely providing these features is not enough. If people have abandoned their automobiles to rideshare or take transit, we must make sure that facilities are within a reasonable and comfortable walking distance.

When designing a center with our objectives in mind, the pedestrian trip must be given a very high priority. If the buildings are widely dispersed over the site, people will not be motivated to walk and the auto will dominate. Figure 3.1 shows the difference between designing for the auto (Plan A) and designing for the pedestrian (Plan B). One of the key elements in pedestrian-friendly environments is to cluster the buildings so that walking distances are minimized and interaction between uses can be more easily facilitated (Jackson and Kulash, 1988). This clustering approach also better accommodates transit, to be discussed in the next section.

Figure 3.1: Land Use Options



Source: Jackson, Timothy T. and Walter Kulash, "Land Use and TransportationEngineering Measures to Support Clustered Development," ITE, 1988.

There is a rule of thumb that walking distances from the parking lot should not exceed 300 feet (Urban Land Institute, 1987). Since we are focusing on how to encourage pedestrian travel of all sorts, we have to search further for some standards. A recent survey showed that 70 percent of all walk trips generated from suburban workplaces are 0.2 miles (1,056 ft.) and 90 percent of the trips are 0.4 miles (2,112 ft.) or less (Barton-Aschman,1989). If we consider that one study showed an average walking speed of 265 feet per minute (Fruin, 1971), this means that 1.056 feet would take about 4 minutes to walk and 2,112 feet would take about 8 minutes to walk. Given that most people have only an hour for lunch, it is reasonable to assume that walking much more than a 16-minute roundtrip would consume too much time to justify the journey. Similar distances have been cited by others, with one study concluding that only 15 percent of Americans are willing to walk 2,000 feet for non-leisure trips and another suggesting that the maximum acceptable walking distance in suburban areas is 1,000 feet (Cervero, 1988). This 1,000 feet should serve as a guideline in determining the proximity of the various uses within a mixed-use center.

An appropriate path system is necessary to encourage both pedestrian and bicycle trips. These pathways must be designed with sensitivity to the needs of these individuals and with the objective of spatially linking the various uses. Often when sidewalks are provided, they are located along wide boulevards designed to facilitate optimal automobile flows. However, pedestrians seek the shortest distance between two points, not always conforming to the street configuration (Cervero, 1986B). Furthermore, the scale of these auto-oriented streets may make pedestrian travel dangerous as walkers try to cross the street. The optimal approach would be to provide a pathway system that includes crossing signals at the points where the pathway intersects the street and design it so that the pedestrian has a safe, direct way to move from building to building.

Another feature to include in this clustered, linked environment is outdoor green space plazas. While many office "parks" currently provide expanses of open space, they are frequently

only large front and side yards created out of compliance with zoning regulations. These areas have no design relationship to one another, lack a central focus, and offer absolutely no pedestrian facilities like benches. To encourage people to get out of the buildings and walk, outdoor spaces should be inviting, providing a "central place" and enhancing the human scale rather than the automobile scale.

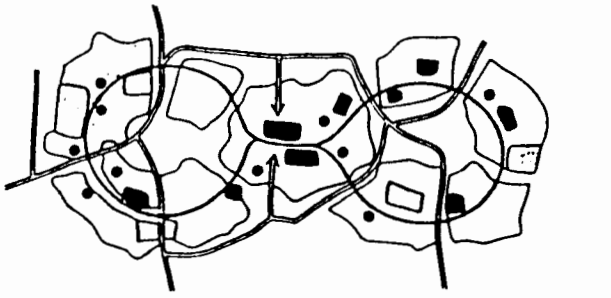
D. Transit-Friendly Features

We have briefly discussed reorienting toward the pedestrian, but now we should go one step further and think about accommodating transit at suburban centers.

To illustrate the conflict between auto-friendly and transit-friendly designs, Stephen Potter studied British new towns. Figure 3.2 shows optimal designs for both automobile and transit accommodation. To prevent congestion from developing at various points in the auto-oriented town, it is necessary to distribute various uses at low densities throughout. However, in the transit-oriented scenario, there are benefits to creating high density clusters close to the transit line so frequent service can be maintained and evenly spread along the route. Thus, the auto and the bus require two very different operating environments (Potter, 1984).

Figure 3.2: Optimal Urban Structures for Public and Private Transport

(a) Optimal structure for private motorized transport. Uniformly low density to reduce traffic intensity and random distribution of facilities to even-out loading on roads



(b) Optimal structure for public transport. Urban facilities located along corridors hence concentrating demand to maintain a high frequency service. Facilities located evenly along corridors to avoid peaks in loading. Increase in density towards public transport route to minimize distances

Source: Potter, Stephen, "The Transport Versus Land Use Dilemma," TRB #964,1984.

Potter looked at the effects of adopting these opposing designs in several new towns. Table 3.2 summarizes the characteristics of several of the new towns considered:

Table 3.2: Key Characteristics of the New Towns Under Study

	Milton Keynes	Washington	Redditch	Runcorn	Peterborough
Population	107,000	55,000	68,000	65,000	124,000
Current gross density (ppha)[a]	12	24	23	32	19
Planned gross density (ppha)[a]	20	27	25	34	23
Development costs to state per person housed	10,200	11,000	4,100	7,000	5,300
Average bus frequency (min)	30	20	10	5	15
Cost of bus season ticket per week	2.40	1.65	3.50	2.50	3.50
Subsidy as percent of bus running costs	42	NA	6	5	14
Average number of shops at local center	5	9	15	7	23

Note: This table includes two new towns in addition to those considered in the text. Washington (in northeast England) is of comparable size to Redditch and Runcorn but was designed similarly to Milton Keynes. Peterborough is comparable in size to Milton Keynes but was designed to promote public transport.

[a] Persons per hectare.

Source: Potter, Ibid.

Milton Keynes and Washington were designed to accommodate the automobile, while the Redditch, Runcorn and Peterborough plans tried to strike a balance between transit priorities and the presence of autos. Although the original Milton Keynes plan called for frequent transit service, once the auto-oriented, low density land use plan was established, the planners realized they had made transit-provision very difficult. The original intention of having 2.5 to 5-minute headways for bus service became impossible without an inordinately high subsidy. As Table 3.2 shows, even with headways of 30 minutes, the Milton Keynes bus system required an operating subsidy of 42 percent.

The contrast between this situation and that in Redditch and Runcorn is quite striking. Not only are these towns able to provide headways of 10 and 5 minutes, respectively, they are able to maintain the service for a very low subsidy. Furthermore, Potter reports that the capacities of the Redditch and Runcorn road systems have been quite adequate in serving the autos which are present on the system. In addition, the orientation toward a transit environment has made the town pedestrian and bicycle-friendly.

As an aside, the other aspect to note about the differences between these new towns is the cost of construction. By concentrating the majority of the activities in denser areas of the town near the transit line, the areas at the periphery do not have to be crossed by water pipes, electric cables, etc. and so provision of all types of infrastructure is more efficient than in the case of the dispersed land patterns. Table 3.2 shows the contrast in the development costs of the auto versus transit-oriented new towns. Figure 3.3 shows the land use plans for Milton Keynes, Runcorn and Redditch.

Potter summarized the basic design principles of Runcorn, Redditch and Peterborough as follows:

1. Public transport and car flows are on separate networks, making it possible to concentrate travel flows for public transport while dispersing car traffic.

2. The size of residential areas is determined by the population needed to maintain a frequent public transport service.

3. Residential densities are zoned so that they increase toward public transport routes.

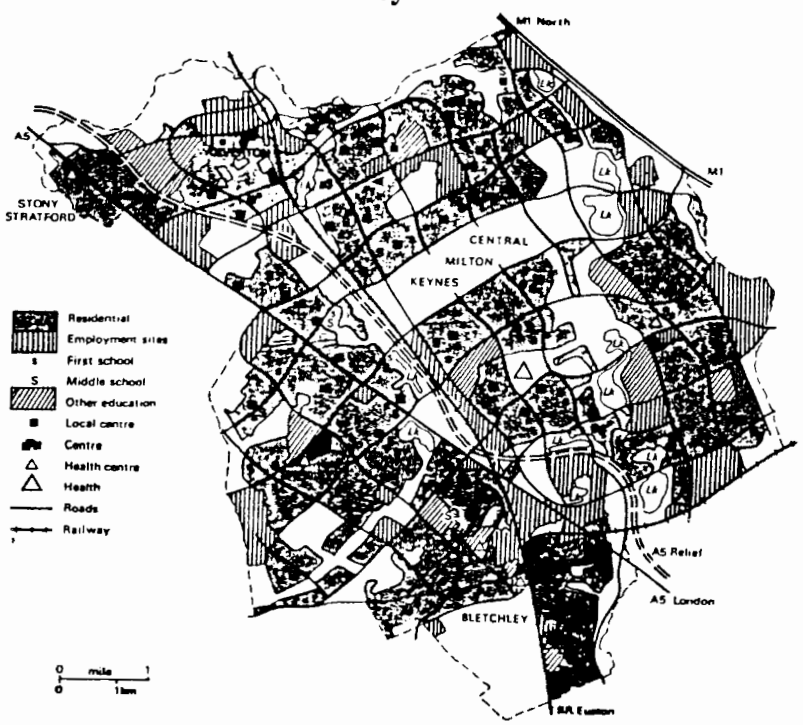
4. Low-density uses (e.g., open space, warehousing, major roads, and parks) are zoned away from public transport routes so as not to increase walking distance to routes.

5. Residential areas, employment, shopping, and other major travel-generating land uses are arranged so that they provide corridors of public transport movement conducive to high service frequencies.

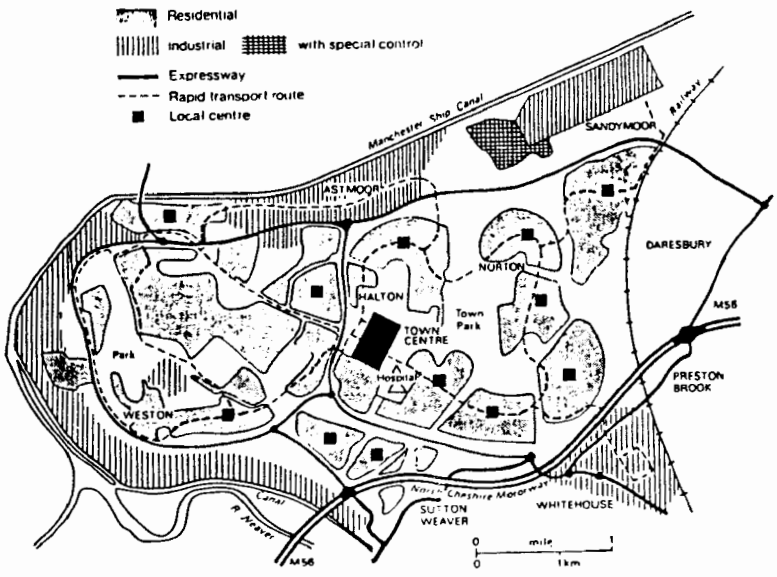
6. The overall density of development is changed little, but land uses are rearranged to provide a pattern of development that is conducive to public transport operations.

Figure 3.3: Comparative Land Use Patterns

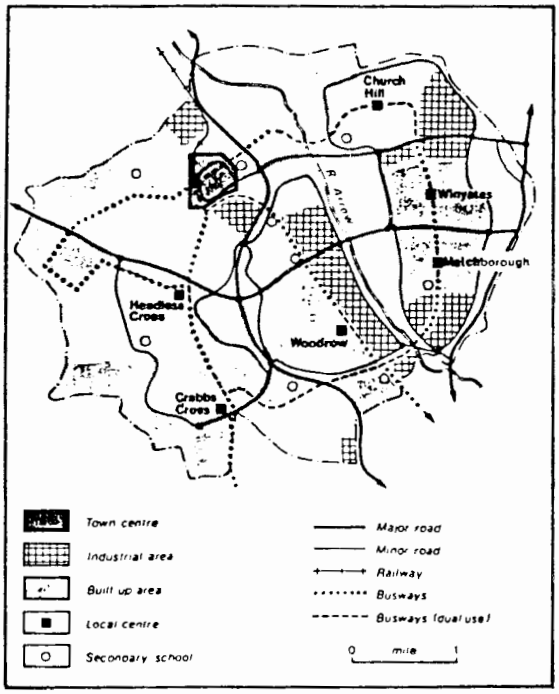
Milton Keynes



Runcorn



Redditch



Source: Potter, **Ibid.**

Because we rarely have the opportunity these days to establish large-scale new towns, the challenge is to take these transit design principles and incorporate them into the suburban fabric in some effective way. As mentioned previously, current suburban development patterns are often too dispersed and lacking in density to support a transit system with a reasonable level of service. Pushkarev and Zupan concluded that nonresidential downtowns, if spread over an area less than one square mile, must contain at least 10 million square feet to support a moderate bus service. However, they also commented that suburban clusters of nonresidential space can only occasionally support minimal bus service and even this is usually only possible if they contain retail centers or are surrounded by housing in densities greater than 7 dwelling units per acre (Pushkarev and Zupan, 1977).

These conclusions must be explored further because there are examples of suburban centers with good bus systems. One example is Bellevue, WA, a suburban center located near Seattle. Bellevue contains approximately 4.7 million sq. ft. of office space and 3 million sq. ft. of retail, enabling it to support enough bus service to achieve about a 7 percent transit work trip mode share, considered quite good in suburban terms (NCHRP, 1989). Bellevue will be studied in more detail in Section 5. As we continue to increase our information base to prepare a suburban mixed-use prototype, we will have to further define the feasibility of supporting a reasonable level of transit service.

4. Transportation Demand Management Strategies

Demand management is a part of a broad spectrum of policies and engineering strategies called Transportation Systems Management (TSM). Demand management devises strategies to decrease the number of vehicles demanding capacity on the roads during the peak period. We will use demand management strategies in concert with the mixed-use center design principles discussed above. Note that our study assumes that the capacity of our transportation system will increase only by those improvements which are already planned through 2010.

The Federal Highway Administration conducted a study to determine the effectiveness of using supply and demand management strategies. In this work, travel demand management strategies included: ridesharing, scheduling techniques, access management, reduction in the need to travel, land use and zoning laws, and vehicle restrictions such as traffic ordinances, congestion and road pricing, and goods movement. It was found that applying these measures to the highway and secondary road system could reduce VMT anywhere from 3 to 8 percent. This was calculated using a high and low scenario approach. The high scenario assumed that one in five SOV (single-occupancy vehicle) drivers could be induced to rideshare or take public transit. The low scenario assumed a rate of one in ten SOV drivers choosing alternative travel means (Lindley and McDade, 1988). In this section we will look at the aspects of demand management which are most applicable to our centers.

Transportation Management Associations (TMAs)

Transportation management associations (TMAs) are organizations created to promote demand management strategies. Membership can be either voluntary or mandatory, depending upon local statutes, and the membership is usually comprised of private sector participants and/or government entities. In some cases, the organization may be entirely a private sector initiative serving a particular office complex or group of businesses. In most instances, TMAs emerge in suburban areas with high concentrations of white collar workers and low levels of transit service (Cervero, 1986B).

The focus of a particular TMA depends upon its membership and the transportation problems specific to its region. The TMA can become involved in anything from lobbying for transit improvements, to providing computerized carpool matching services, to actually brokering vans and buses. The developer and private sector-supported TMAs tend to shy away from promoting legislation which requires developer contributions for road improvements or mandatory traffic reduction programs.

The central issue for this report is how effective these TMAs might be in reducing traffic associated with the mixed-use centers we are studying. Much of this effectiveness depends upon how successful the organization is in applying demand management strategies appropriate to the particular problems of its region. There are moderately successful cases like the one in Tysons Corner, VA, where 70,000 workers converge daily on this large office/retail center. The Tysons Corner Association initiated a vanpool program and shuttle bus system which got 5,000 vehicles off the area's clogged roads (Cervero, 1986B). As discussed below, the most successful efforts tend to be carried out for and by large, single-tenant projects like Pacific Northwest Bell with

1,200 employees in Bellevue, WA. Through a combination of incentives and disincentives, PNB recently reported a mere 25 percent rate of solo commuting (UMTA,1989).

On the other hand, there is the Newport Center Association in Southern California which closed down after a year of promoting ridesharing to 10,000 employees in an area of Newport Beach. The whole program failed because of inadequate top-level management interest and commitment among the target corporations. The most difficult situation for a TMA to surmount is one with a multitude of small office developments with many different tenants (Cervero, 1986B). To further assess the potential effectiveness of transportation management initiatives, we will look at individual strategies below.

Ridesharing

In an attempt to reduce the number of vehicles on the road, programs are often instituted to encourage people to either carpool or vanpool. It has been concluded, however, as evidenced in Newport Beach, that employers must get involved for ridesharing programs to succeed. Some employers have actually designated on-site transportation management coordinators to provide matching services and promote the program. There is some evidence that the presence of a coordinator does help to increase ridesharing participation. In a survey of 120 sites, those without a coordinator were found to have an average ridesharing of 5 percent, compared to 11 percent at those with coordinators (Cervero, 1986B).

As mentioned previously, ridesharing programs tend to be less successful at sites with multiple establishments. Even places with active TMAs like Tysons Corner have reduced SOVs by about three or four percent primarily because of this multi-tenant constituency. Firm size and type of labor force also affect ridesharing rates. The greatest success has been seen at large firms with relatively sizable portions of clerical and data processing staff. One survey showed that non-SOV shares at firms with over 1,000 employees range from 30 to 40 percent, while those under 1,000 average around 20 percent (UMTA, 1989).

Design incentives are an important consideration. Designating priority parking near the building for carpools and vanpools is an inexpensive way to encourage ridesharing. Providing pedestrian-accessible, on-site restaurants and stores encourages employees to give up their autos. If stores and services are not within a reasonable and comfortable walking distance, which is the preferred situation, then excellent shuttle service connecting these uses must be furnished. These elements also encourage transit usage, a topic which was considered in more detail in Section 3-D.

There are other factors which affect the success of ridesharing programs. In the discussion on the jobs-housing mismatch, it was proposed that having a substantial portion of the workforce living within three to five miles of the job site was adequate to overcome the problem. While this will reduce vehicle-miles traveled (VMT), it will also most likely thwart ridesharing efforts if SOV disincentives are not also employed. Commuters with long trips tend to rideshare more readily than those living nearby. However, because we are concerned with the regional road system, the localized congestion caused by a more proximate workforce may be the price we pay to see a decline in VMT.

Flextime, discussed in the next section, also might act to undo ridesharing efforts. While flextime might serve to spread out the arrival and departure times of employees so that peak congestion is reduced, it also makes matching people for ridesharing more difficult because the starting times might vary widely. However, there is conflicting evidence on this point. In the San Francisco Bay Area, those having flextime privileges were able to be matched for ridesharing 30 percent of the time compared to 16 percent for those not on flextime. On the other hand, in Pleasonton, CA, only 7.9 percent of the employees with flextime rideshare compared to the 11.4 percent rate for the entire workforce (UMTA, 1989). Again, the key to applying transportation management techniques is understanding the needs and priorities of the population being targeted.

Time Scheduling Techniques

Time scheduling refers to flextime and staggered hours programs. The main objective is to avoid exacerbating peak period congestion by extending the period of time over which employees arrive and depart. Flextime is implemented on an individual company basis and involves establishing windows of time in the morning and evening within which employees can choose their work hours. Usually, an employee can choose to arrive at work between 7:00 a.m. and 10:00 a.m., work the required number of hours and then depart between 3:00 p.m. and 6:00 p.m. The net effect is that all employees are not converging on the site between 8:45 a.m. and 9:00 a.m.

The same effect can be achieved through staggering work hours in a multi-tenant complex. This requires businesses to establish work hours starting at various times, with each business maintaining a set daily work schedule. For example, company A may have an 8 to 4 day, while B has an 8:30 to 4:30 day, and C works 9 to 5. Another approach to staggering hours carried out within a particular firm is to have shifts with several different starting times in the morning, instead of allowing individuals to choose their arrival times as is the case under flextime.

As mentioned earlier, there is some skepticism about the effectiveness of flextime in achieving regional traffic reduction objectives. In some cases it has been shown to interfere with ridesharing programs unless the two programs are linked. On the other hand, this flexibility is certainly a blessing to working parents and those who have long commutes both in cars and on transit. As with all policies, time scheduling techniques will only be effective if applied in appropriate situations.

Parking Management

Probably the single most effective means of getting SOV commuters to change their behavior is through regulating the parking supply at the workplace. The Pacific Northwest Bell case in Bellevue, WA, is a prime example of this. When the project was built, there were only 440 parking spaces supplied for 1,200 employees. Of these spaces, over half were designated for ridesharing vehicles. In addition, those having a vehicle occupancy of less than three were required to pay $60 per month to park. The net effect has been a decline of SOV commuting to 25 percent (NCHRP, 1989).

It must be kept in mind that parking disincentives cannot be imposed without presenting some ridesharing or transit incentives. Otherwise, it may become difficult to hire employees. In the PNB case, there is an in-house ridesharing coordinator who provides rideshare matching services, a good bus system serving the area, the use of flextime, and reduced parking rates for those who manage to form a carpool with only two people (UMTA, 1989).

Another example of the effectiveness of combining parking disincentives with alternative incentives is the Twentieth Century Corporation at Warner Center in West San Fernando, CA. This company, with 1,150 employees, reduced the solo driving rate from 95 percent to 65 percent by having a ridesharing coordinator who provides matching services and transit passes, by giving free parking to carpools, and by charging SOVs. It was noted that when the company began charging for parking, the carpool rate jumped from 6 to 31 percent (UMTA, 1989).

One of the problems with restricting parking supply is the strong opposition of many developers, particularly those who build speculative projects. Currently, developers expect to be able to supply between three and four parking spaces for every 1,000 square feet of office space, claiming the market will not accept anything less. This results in a sea of parking that caters to the SOV. Furthermore, recent calculations show that a standard at-grade parking space costs $4,972 on average for development and constructions costs with additional operating expenses of $955 per year. For a freestanding multi-level parking structure, the figure jumps to $20,125 per space plus $2,756 annually for operating costs (Urban Land Institute, 1989). Current practices actually subsidize people who drive, while those who take transit often get nothing. Parking policy is something that both developers and local regulators must seriously reassess.

Traffic Reduction Ordinances

We have mostly been talking about getting the SOV drivers to change their behavior. However, as mentioned previously, transportation management programs do not work without the support of upper management. Therefore, sometimes it is necessary to take measures to get executives and developers to change their behavior as well. These measures have recently been taking the form of traffic reduction ordinances.

Generally speaking, a traffic reduction ordinance is a law enacted by a local government which requires companies to undertake programs to reduce SOV trips by some specified amount. The most notable example is Pleasanton, California. Its ordinance applies to employers with 10 or more employees, with stricter requirements imposed on larger companies and developments. The broad goal is a 45 percent reduction in SOV trips over a specified period of time. The company is given free reign to achieve this goal within this period, and if it does not, the city may impose a specific program. Then, if this plan is not implemented, fines of $250 per day can be levied until the company complies (UMTA, 1989).

Other such ordinances are being enacted all over the country. Some areas like the South Coast Air Quality Management District in California are taking such measures with the ultimate goal of reducing air pollution from auto emissions. In New Jersey, a bill has been introduced in the State Legislature requiring all municipalities to develop traffic reduction ordinances. We can expect to see an increasing number of these ordinances in the next several years.

Summary

To sum up the implementation of transportation management programs, UMTA has prepared the table presented below. This concise synopsis of transportation management will be referenced again in the process of designing our mixed-use center prototypes.

Best and Worst Cases for Transportation Management Programs

VARIABLE	BEST CASE	WORST CASE
Program	Transportation Coordinator, personalized in-house carpool matching, priority carpool parking, transit encouragements, bicycle facilities and promotions, possibly flextime	No Coordinator or little commitment, carpool information, no matching, little if any transit information or pass sales, few bicycle facilities, little management support
Tenant	Large company, numerous clerical, or data processing staff	Small company, high proportion of professional staff
Parking	Tight supply, moderate to high prices, low level of parking cost subsidy, little on or off street parking nearby, good enforcement of carpool preferential parking	Ample supply, low or no prices, parking subsidies from employer, available nearby parking, no carpool stall enforcement
Transit	Frequent service, ample capacity, stable fares	Capacity constrained, service less frequent, fares increasing

Source: UMTA, "An Assessment of Travel Demand Approaches at Suburban Activity Centers," 1989.

5. Travel Behavior at Existing Mixed-Use Centers

Trip generation and modal split rates are typically assigned standard values which have been calculated using information from existing places. However, because there is not a great deal of experience with the mixed-use suburban prototype we are studying, the standard values may not be appropriate. Thus, we must look at case studies of existing mixed-use centers to help us understand how to model behavior accurately for our prototype. (Note: No center studied has all the characteristics we have determined would be needed in our suburban prototype. Therefore, figures derived from existing places must be considered of limited significance.)

There are two noteworthy studies for us to draw upon. The first is a study in progress being conducted by the National Cooperative Highway Research Program (NCHRP) of the Transportation Research Board: "Travel Characteristics at Large-Scale Suburban Activity Centers," and the second, "Trip Generation for Mixed-Use Developments," was published in 1987 by the Colorado/Wyoming Section of ITE. Both projects utilized survey instruments to gather actual data on travel patterns associated with mixed-use centers. The conclusions are presented below.

"Travel Characteristics at Large-Scale Suburban Activity Centers"

The NCHRP consultants chose six recently-developed "suburban activity centers," each with at least 5 million square feet of office and retail, with the retail component being at least 600,000 square feet. These centers are between 5 and 45 miles from the regional central business district: Bellevue (Seattle), South Coast Metro (Los Angeles), Parkway Center (Dallas), Perimeter Center (Atlanta), Tysons Corner (Washington, DC), and Southdale (Minneapolis-St. Paul). More detailed characteristics of each center can be found in Table 5.1 below.

The team produced a comparison, by land use, of **observed** trip generation and trip generation which would result from the application of published ITE rates. This assessment was conducted for both AM and PM peak periods. The detailed trip generation tables included in the NCHRP report are presented in the Appendix. Following are the general conclusions drawn from the comparison:

1. **Office** - On a per square foot basis, the observed rates were lower than ITE. However, the observed rates per employee were generally higher than the published ITE rates.

2. **Retail** - The majority of the regional malls surveyed showed rates lower than the ITE rates. The results varied, however, among the specialty, community and neighborhood centers.

3. **Residential** - On a per occupied square foot basis, the observed rates are comparable to the ITE published rates. Per resident, however, the observed rates are actually higher.

4. **Hotel** - The majority of the hotels had a lower observed rate than the ITE rate.

"Trip Generation for Mixed-Use Developments"

The ITE Colorado Section Technical Committee on Trip Generation conducted its survey at six mixed-use sites in Colorado only. Compared to the NCHRP centers, the Colorado centers chosen were rather small, ranging from 95,104 to 1,000,000 square feet. The only criterion for the mix was that the site include two or more different uses. The general conclusions reported in an article in the February 1987 ITE Journal were:

1. Published ITE rates can be used to estimate total daily trip generation for mixed-use centers.

2. The peak hour ITE rates should be reduced by 2.5 percent when applied to mixed-use developments.

3. Studies should be conducted in other states to determine if the results of this study are valid.

Given the somewhat inconsistent nature of the conclusions of these two studies, the specific trip generation rates used in the evaluation phase of this study will have to be carefully assessed.

A Comparison of the NCHRP Study and the Rice Center Study

A research project conducted by the Rice Center for the Houston-Galveston Area Council in 1987, "Houston's Major Activity Centers and Worker Travel Behavior," looked at travel characteristics associated with the Houston CBD, and three suburban centers in the Houston region: Greenway, City Post Oak and the Energy Corridor.

Table 5.1 presents the general characteristics of the Houston CBD, the three Houston suburban centers and the six centers covered by the NCHRP study. These centers range in size from Bellevue, which is 440 acres, to Parkway Center near Dallas, which is 1,870 acres. Each center contains some amount of office, retail, hotel and residential uses, although data is not available in detail for each of these items in every center (see notes on Table 5.1). Because average FAR's were not always available, commercial space per total acreage was calculated for each center as a rough means of comparing development intensity. Houston CBD and City Post Oak are the most dense centers when evaluated using this measure.

Table 5.1: Characteristics of Case Study Centers

Center	Acres	Commercial Space (mill. sq. ft.) Office	Retail	Commercial Space/Acre (sq. ft.)	Hotel Rooms	Total Employment*	Residential Units**	Distance From CBD (miles)
Houston CBD	969	51.8	5.9	59,546	5,500	178,304	N/A	--
City Post Oak	960	25.3	16.0	43,020	3,727	54,650	N/A	6
Greenway	848	12.1	0.5	14,858	980	37,878	N/A	4
W. Houston Energy Corridor	1,715	7.4	2.6	5,830	1,057	28,317	N/A	12
Bellevue (Seattle)	440	4.7	3.0	17,500	1,000	19,030	556	10
S. Coast Metro (Los Angeles)	580	3.5	4.0	12,931	1,800	17,330	2,300	45
Parkway Center (Dallas)	1,870	17.0	7.0	12,834	2,200	48,375	15,000	10
Perimeter Center (Atlanta)	1,450	13.0	2.0	10,344	1,800	42,430	200	12
Tysons Corner (Washington, DC)	1,230	13.0	3.0	21,138	N/A	37,650	1,745	12
Southdale (Minneapolis)	960	4.0	3.0	7,292	2,200	19,855	3,000	10

*The employment figures for the NCHRP centers include only workers associated with the office and retail space.

**The Houston study did not focus directly on the travel characteristics of residents in the centers and so no counts of residential units were done. The figures given for Bellevue and Tysons Corner represent only those surveyed and not total units in the centers.

The NCHRP study looked at employees per acre to also get some sense of the intensity of use of floor space. This calculation yields the following based on office and retail employees and total acreage:

	emp./acre
Bellevue	43.2
S. Coast Metro	29.9
Parkway Center	25.9
Perimeter Center	29.3
Tysons Corner	30.6
Southdale	20.7

When evaluated in these terms, Bellevue clearly is the most intensively utilized center of these six.

Employee Work Trips

One of the first elements to assess is the work trip patterns of the employees of a center. A major aspect of the journey-to-work is modal split. Table 5.2 shows the mode choice determined through the administration of a travel survey at the NCHRP centers; the data for the Houston centers has been taken from the 1980 Census journey-to-work information because mode information was only gathered for all trips in aggregration by the survey team.

Table 5.2: Work Trip Modal Split

Center	Drive Alone	Carpool/ Vanpool	Driver	Passenger	Bus	Walking/Bike
Houston CBD	56.4%	29.1%			13.5%	0.7%
City Post Oak	73.0	21.9			2.5	2.4
Greenway	69.4	25.4			2.7	1.6
W. Houston Energy Corridor	75.7	18.8			0.2	4.4
Bellevue (Seattle)			73.9%	16.9%	8.8	1.1
S. Coast Metro (Los Angeles)			92.5	6.4	0.1	1.0
Parkway Center (Dallas)			94.2	5.6	0.2	0.0
Perimeter Center (Atlanta)			93.0	6.5	0.5	0.0
Tysons Corner (Washington, DC)			89.2	9.8	0.7	0.3
Southdale (Minneapolis)			92.1	6.6	0.8	0.5

Note: Modal statistics were gathered for all of the centers through the administration of travel surveys. However, the Houston surveys obtained only information on mode split for all trips, not just work trips. Therefore the information presented here for the Houston centers is taken from 1980 Census journey-to-work data.

Although we must be somewhat guarded in drawing conclusions from the Houston 1980 data, there are several points that seem fairly apparent about the modal choices among all ten of the centers. First, Houston CBD and Bellevue have substantially higher bus utilization than the other centers. In the case of the Houston region, over 90 percent of the transit routes are CBD-oriented, which may partially explain for why the bus utilization is much lower in the suburban centers despite of the fact that City Post Oak is a fairly large and dense location.

The Bellevue bus share of 8.8 percent is remarkable given the relatively small size of this center compared with most of the others. Like Houston, this is partially explained by the differences in transit supply between Bellevue and the other five NCHRP centers. None of the other five centers has fixed-route transit serving it as an end-of-the-line destination. However, Bellevue has 17 Seattle Metro routes delivering commuters to the Bellevue Transit Center, which has bus bays, covered seating areas and information booths. Thus, while demand for transit certainly is a crucial element, the supply side is equally important. The destinations can be very large and dense, but if there is not adequate service available to the workforce, obviously there is no means of inducing use of transit.

Another element is the rate of carpooling and vanpooling. Because the data on ridesharing was collected differently in the two studies, a comparison cannot readily be made. However, Table 5.3 shows the average automobile occupancy for all of the centers. There is no qualitative information in the Houston report to explain why the least dense center, W. Houston Energy Corridor, has one of the highest vehicle occupancy rates. While it makes intuitive sense that the Houston CBD has a relatively higher occupancy rate, it is not immediately apparent why the moderately-sized Greenway Center has the highest rate. It is neither the largest nor the densest of the ten centers. The report may fail to mention area TMA's which are affecting these rates.

Table 5.3: Average Auto Occupancy - Work Trips

	Average Auto Occupancy
Houston CBD	1.21
City Post Oak	1.13
Greenway	1.26
W. Houston Energy Corridor	1.21
Bellevue (Seattle)	1.16
S. Coast Metro (Los Angeles)	1.07
Parkway Center (Dallas)	1.06
Perimeter Center (Atlanta)	1.07
Tysons Corner (Washington, DC)	1.11
Southdale (Minneapolis)	1.07

A clue to the success of ridesharing is found in the case of Bellevue. Bellevue's auto occupancy rate of 1.16 is not remarkable when compared to the other centers. However, when one office building is removed from the figure, the rate drops to 1.10. This particular building, PNB Plaza has an auto occupancy rate of 1.74 and a transit usage rate of 12 percent. This anomaly is due to a very stringent parking management system at the PNB building described in Section 4. With 1,200 employees in the building, there are only 402 on-site parking spaces and over half are reserved for HOV's. In addition, vehicles arriving with three or more persons can park for free; otherwise, the fee is $60 per month.

Intermediate Trips

Another influence on modal split and the overall regional traffic congestion level is the rate at which people take trips for purposes other than to get to and from work. Earlier in this report, we discussed the importance of understanding the lifestyles of the current workforce so that we may better influence the commuting patterns. Looking at why people stop on the way to and from work, and what they do on their lunch hours may assist us in determining how to design centers which will take some of the strain off the regional transportation network.

The NCHRP study did an excellent job of capturing the patterns of intermediate stops made during the work trip and the midday. The results are summarized in Table 5.4. Bellevue has a significantly higher proportion of employees making stops to and from work than the other five centers. The NCHRP study team attempted to determine a reason for this and could not. They posed the hypothesis that Bellevue is far more dense and compact than the other centers, but no support for this theory was readily apparent. Bellevue employees show midday rates similar to the other centers.

Table 5.4: Characteristics of Trips Made By Suburban Activity Center Employees

	Bellevue	South Coast Metro	Parkway Center	Perimeter Center	Tysons Corner	Southdale
Trip To Work						
- Proportion of employees who stop	34%	23%	21%	17%	17%	17%
- Proportion who stop within SAC	15%	8%	9%	12%	9%	7%
- Average number of stops per trip	1.4	1.2	1.2	1.2	1.2	1.2
Midday Trips						
- Proportion of employees who make a midday trip	55%	59%	45%	46%	55%	42%
- Proportion who make a midday trip within the SAC	29%	22%	20%	33%	32%	23%
- Average number of stops per trip	1.7	1.9	1.6	1.6	1.6	1.6
Trip From Work						
- Proportion of employees who stop	66%	40%	37%	35%	36%	36%
- Proportion who stop within SAC	13%	6%	9%	16%	10%	13%
- Average number of stops per trip	1.7	1.0	1.1	1.2	1.5	1.5

Source: NCHRP, 1989.

Excluding Bellevue, the two centers with slightly higher rates of employee stops en route are South Coast Metro and Parkway Center. It was determined that this is due in part to the presence of greater proportions of female and secretary/clerical workers in these two centers. These groups tend to have more intermediate stops than others.

Important to examine in these patterns is the proportion of those who make intra-center stops. We proposed early on that to reduce trips on the regional network, more trips would have to be captured within the center. The NCHRP team identified a possible causal factor for centers having lower than average intra-center stop rates. The four centers with lower rates are South Coast Metro, Parkway Center, Southdale, and Tysons Corner. The one factor these centers have in common is the proximity of external retail trip generators. Thus, more people will be attracted to stop outside these centers than in the case of Bellevue and Perimeter Center which are relatively isolated in terms of activity concentration in their region. The NCHRP team proposed the following relationship:

1. For centers with relatively little retail activity immediately adjacent, about 13 percent of the employees will stop within the center on their way to work and approximately 15 percent will stop there on the way home.

2. Centers with a significant amount of retail immediately adjacent will have approximately 8 percent of the workforce stopping in the center on the way to work and about 10 percent stopping on their way home.

Table 5.4 also shows the patterns of midday trip-making. The NCHRP team determined that there is a correlation between occupation and the proclivity for making a midday trip, with professional/technical staff more likely to go out at lunchtime. Given the data gathered from the six centers, the following relationships were suggested:

1. For centers with at least 60 percent professional, technical, manager, or administrator positions, the proportion of office employees making midday trips within the center ranges from 29 to 33 percent.

2. For centers which have lower proportions of these professional categories, the expected internal midday trip rate is between 20 and 23 percent.

Another factor which influences the midday internal trip patterns is the availability of eating establishments. The fact that Perimeter Center has the highest midday intra-center trip rate is probably due to the availability of various restaurants within the center and a corresponding lack of lunch opportunities in the largely residential area surrounding the center.

Intermediate Stop Trip Purposes

The NCHRP study also surveyed intermediate stop trip purposes. The results are presented in Table 5.5. The most frequently cited reason for a stop on the way to work is to drop a child at childcare or school -- an average of 34 percent of the office workers stop for this purpose. In second place, an average of 21 percent said they stop on work-related business on the way to the office. On the way home, 21 percent stop to shop, 14 percent pick up a child at school or childcare, 15 percent stop for social or recreation reasons such as health clubs, and 13 percent stop at the grocery store.

It is rather clear given these intermediate trip purposes that there is ample opportunity to shape travel patterns by providing needed services within the center. If there were childcare services on-site, perhaps more people would be free to carpool by bringing the child along. If there were shops, restaurants and supermarkets within the center, workers might be enticed to remain in the center for a longer period of time, thus spreading the peak demand for regional highway capacity. These factors must be considered in the design phase of this project.

Table 5.5: Intermediate Stop Trip Purposes

	Distribution of Trip Purposes by Time Period		
	Along Trip To Work	Midday Trips	Along Trip Home
Trip Purpose			
Work Related	21%	25%	6%
Meal/Snack	10	35	4
Shopping	3	13	21
Childcare/School	34	*	14
Pick Up/Drop Off Passenger	5	1	3
Education	*[1]	*	2
Social/Recreation[2]	3	3	15
Home	*	4	0[3]
Banking	7	9	6
Medical	2	2	3
Dry Cleaners	9	1	7
Gas Station	0[4]	1	0[4]
Grocery Store	2	1	13
Other	3	3	6
	100	100	100

Notes:

[1] * indicates less than 1 percent

[2] Health club trips have been included under the Social/Recreation category

[3] By definition, trips to home from work cannot have an intermediate stop at home

[4] Intermediate stops at gas stations along the way either to work or from work have been excluded in this distribution. During the trip to work, the survey indicates that roughly 11 percent of all intermediate stops are at a gas station. Along the trip home, roughly 9 percent of all intermediate stops are at gas stations.

Source: NCHRP, 1989.

Table 5.5 also shows midday trip purposes. An average of 35 percent of the midday trips are for a meal or snack, 13 percent are shopping trips, and 9 percent are for banking. This again shows the opportunities which exist to shape travel behavior by locating appropriate services within the center.

Midday Walking Trips

The NCHRP study also identified a rather direct relationship between the proximity of the services to the office space and the propensity of the workers to walk to their midday destinations. The Galleria Mall in the Parkway Center showed a 17 percent walk share for midday trips. The Galleria, containing 970,000 square feet, is connected by enclosed walkways to approximately 1 million square feet of office space and has a total of 2.1 million square feet of office space within 2,000 feet of the mall. Bellevue Square Mall, also with 2.1 million square feet of office space within 2,000 feet, generates a midday peak hour walk mode of 6 percent and

contains 1,066,300 square feet of retail space. Bellevue has a pedestrian pathway system as well. Perimeter Mall in Perimeter Center has 1,436,000 square feet, receives a 7 percent midday walk trade, and has 2.8 million square feet of office space within 2,000 feet.

Residential Travel Characteristics

Various residential areas within the six NCHRP mixed-use centers were surveyed to determine their travel characteristics. Residents were asked specifically about the work location and the trips they made within the center. Table 5.6 summarizes the findings.

The percentage of those living and working within the center ranges from 13 to 50. It was determined that, on average, owner-occupied households have "internal" workers more often (31 percent) than renter-occupied units (28 percent). In addition, the larger the center, the more likely it is that the residents will also work there. Those classified as large, Tysons Corner and Parkway Center, had an average of 33 percent of their residents employed within the centers, while the smaller centers averaged 27 percent.

The denser centers of Bellevue and South Coast Metro exhibited a higher walk mode share for trips internal to the center. Shorter walk distances and Bellevue's pedestrian path system contribute to increased walking trips. While these walking trips represent only a very small proportion of the intra-site trips, perhaps if larger residential components were studied and/or provided on-site, a significant impact on travel patterns could be made.

Table 5.6: Intra-Center Trips Made by Residents

Residential Site	% of Employed Residents[2] Which Work Within SAC	Mode of Trips Made Within the SAC		
		Auto	Walk	Transit
Bellevue				
East Side	45%	85%	15%	0%
The Park	32	86	4	0
12 Central Square	27	72	24	4
South Coast Metro				
The Lakes	33	76	24	0
The Cape	13	96	4	0
Village Creek	27	89	11	0
Parkway Center				
Spring Meadows	33	100	0	0
Carolina Chase	50	91	0	9
Preston Racquet Club	14	98	2	0
Tysons Corner				
Commons	40	93	6	1
Rotonda	33	94	1	5
Southdale				
Edinborough	27	98	2	0
The Colony	15	87	10	3
The Cedars	32	93	2	5
The Durham	33	94	4	2

[1] Use of these data by individual residential complex is cautioned. A more appropriate use of the data would be in total.

[2] Based on the trip diary provided by the survey respondents. It is estimated that on average the residents make 2.8 trips outside their complex but internal to the SAC.

Source: NCHRP, 1989.

Pleasanton Study

Pleasanton, California, enacted a traffic reduction ordinance requiring employers to reduce peak hour trips by 45 percent. This program has been in force for several years; Cervero and Griesenbeck (1987) conducted a study of the travel patterns occurring as a result of the regulations. The general conclusions drawn from the study are as follows:

1. In 1986, 62 percent of those employed in Pleasanton were female.

2. Over 26 percent were classified as management/administration, 21.1 were clerical, 21.0 were service, and 17.6 were professional/technical.

3. The share of professional employees commuting more than 15 miles was much higher than that of the non-professionals. This suggests that the long average commuting distance of 15 miles is more a function of higher-income workers choosing to live farther away, rather than lower-income workers being pushed out by rising housing prices.

4. Analysis of travel data showed that those most likely to rideshare have long commuting distances, work for a large company in a single-tenant site, and are in non-professional, non-management positions.

5. People are more likely to "flex" their working hours if they commute relatively long distances, work for a small firm in a multi-tenant complex, and have a professional/management position. This may reflect in part the difficulty of implementing ridesharing for smaller firms, which leaves them with flex-time as the other option for fulfilling the TSM ordinance requirements.

6. Flex-time privileges discourage ridesharing. Most of Pleasanton's trip reduction requirements have been achieved through flex-time.

7. The most effective approach to demand management may be to encourage staggered hours across firms so that ridesharing within firms can be accomplished in concert with spreading the trips over a longer time period.

6. New Jersey: Route 1 Corridor Region

While the purpose of this study is to further our understanding of the relationship between suburban land use and transportation in general, the laboratory we will be using to test our ideas is the Route 1 Corridor region in central New Jersey. This region includes Mercer County and southern portions of Middlesex and Somerset Counties. To establish a foundation for the analytical portion of this project, we will begin by assessing some of the attributes of the Route 1 region which are pertinent to issues discussed throughout this report. In addition, the efforts of the REGIONAL FORUM and the State Planning Commission will be discussed in terms of their recommendations for establishing mixed-use centers. It should be understood, however, that this section will be somewhat cursory in nature, with a substantial amount of data and analysis to be provided in a subsequent phase of this project.

Economic and Demographic Characterics of the Route 1 Corridor

The Route 1 Corridor Region, comprised of 32 municipalities, had an estimated population of 616,766 in 1987. Table 6.1 shows the change in population by municipality since 1980. Growth has clearly been taking place in the suburban and more rural municipalities like West Windsor, Franklin, Plainsboro and South Brunswick, while older localities and cities like Manville, Milltown, Trenton and New Brunswick have been losing population. However, this losing trend is expected to turn around by 2010, with every municipality in the region experiencing some level of growth, albeit with the suburban areas continuing to caputre a greater share. The task is to determine how much of this growth is already accounted for in existing development proposals and how much can be shaped by our mixed-use center land use approach.

Table 6.2 shows projected jobs/housing ratios for each municipality. While the regional figure shows a nice balance of 1.56, some municipalities have rather low ratios, indicating that their resident labor force is commuting somewhere else to work. Without current travel data, however, it is difficult to know the extent of a spatial mismatch between jobs and housing within the region. The jobs-housing factor is one important consideration when deciding upon the potential future location for our prototype centers.

The State Department of Labor recently prepared an analysis of labor demand versus supply in New Jersey through the end of the century. Most of the labor force growth within the next decade will be accounted for by women and minorities, with a declining overall proportion of white males relative to the total. There may be a labor shortage because of the baby-bust (a decline in the 16 to 24 age cohort), skills mismatch and a lack of affordable housing. Unemployment is expected to be 3.5 percent in 2000 if the economy continues to grow as projected. Retraining efforts will be needed because a major portion of the new jobs will be in the service sector, requiring higher levels of education and skills to meet "high tech" information-processing needs or to fill specialized positions such as nursing and computer maintenance. Raising the retirement age may be considered to keep older workers in the workforce longer. In addition, if the affordable housing issue is not addressed, it will be very difficult to attract workers from other areas (Department of Labor, June 1989).

Table 6.1: Municipal Population Trends and Projections

Municipality	Population 1980	Estimated Population 1987	Change 1980-1987	Percent Change 1980-1987	Projected Population 2010	Change 1987-2010	Percent Change 1987-2010
East Windsor	21,041	23,171	2,130	10.1	34,000	10,829	46.7
Ewing	34,842	35,656	814	2.3	38,700	3,044	8.5
Hamilton	82,801	87,106	4,305	5.2	101,630	14,524	16.7
Hightstown	4,581	4,843	262	5.7	4,900	57	1.2
Hopewell B.	2,001	2,021	20	1.0	2,550	529	26.2
Hopewell Twp.	10,893	11,282	389	3.6	16,850	5,568	49.4
Lawrence	19,724	25,166	5,442	27.6	31,200	6,034	24.0
Pennington	2,109	2,276	167	7.9	2,800	524	23.0
Princeton B.	12,035	12,172	137	1.1	13,000	828	6.8
Princeton Twp.	13,683	14,288	605	4.4	23,000	8,712	61.0
Trenton	92,124	90,646	(1,478)	-1.6	97,898	7,252	8.0
Washington	3,487	5,347	1,860	53.3	10,500	5,153	96.4
West Windsor	8,542	13,149	4,607	53.9	26,400	13,251	100.8
MERCER	307,863	327,123	19,260	6.3	403,428	76,305	23.3
Franklin	31,358	38,468	7,110	22.7	62,790	24,322	63.2
Hillsborough	19,061	24,001	4,940	25.9	35,850	11,849	49.4
Manville	11,278	10,490	(788)	-7.0	10,770	280	2.7
Millstone	530	477	(53)	-10.0	520	43	9.0
Montgomery	7,360	9,116	1,756	23.9	16,030	6,914	75.8
Rocky Hill	717	696	(21)	-2.9	730	34	4.9
S. Bound Brook	4,331	4,007	(324)	-7.5	4,050	43	1.1
SOMERSET	74,635	87,255	12,620	16.9	130,740	43,485	49.8
Cranbury	1,927	2,292	365	18.9	5,311	3,019	131.7
East Brunswick	37,711	44,508	6,797	18.0	53,803	9,295	20.9
Helmetta	955	975	20	2.1	2,702	1,727	177.1
Jamesburg	4,114	4,806	692	16.8	5,772	966	20.1
Milltown	7,136	6,960	(176)	-2.5	7,979	1,019	14.6
Monroe	15,858	21,143	5,285	33.3	33,592	12,449	58.9
New Brunswick	41,442	39,568	(1,874)	-4.5	46,691	7,123	18.0
North Brunswick	22,220	26,165	3,945	17.8	37,889	11,724	44.8
Plainsboro	5,605	11,395	5,790	103.3	22,063	10,668	93.6
South Brunswick	17,127	22,838	5,711	33.3	44,000	21,162	92.7
South River	14,361	13,243	(1,118)	-7.8	13,947	704	5.3
Spotswood	7,840	8,495	655	8.4	9,462	967	11.4
MIDDLESEX	176,296	202,388	26,092	14.8	283,211	80,823	39.9
REGIONAL TOTAL	558,794	616,766	57,972	10.4	817,379	200,613	32.5

Sources: 1980 - US Census; 1987 - NJ Dept. of Labor; 2010 - Mercer County Planning Board, Somerset County Planning Board, Middlesex County Planning Board.

Table 6.2: Projected Jobs/Housing Ratios - 2010

Municipality	Projected Population 2010	Household Size 2000	Estimated Housing 2010	Projected Employment 2010	Jobs/Housing 2010
East Windsor	34,000	2.51	13,546	13,230	0.98
Ewing	38,700	2.46	15,732	33,070	2.10
Hamilton	101,630	2.52	40,329	33,610	0.83
Hightstown	4,900	2.38	2,059	4,590	2.23
Hopewell B.	2,550	2.35	1,085	665	0.61
Hopewell Twp.	16,850	2.74	6,150	4,060	0.66
Lawrence	31,200	2.51	12,430	28,765	2.31
Pennington	2,800	2.52	1,111	3,480	3.13
Princeton B.	13,000	1.98	6,566	17,130	2.61
Princeton Twp.	23,000	2.40	9,583	12,370	1.29
Trenton	97,898	2.47	39,635	68,510	1.73
Washington	10,500	2.52	4,167	3,860	0.93
West Windsor	26,400	2.83	9,329	25,010	2.68
TOTAL	403,428	2.49	162,019	248,350	1.53
Franklin	62,790	2.70	23,256	26,610	1.14
Hillsborough	35,850	2.52	14,226	10,650	0.75
Manville	10,770	2.61	4,126	3,630	0.88
Millstone	520	2.79	186	210	1.13
Montgomery	16,030	3.06	5,239	10,260	1.96
Rocky Hill	730	2.43	300	850	2.83
S. Bound Brook	4,050	2.43	1,667	1,080	0.65
TOTAL	130,740	2.64	49,523	53,290	1.08
Cranbury	5,311	2.45	2,168	7,676	3.54
East Brunswick	53,803	3.03	17,757	32,762	1.85
Helmetta	2,702	2.74	986	225	0.23
Jamesburg	5,772	2.61	2,211	2,703	1.22
Milltown	7,979	2.66	3,000	950	0.32
Monroe	33,592	2.36	14,234	12,304	0.86
New Brunswick	46,691	2.32	20,125	27,412	1.36
North Brunswick	37,889	2.49	15,216	34,332	2.26
Plainsboro	22,063	1.63	13,536	33,549	2.48
South Brunswick	44,000	2.81	15,658	44,063	2.81
South River	13,947	2.53	5,513	3,252	0.59
Spotswood	9,462	2.82	3,355	2,962	0.88
TOTAL	283,211	2.55	111,063	202,190	1.82
REGIONAL TOTAL	817,379	2.53	323,075	503,830	1.56

Source: MSM Regional Council, Mercer County Planning Board, Somerset County Planning Board, Middlesex County Planning Board.

If we look at the specific labor market areas which include the Route 1 Corridor region, it is apparent that the regional trends are expected, in large part, to be the same as those predicted for the entire state. In the Middlesex-Union labor area, approximately 77 percent of the new jobs projected through the year 2000 will be in the non-production industries of wholesale trade, retail trade and services. Of this portion, half of the jobs are expected to be in business and health services. Similarly, in Mercer, 68 percent of the new jobs are projected to be in trade and services, with legal, business and health services as the leaders. Finally, in the Somerset/Hunterdon labor area, the trend is the same, with 72 percent of the new jobs in trade and services, particularly business and health services (Department of Labor, Feb. 1989). A more thorough look at the attributes of the region's employment structure may also help us to understand how to approach the location of the future mixed-use centers.

As mentioned above, these points will be expanded upon in a subsequent analysis, but we can draw some preliminary implications. As we saw in the NCHRP case studies, women are more likely to have the responsibility for dropping a child at school or daycare and for doing the household's shopping. Because a large portion of the labor force growth will be women, child-care and shopping facilities should be offered on-site in our centers of the future. In addition, while many of the new jobs are high tech, many of the service jobs are lower-paying positions, making affordable housing in or near the centers a very important issue. Finally, if we are going to increasingly call on the retirement-age workers to remain in the workforce, their needs will have to be accommodated as well.

REGIONAL FORUM and State Plan Standards for Mixed-Use Centers

Two ongoing land use planning efforts in New Jersey are MSM's REGIONAL FORUM and the State Planning Commission's State Development and Redevelopment Plan. The REGIONAL FORUM was initiated in 1985 to address growth management issues in what we have designated in this report as the Route 1 Corridor region. Through an extensive consensus-building effort, bringing together 250 individuals representing various interests in the region, the REGIONAL FORUM produced a growth management agenda for the Route 1 Corridor region.

The State Planning Commission was created by legislative action in 1986 with the mandate to establish a growth management plan for all of New Jersey. The Commission is currently in the process of revising the Preliminary State Development and Redevelopment Plan, an interim document which will eventually be crafted into the Final State Development and Redevelopment Plan. The Final Plan will present a set of policies and guidelines for future land use throughout the State.

REGIONAL FORUM and State Planning efforts are being considered in this report because they both advocate the establishment of mixed-use centers as an alternative to the current patterns of suburban growth. The Preliminary State Plan uses an approach called the Regional Design System, which sets out standards for a hierarchy of centers ranging from traditional central cities to rural hamlets. The REGIONAL FORUM discussed a similar hierarchy of centers. The Preliminary State Plan's "corridor center" and the FORUM's "regional center" criteria are relevant to our work.

Some of the questions we have asked regarding the optimal design of mixed-use suburban centers have been addressed by both the Preliminary Plan and the REGIONAL FORUM. Table 6.3 presents suggested standards for centers:

Table 6.3: Standards for Mixed-Use Centers

	Regional Center	Corridor Center
Acreage	400+	640-6,400
Employment	9,000+ jobs	4,000-30,000 jobs
Population	5,700+	5,000-40,000
Dwelling Units	2,700+	2,000-15,000
Jobs/Housing Ratio	3.5	2.0-5.0
Net DU's per Acre	8-11	4-20+
Nonresidential FAR	1.10	1-4+
Open Space	13%	20%-35%
Height Range	4-10 stores	
Modal Split		85:15-60:40*

* Modal Split = % auto travel: % all other modes

Sources: "An Action Agenda for Managing Regional Growth," REGIONAL FORUM, MSM Regional Council, 1987. "The Preliminary State Development and Redevelopment Plan," Vol. III, New Jersey State Planning Commission, 1988

Both the Preliminary State Plan and the REGIONAL FORUM recommend that these centers be located proximate to the places on the transportation infrastructure that are most appropriate for supporting them, namely highway interchanges and transit stops. The Preliminary Plan suggests that the best approach to siting these centers is through the establishment of corridor plans focused on particular highway and transit corridors. No recommendations have been made, however, as to where specific corridor centers should be located. The counties and municipalities have been given the responsibility for determining appropriate locations.

As we have seen in our case studies, it is difficult to conclude that merely providing a mix of uses and a relatively high density and large size will achieve our transportation objectives. One of our most successful case studies from a transportation perspective is also one of the smallest -- Bellevue. Bellevue is 440 acres in size, with a total of 7.7 million square feet of commercial space, and employment of 19,030. Part of Bellevue's ability to achieve a greater than 25 percent non-SOV share is the relative intensity of the activities, 43.2 employees per acre compared with the next highest of 30.6 percent in Tysons Corner with 37,650 employees and a non-SOV mode split of only slightly greater than 10 percent. Bellevue also has a pedestrian walkway system, a relatively good transit service, and some corporations with aggressive parking management programs. In short, both the REGIONAL FORUM and the State Plan guidelines may be necessary, but not sufficient conditions for transportation success.

The REGIONAL FORUM has suggested generalized locations for possible mixed-use centers throughout the Route 1 Corridor region. These include:

- Proposed Monmouth Junction Station Area
- I-287/Franklin Twp.
- I-95/Mercer Airport
- NJ Turnpike Exit 7/I-95
- NJ Turnpike Exit 8/Hightstown
- NJ Turnpike Exit 8A/Forsgate
- I-95 Quakerbridge Area

Two other centers have been growing since 1980: the Princeton Junction area including Carnegie Center and the Forrestal Center area. These two areas are mixed-use in nature, but are not dense enough, nor adequately integrated in design to achieve the transportation objectives we hope to realize. These centers will be considered in our location analysis, however, because there may be possibilities to improve them as they continue to expand.

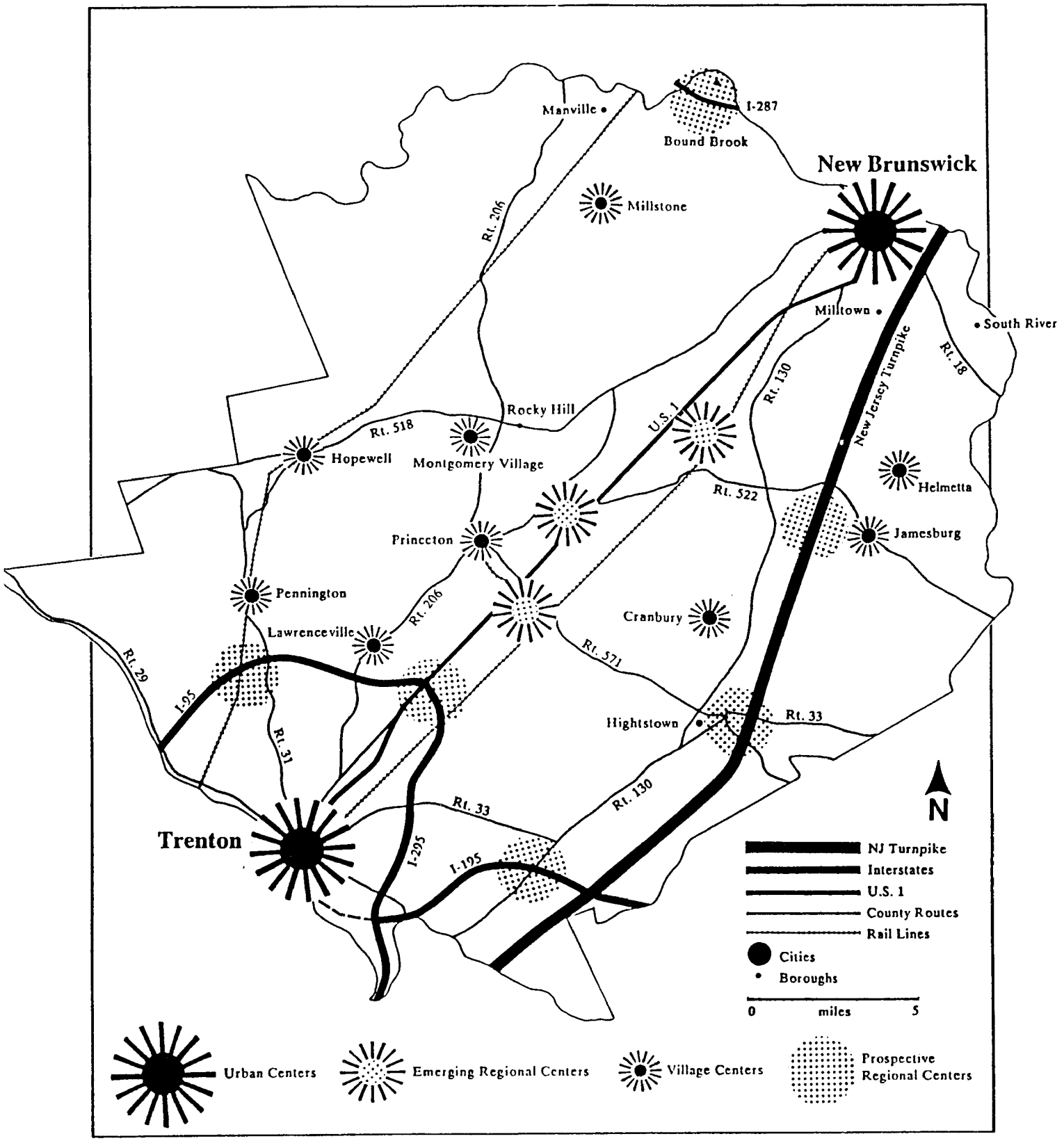
Figure 6.1 shows the location of the existing and prospective centers throughout the Route 1 region. The locations of future centers must be assessed not only in terms of their ability to absorb growth, but also from the perspective of their locations relative to other regional activities. If there is already a great deal of pressure on the highways and train lines which would serve the centers, there may be a resulting congestion problem when the centers compete with through traffic for capacity. In addition, as the NCHRP study showed, it is easier to capture intra-site trips if the center is relatively isolated from other retail and service activities.

Within the past six months, there have been two proposals for centers at the proposed Monmouth Junction train station and the I-95 Mercer Airport area. The former was brought forth by a development firm and the latter effort is being carried out by the Mercer County Division of Planning in conjunction with a variety of development interests in that area. As mentioned above, both of these locations were included in the REGIONAL FORUM recommendations.

The center proposed for the Mercer Airport area is included in a plan for what has been designated the Mercer County I-95/295 Corridor (Mercer County Planning Board, October, 1989). The Mercer County Division of Planning is currently working with a team of consultants to prepare this plan. The draft plan calls for:

	square feet	**acres**
Office/Research	5,463,874	505
Light Industrial	72,000	11
Retail	239,500	28
Hotel	160 rms	10
Residential	2,719 du's	1,712

Figure 6.1: Existing and Proposed Centers in the Route 1 Corridor Region



Source: "An Action Agenda for Managing Regional Growth," REGIONAL FORUM, MSM Regional Council, 1987.

On most of the nonresidential parcels the FAR is .15 and the total new employment estimated for this area is 19,328. Residential densities per parcel vary from .5 to 8 dwelling units per acre, with a total gross residential density of 1.6 units per acre for the entire residential area. While the total employment and housing is within the parameters put forth by the Preliminary State Plan and the REGIONAL FORUM, the overall density of development is quite low and the balance is off.

If this area were developed according to previous individual proposals, there would eventually be 30,651 jobs and 1,687 dwelling units with a jobs/housing ratio of 18.16. Under the draft corridor plan, the jobs/housing ratio has been reduced to 7.11, obviously a great improvement, but still over four times the 1.5 ratio recommended in the literature. We cannot forget, however, that the county is dealing with a large group of developers, some of whom have already submitted plans for local approval based on existing zoning conditions.

Should this corridor planning effort be successful in achieving its proposed levels of development, the center will certainly represent a laudable example of improved land use through collaboration and compromise. In addition, the county is planning to apply for a Transportation Development District designation for this area which would help to assure that necessary transportation improvements will be made to accommodate the growth, and transportation management programs will be carried out.

To be sited adjacent to the future Monmouth Junction Train Station, the Jersey Center Metroplex has been proposed (Rieder Land Technology, 1989). This development has generated quite a lot of controversy because of its size, the height of the proposed buildings and density. The target build-out year is 2002, at which point there would be 6.5 million square feet of office space under the proposed plan. This translates into employment of over 20,000. With a total site area of 506 acres, there would be over 40 employees per acre, a level approaching that of the Bellevue case study we examined. The retail component of 180,000 square feet is relatively minor when compared with the amount of office space. In addition, there are only 700 units of housing proposed, which would yield a jobs/housing ratio of over 29.

In addition to the proposed height of 14 stories for the tallest building, there are many questions about the underlying transportation assumptions of this development. A shuttle bus is proposed to connect the uses with each other and the train station, which, in absence of a walking scale could be an acceptable alternative. However, the developer has calculated that over 20 percent of the workers will commute using transit. This assumes that reverse-flow commuting will occur on the westbound Northeast Corridor Rail Line and that there is adequate capacity for the rail system to handle additional eastbound peak flow. In addition, the local road system is still left to handle the trips of the remaining 16,000+ employees who don't travel by transit. While the proposed size and density is at a level advocated by the Preliminary State Plan and the REGIONAL FORUM, the transportation issues and mix of uses need to be addressed more adequately.

7. Proposed Center Prototype

Throughout this report, various relationships between land use and transportation characteristics have been examined. While certain factors such as increased size, density and mix of land uses have been shown to favorably impact travel patterns, no clear standards or minimum thresholds have emerged from the literature. On the other hand, we know there are some basic design parameters like clustering buildings within the center and providing approximately 1,000-foot walking distances to effectively facilitate pedestrian and transit travel. Furthermore, we also know the optimal components for transportation management programs such as parking management and custom rideshare matching programs.

We are now faced with making a leap to propose a prototype center which can be tested in the Route 1 Corridor region. Given what we have learned, the REGIONAL FORUM standards, with some additional stipulations, seem to be reasonable minimum thresholds for designing the prototype. These figures have the added advantage of having been developed through a consensus-building process specific to the Route 1 Corridor region. The Preliminary State Plan standards might also be appropriate, but the ranges given are quite wide; they have been prepared for use in many types of areas throughout the state, and have not yet been completely through the public scrutiny and amendment process. Therefore, open for modification as our study proceeds, the REGIONAL FORUM standards shall be our starting point:

Acreage	400+
Employment	9,000+ jobs
Population	5,700+
Housing Units	2,700+
Net DU's/Acre	8-11
Net Nonres. FAR	1.10
Jobs/Housing	3.5
Height Range	4-10 stories

In addition, the prototype should incorporate the following:

- Relatively intensive use of the nonresidential land, perhaps at least 40 employees per acre
- Ample supply of retail and services, possibly a relationship of .5 square feet of retail for every square foot of office
- A housing supply which accommodates all anticipated employee income levels
- A phasing and marketing plan which would promote the opportunity for people to both live and work within the center
- The inclusion of services such as childcare, grocery stores, restaurants, health clubs, medical offices, movie theaters and banks

- Location of the center so that it does not excessively compete with through traffic for what would become an inadequate amount of road capacity

- Location of the center in an area relatively remote from other commercial developments

- A transportation management coordinator on-site who implements parking management and programs appropriate for the demographics of the workforce

- Possible parking supply restriction to 2 spaces per 1,000 square feet of office space

- A design which clusters activities and provides a pathway system to encourage pedestrian and transit trips

As the study proceeds and the actual sites are selected for testing the effects of the regional mixed-use centers, there will certainly be a variation in the application of the standards. Most likely, we will attempt to make the centers as large and dense as political, economic and physical constraints will allow. The final configuration of the test centers will be determined through careful analysis, and review and modification by local and national experts.

APPENDIX

NCHRP Trip Generation Rates

The following tables have been taken directly from the National Cooperative Highway Research Program report "Travel Characteristics at Large-Scale Suburban Activity Centers," prepared by JHK & Associates, 1989. These figures were collected through the administration of a survey at each of the listed sites. This data is important because it speaks to the question of whether or not the ITE trip generation rates are applicable for large suburban mixed-use centers. Each entry in the table is compared with the corresponding ITE rate. A summary of this comparison is presented in Section 5-A.

Table 8. Office vehicle-trips (AM peak hour).

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	AM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Inbound	Inbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Bellevue											
PNB Plaza	442.0	100	1150	203	0.46	0.46	0.20	89	1.74	1.63	0.50
United Olympic Building	214.2	80	425	242	1.13	1.41	0.57	94	1.04	1.86	0.51
Rainier Bank Plaza	441.8	80	1000	367	0.83	1.04	0.37	93	1.06	1.68	0.50
Honeywell Center	235.8	90	650	283	1.20	1.34	0.44	94	1.09	1.80	0.51
Business Center Bldg.	146.0	99	450	242	1.66	1.69	0.54	83	1.20	1.90	0.51
Pacific First Plaza	134.0	60	100	58	0.43	0.72	0.58	93	1.10	2.07	0.53
Skyline Tower	420.0	82	775	403	0.96	1.17	0.52	94	1.05	1.69	0.51
Transamerica Title	73.1	100	250	112	1.53	1.53	0.45	87	1.08	2.09	0.52
One Bellevue Center	357.0	92	900	196	0.55	0.60	0.22	89	1.06	1.70	0.50
Wells Development	21.5	90	60	29	1.35	1.50	0.48	79	1.04	2.52	0.53
South Coast Metro											
Imperial Bank Tower	310.0	93	725	411[1]	1.33	1.43	0.57	93	NA	1.73	0.51
Central Bank Tower	289.6	89	810	663[1]	1.14	1.24	0.41	92	NA	1.61	0.51
Great Western Savings Tower	289.9	96	805								
Metro Center	240.0	80	635	341	1.42	1.77	0.54	89	1.05	1.83	0.51
Downey Plaza	118.0	100	NA	283	2.40	2.40	NA	90	1.07	1.96	NA
Griffin Towers	285.0	86	500	319	1.12	1.30	0.64	92	1.10	1.77	0.51
3 Hutton Center Drive	200.0	NA	NA	161	0.80	NA	NA	92	1.06	NA	NA
Butterfield Tower	146.3	100	400	196	1.34	1.34	0.49	94	1.06	1.90	0.51
Corporate Center	159.2	71	350	229	1.44	2.03	0.65	75	1.08	1.97	0.51
Metro Pointe											
940 South Coast Drive	40.0	95	120	77	1.92	2.03	0.64	91	1.04	2.30	0.52
950 South Coast Drive	40.0	100	160	88	2.20	2.20	0.55	80	1.04	2.28	0.52

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 8. Continued

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	AM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Inbound	Inbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Parkway Center											
Galleria Tower I	500.0	90	1000	464	0.93	1.03	0.46	85	1.10	1.62	0.50
Occidental Tower	537.0	75	750	491	0.91	1.22	0.65	86	1.05	1.65	0.51
Signature Place I & II											
14755 W. Preston Rd.	217.3	60	235	318	0.62	1.09	0.61	87	1.10	1.72	0.51
14785 W. Preston Rd.	295.4	55	290								
Colonnade I	288.7	90	600	640	1.02	1.14	0.51	88	1.06	1.57	0.50
Republic Bank Tower											
Colonnade II	336.8	90	650								
Rolm Tower											
Stone Tower	265.0	42	275	141	0.53	1.27	0.51	93	1.11	1.97	0.52
Heritage Square Tower 2[3]	200.0	80	400	243[3]	1.22	1.52	0.61	93	NA	1.88	0.51
Stanford Park	295.0	95	500	378	1.28	1.35	0.76	96	1.02	1.73	0.51
Princeton	370.0	70	NA	444	1.20	1.71	NA	92	1.04	1.75	NA
One Spectrum Center	597.0	80	NA	710	1.19	1.49	NA	88	1.04	1.61	NA
Perimeter Center											
Southern Company	512.5	100	NA	753	1.47	1.47	NA	91	1.13	1.59	NA
Terraces North	429.0	99	NA	740	1.72	1.74	NA	92	1.03	1.64	NA
Ravinia One	377.5	95	1200	824	2.18	2.30	0.69	92	1.07	1.68	0.50
Concourse II	288.0	100	NA	521	1.81	1.81	NA	93	1.06	1.73	NA
UNISYS	286.0	NA	NA	467	1.63	NA	NA	96	1.06	NA	NA
Cotton States/Goldkist	264.8	100	NA	287	1.08	1.08	NA	95	1.07	1.75	NA
219/223 Perimeter Center Pkwy.	260.1	NA	NA	247	0.95	NA	NA	90	1.06	NA	NA
Travellers	225.6	NA	NA	255	1.13	NA	NA	91	1.09	NA	NA
Ashwood 1200	218.8	NA	NA	244	1.12	NA	NA	93	1.06	NA	NA
Contel	215.0	100	NA	355	1.65	1.65	NA	94	1.06	1.80	NA

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Appendix 1 (Continued)

Table 8. Continued

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	AM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Inbound	Inbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Perimeter Center (cont.)											
41/47 Perimeter Center East	189.5	100	NA	527	2.78	2.78	NA	85	1.10	1.83	NA
Maryland Casualty Building	146.0	NA	NA	204	1.40	NA	NA	93	1.19	NA	NA
AT&T	86.0	100	400	55	0.64	0.64	0.14	85	1.09	2.05	0.51
Northpark 400	585.1	70	NA	620	1.06	1.51	NA	99	1.06	1.65	NA
400 Embassy Row	155.0	97	530	224	1.45	1.49	0.42	98	1.07	1.89	0.51
Tysons Corner											
The BDM Corporation											
• 7915 Jones Branch Dr.	135.3	100	400	352	1.57	1.57	0.54	90	1.09	1.80	0.51
• 7923 Jones Branch Dr.	88.8	100	250								
• 1517 Westbranch Dr.	135.3	100	400	357	1.79	1.79	0.65	92	1.03	1.82	0.51
• 1521 Westbranch Dr.	64.5	100	150								
Lancaster Building	135.3	65	270	107	0.79	1.22	0.40	85	1.07	2.04	0.52
8201 Greensboro Dr.	353.1	100	800	604	1.71	1.71	0.75	85	1.07	1.68	0.50
Tysons International											
1919 Gallows Rd.	425.6	100	675	408	0.96	0.96	0.60	89	1.32	1.60	0.51
1921 Gallows Rd.	425.6	20	95								
Tycon Tower	427.3	50	350	221	0.52	1.03	0.63	88	1.04	1.80	0.51
The Mitre Corporation											
• 1820 Dolley Madison Blvd.	170.5	100	570	362	2.12	2.12	0.64	91	1.08	1.86	0.51
• 7525 Colshire Dr.	347.0	100	1160	591	1.70	1.70	0.51	82	1.05	1.68	0.50
• 1575 Anderson Rd.	61.2	100	200	172	2.81	2.81	0.86	84	1.08	2.15	0.52
NADA	195.9	100	650	348	1.78	1.78	0.54	93	1.57	1.82	0.51

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 8. Continued

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	AM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Inbound	Inbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Southdale											
Southdale Medical Office	198.0	85	1100	632	3.19	3.76	0.51	75	1.09	1.86	0.50
Southdale Place	73.3	92	250	197	2.69	2.92	0.79	88	1.08	2.12	0.52
National Car Rental	335.0	85	1000	486	1.47	1.71	0.49	97	1.06	1.73	0.50
Minnesota Center	300.0	50	550	320	1.07	2.13	0.58	90	1.11	1.89	0.51
Northland Plaza	328.8	84	800	436	1.33	1.58	0.55	94	1.02	1.74	0.50
Northland Exec. Center	516.1	96	1500	853	1.65	1.72	0.57	94	1.06	1.60	0.50
Northwestern Financial Ctr.	480.0	89	1500	798	1.66	1.87	0.53	96	1.08	1.64	0.50
Southgate Office Tower	238.9	80	750	368	1.54	1.93	0.49	78	1.06	1.83	0.51
Normandale Lake Office Park	700.0	78	2150	915	1.31	1.68	0.43	90	1.06	1.58	0.49
8300 Normandale Lake Blvd.	280.0	75	850	310	1.11	1.48	0.36	93	1.03	1.81	0.50
8400 Normandale Lake Blvd.	420.0	80	1300	605	1.44	1.80	0.47	88	1.07	1.69	0.50

[1] These buildings have no isolated parking. Person counts were taken at the building entrances (as reflected in Table 30). Vehicle trips are based on an assumed average auto occupancy of 1.07 (average for South Coast Metro office buildings).

[2] Parking garage is shared with another office building. Person counts were taken at building entrances. Vehicle trips are based on an assumed average auto occupancy of 1.06 (average for Parkway Center office buildings).

Table 9. Office vehicle-trips (PM peak hour).

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	PM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Outbound	Outbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Bellevue											
PNB Plaza	442.0	100	1150	230	0.52	0.52	0.20	91	1.69	1.53	0.48
United Olympic Building	214.2	80	425	218	1.02	1.27	0.51	91	1.02	1.80	0.49
Rainier Bank Plaza	441.8	80	1000	389	0.88	1.10	0.39	87	1.08	1.59	0.48
Honeywell Center	235.8	90	650	304	1.29	1.43	0.47	97	1.06	1.73	0.48
Business Center Bldg.	146.0	99	450	380	2.60	2.63	0.84	66	1.13	1.85	0.48
Pacific First Plaza	134.0	60	100	72	0.54	0.91	0.72	87	1.13	2.04	0.50
Skyline Tower	420.0	82	775	290	0.69	0.84	0.37	92	1.07	1.60	0.48
Transamerica Title	73.1	100	250	167	2.28	2.28	0.67	81	1.03	2.08	0.49
One Bellevue Center	357.0	92	900	178	0.50	0.54	0.20	91	1.05	1.61	0.48
South Coast Metro											
Imperial Bank Tower	310.0	93	725	385[1]	1.24	1.34	0.53	82	NA	1.64	0.48
Central Bank Tower	289.6	89	810	548[1]	0.95	1.03	0.34	88	NA	1.46	0.47
Great Western Savings Tower	289.9	96	805								
Metro Center	240.0	80	635	216	0.90	1.13	0.34	83	1.10	1.76	0.48
Downey Plaza	118.0	100	NA	251	2.13	2.13	NA	83	1.14	1.91	NA
Griffin Towers											
5 Hutton Center Dr.	285.0	86	500	336	1.18	1.37	0.67	93	1.15	1.69	0.48
3 Hutton Center Drive	200.0	NA	NA	126	0.63	NA	NA	88	1.13	NA	NA
Butterfield Tower	146.3	100	400	217	1.48	1.48	0.54	84	1.10	1.84	0.49
Corporate Center	159.2	71	350	215	1.35	1.90	0.61	79	1.09	1.93	0.49
Metro Pointe											
940 South Coast Drive	40.0	95	120	80	2.00	2.10	0.67	89	1.04	2.32	0.50
950 South Coast Drive	40.0	100	160	81	2.03	2.03	0.51	84	1.19	2.30	0.50

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 9. Continued

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	PM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Outbound	Outbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Parkway Center											
Galleria Tower I	500.0	90	1000	394	0.79	0.88	0.39	81	1.12	1.52	0.48
Occidental Tower	537.0	75	750	435	0.81	1.08	0.58	87	1.09	1.55	0.48
Signature Place I & II 14755 W. Preston Rd.	217.3	60	235	348	0.68	1.19	0.66	76	1.16	1.49	0.48
14785 W. Preston Rd.	295.4	55	290								
Colonnade I Republic Bank Tower	288.7	90	600	939	1.50	1.67	0.75	87	1.07	1.47	0.48
Colonnade II Rolm Tower	336.8	90	650								
Stone Tower	265.0	42	275	169	0.64	1.52	0.61	82	1.09	1.93	0.49
Heritage Square Tower 2[2]	200.0	80	400	258[2]	1.29	1.61	0.64	93	NA	1.82	0.49
Stanford Park	295.0	95	500	321	1.08	1.15	0.64	59	1.07	1.65	0.48
Princeton	370.0	70	NA	467	1.26	1.80	NA	88	1.13	1.67	NA
One Spectrum Center	597.0	80	NA	606	1.02	1.27	NA	82	1.06	1.45	NA
Perimeter Center											
Southern Company	512.5	100	NA	697	1.36	1.36	NA	91	1.14	1.49	NA
Terraces North	429.0	99	NA	701	1.63	1.65	NA	88	1.05	1.54	NA
Ravinia One	377.5	95	1200	613	1.62	1.71	0.51	83	1.11	1.58	0.48
Concourse II	288.0	100	NA	490	1.70	1.70	NA	86	1.09	1.64	NA
UNISYS	286.0	NA	NA	417	1.46	NA	NA	89	1.10	NA	NA
Cotton States/Goldkist	264.8	100	NA	325	1.23	1.23	NA	90	1.12	1.67	NA
219/223 Perimeter Center Pkwy.	260.1	NA	NA	252	0.97	NA	NA	87	1.04	NA	NA
Travellers	225.6	NA	NA	245	1.09	NA	NA	91	1.25	NA	NA
Ashwood 1200	218.8	NA	NA	268	1.22	NA	NA	89	1.09	NA	NA
Contel	215.0	100	NA	309	1.44	1.44	NA	87	1.06	1.73	NA

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 9. Continued

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	PM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Outbound	Outbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Perimeter Center (cont.)											
41/47 Perimeter Center East	189.5	100	NA	475	2.51	2.51	NA	70	1.14	1.77	NA
Maryland Casualty Building	146.0	NA	NA	219	1.50	NA	NA	92	1.22	NA	NA
AT&T	86.0	100	400	183	2.13	2.13	0.46	92	1.04	2.02	0.49
Northpark 400	585.1	70	NA	606	1.04	1.48	NA	86	1.06	1.55	NA
Tysons Corner											
The BDM Corporation											
• 7915 Jones Branch Dr.	135.3	100	400	305	1.36	1.36	0.47	86	1.10	1.72	0.48
• 7923 Jones Branch Dr.	88.8	100	250								
• 1517 Westbranch Dr.	135.3	100	400	306	1.53	1.53	0.56	90	1.05	1.75	0.48
• 1521 Westbranch Dr.	64.5	100	150								
8201 Greensboro Dr.	353.1	100	800	420	1.19	1.19	0.52	73	1.08	1.59	0.48
Tysons International											
1919 Gallows Rd.	425.6	100	675	458	0.54	0.90	0.59	93	1.26	1.38	0.48
1921 Gallows Rd.	425.6	20	95								
Tycon Tower 8000 Tower Crescent Dr.	427.3	50	350	188	0.44	0.88	0.54	76	1.09	1.73	0.49
The Mitre Corporation											
• 1820 Dolley Madison Blvd.	170.5	100	570	360	2.11	2.11	0.63	87	1.10	1.80	0.48
• 7525 Colshire Dr.	347.0	100	1160	736	2.12	2.12	0.63	82	1.10	1.59	0.48
• 1575 Anderson Rd.	61.2	100	200	125	2.04	2.04	0.62	85	1.09	2.14	0.49
NADA	195.9	100	650	384	1.96	1.96	0.59	90	1.33	1.76	0.48

Table 9. Continued

Office Building	Total GSF (x 1,000)	Percent Occupied	Approx. No. of Employees	PM Peak Hour (2-way vehicle trips) Total Trips	Trips/ 1,000 GSF	Trips/ Occupied 1,000 GSF	Trips/ Employee	% Outbound	Outbound Auto Occupancy	ITE Trips/Occupied 1,000 GSF	ITE Trips/ Employee
Southdale											
Southdale Medical Office	198.0	85	1100	768	3.88	4.56	0.61	66	1.25	1.80	0.48
Southdale Place	73.3	92	250	188	2.56	2.79	0.75	67	1.14	2.10	0.49
-inlcuding the drive-in banking				355	4.84	5.26	1.42				
National Car Rental	335.0	85	1000	477	1.42	1.68	0.48	89	1.07	1.65	0.48
Minnesota Center	300.0	50	550	314	1.05	2.09	0.57	81	1.08	1.84	0.48
Northland Plaza	328.8	84	800	411	1.25	1.49	0.51	84	1.07	1.66	0.48
Northland Exec. Center	516.1	96	1500	777	1.51	1.57	0.52	88	1.10	1.50	0.47
Northwestern Financial Ctr.	480.0	89	1500	842	1.75	1.97	0.56	85	1.09	1.54	0.47
Southgate Office Tower	238.9	80	750	332	1.39	1.74	0.44	80	1.08	1.76	0.48
Normandale Lake Office Park											
8300 Normandale Lake Blvd.	287.0	85									
8400 Normandale Lake Blvd.	434.0	95	NA	1075	0.89	1.29	NA	81	1.11	1.38	NA
8500 Normandale Lake Blvd.	484.0	35									

[1] These buildings have no isolated parking. Person counts were taken at the building entrances (as reflected in Table 31). Vehicle trips are based on an assumed average auto occupancy of 1.11 (average for South Coast Metro office buildings).

[2] Parking garage is shared with another office building. Person counts were taken at building entrances. Vehicle trips are based on an assumed average auto occupancy of 1.10 (average for Parkway Center office buildings).

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 35. Residential vehicle trips (AM and PM peak hour).

AM Peak Hour (total vehicle trips)

Residential Site	# DU's	Occupied DU's	Total Trips	Trips/ DU	Trips/ Occupied DU	Trips/ Resident[1]	% Outbound	Outbound Auto Occupancy	ITE Trips/ Occ. DU	ITE Trips/ Resident
Bellevue										
The East Side	168	147	53	0.32	0.36	0.23	88.7	1.11	0.48[2]	0.28[2]
The Park	184	168	75	0.41	0.45	0.32	85.5	1.17	0.48[2]	0.28[2]
12 Central Square	204	171	77	0.38	0.45	0.22	79.2	1.26	0.35[3]	0.27[2]
South Coast Metro										
The Lakes at South Coast	772	710	301	0.39	0.42	0.24	85.0	1.07	0.30[3]	0.27[2]
The Cape at Metro Pointe	296	246	139	0.47	0.57	0.33	91.4	1.21	0.47[2]	0.26[2]
Village Creek	133	133	63	0.47	0.47	0.25	73.0	1.13	0.50[4]	0.25[4]
Parkway Center										
Spring Meadows	152	128	126	0.83	0.98	0.61	56	1.16	0.49[2]	0.28[2]
Carolina Chase Apts.	334	280	113	0.34	0.40	0.22	79	1.17	0.47[2]	0.26[2]
Preston Raquet Club	184	170	114	0.62	0.67	0.42	87	1.07	0.47[4]	0.24[4]
Galleria Plaza Apts.	153	109	55	0.36	0.50	NA	75	1.10	0.49[2]	NA

AM Peak Hour (total vehicle trips)

Residential Site	# DU's	Occupied DU's	Total Trips	Trips/ DU	Trips/ Occupied DU	Trips/ Resident	% Outbound	Outbound Auto Occupancy	ITE Trips/ Occ. DU	ITE Trips/ Resident
Perimeter Center										
Dunwoody Chace	50	50	35	0.70	0.70	NA	91	1.00	0.55[2]	NA
Dunwoody Springs	156	150	128	0.82	0.85	NA	90	1.10	0.49[4]	NA
Tysons Corner										
The Commons of McLean[5]	246	235	133	0.54	0.57	0.35	78	1.13	0.45[4]	0.21[4]
The Rotonda	1168	1160	388	0.33	0.33	0.20	86	1.25	0.34[4]	0.14[4]
Southdale										
Edinborough	392	360	132	0.34	0.37	0.28	89	1.09	0.41[4]	0.19[4]
Cedars of Edina	510	415	219	0.43	0.53	0.41	92	1.11	0.46[2]	0.26[2]
York Plaza	530	470	120	0.23	0.26	NA	88	1.18	0.40[4]	NA

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 35. Continued

PM Peak Hour (total vehicle trips)

Residential Site	# DU's	Occupied DU's	Total Trips	Trips/ DU	Trips/ Occupied DU	Trips/ Resident	% Inbound	Inbound Auto Occupancy	ITE Trips/ Occ. DU	ITE Trips/ Resident
Bellevue										
The East Side	168	147	84	0.50	0.57	0.36	70.2	1.08	0.63[2]	0.34[2]
The Park	184	168	89	0.48	0.53	0.38	67.4	1.15	0.62[2]	0.34[2]
12 Central Square	204	171	90	0.44	0.53	0.31	73.3	1.20	0.45[3]	0.34[2]
South Coast Metro										
The Lakes at South Coast	772	710	255	0.33	0.36	0.20	72.7	1.16	0.42[3]	0.32[2]
The Cape at Metro Pointe	296	246	145	0.49	0.59	0.35	68.3	1.15	0.58[2]	0.32[2]
Village Creek	133	133	94	0.71	0.71	0.37	64.9	1.11	0.60[4]	0.32[4]
Parkway Center										
Spring Meadows	152	128	158	1.04	1.23	0.77	52	1.20	0.60[2]	0.35[2]
Carolina Chase Apts.	334	280	134	0.40	0.48	0.27	55	1.25	0.57[2]	0.32[2]
Preston Raquet Club	184	170							[4]	[4]
Galleria Plaza Apts.	153	109	116	0.76	1.06	NA	54	1.48	0.66[2]	NA
Perimeter Center										
Dunwoody Chace	50	50	30	0.60	0.60	NA	70	1.10	0.92[2]	NA
Dunwoody Springs	156	150	124	0.79	0.83	NA	65	1.21	0.59[4]	NA
Tysons Corner										
The Commons of McLean[5]	246	235	115	0.47	0.49	0.31	63	1.13	0.53[4]	0.27[4]
The Rotonda	1168	1160	385	0.33	0.33	0.20	71	1.28	0.38[4]	0.18[4]
Southdale										
Edinborough	392	360	145	0.37	0.40	0.31	67	1.09	0.49[4]	0.19[4]
Cedars of Edina	510	415	216	0.42	0.52	0.40	69	1.15	0.54[2]	0.32[2]

[1] Number of residents is based on average number of residents per household in the listed residential complex as shown in Table 36.

[2] Based on ITE Land Use Code 220 (Apartment); for complexes with known household size characteristics, appropriate adjustment factors have been applied.

[3] Based on ITE Land Use Code 222 (High-Rise Apartment)

[4] Based on ITE Land Use Code 230 (Residential Condominium)

[5] Trip generation counts were taken at only a portion of the total complex.

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 28. PM peak-hour trip-generation at retail sites.

Retail Site	Gross Leaseable Area (GLA) (x1000)	2-Way Person Trips	2-Way Vehicle Trips	Percentage Inbound	Average Auto Occupancy	Person Trips Per Occupied GLA	Vehicle Trips Per Occupied GLA	ITE Rates: Vehicles/ GLA	ITE Rates: Percentage Inbound
Bellevue									
Bellevue Square	1066.3	4753	3335	53	1.27	4.5	3.2	2.9	47
Bellevue North	47.0	637	531	48	1.19	17.6	14.7	10.2	49
Ernst Hardware	54.2	250	215	54	1.15	4.6	4.0	--	--
Park Row	17.8	132	125	52	1.05	7.4	7.0	14.3	49
South Coast Metro									
South Coast Plaza Mall	2,200.0	5096	3427	54	1.45	2.4	1.6	2.8	47
South Coast Plaza Crystal Court	600.0	754	613	47	1.18	1.6	1.3	3.4	47
South Coast Plaza Village	130.0	595	416	56	1.30	7.6	5.3	7.0	49
Sunflower-Bristol Plaza	45.0	604	447	53	1.23	15.1	11.2	9.7	49
Parkway Center									
Galleria Mall	970.0	3115	2232	55	1.34	3.3	2.3	3.0	47
Prestonwood Mall	1112.0	3300	2581	52	1.28	3.0	2.3	2.9	47
Plaza at the Quorum I	85.2	456	296	57	1.51	5.4	3.5	6.7	49
Plaza at the Quorum II	79.2	481	323	51	1.46	6.5	4.3	7.0	49
Perimeter Center									
Perimeter Mall	1436.0	4070	3173	53	1.26	2.9	2.3	2.9	47
Park Place Shopping Center	61.0	423	351	75	1.18	6.9	5.8	7.9	49
Tysons Corner									
Tysons Corner Mall	2114.1	5245	3875	51	1.33	2.5	1.8	2.8	47
Tysons Commons	70.2	1205	765	60	1.53	17.2	10.9	7.6	49
Southdale									
Southdale Mall	1161.3	3820	2988	52	1.27	3.3	2.6	2.9	47
Galleria	147.4	922	677	47	1.36	6.3	4.6	5.2	49
Yorktown Mall	92.0	434	347	57	1.18	5.2	4.2	6.8	49
Target	113.0	1434	1067	50	1.33	12.7	9.4	8.0	49
Byerlcys	70.0	969	760	51	1.26	13.8	10.9	--	--
Fuddruckers	10.0	217	117	67	1.85	21.7	11.7	3.3	--

Source: *Travel Characteristics at Large Scale Suburban Activity Centers*

Table 39. Hotel trips generated during AM peak hour.

Hotel	Total Peak Hour Trips Person	Vehicle	Trips Per Room Person	Vehicle	Trips Per Occupied Room Person	Vehicle	Percentage Inbound	Avg. Auto Occupancy
Bellevue								
Greenwood Hotel	327	250	1.86	1.42	1.96	1.50	70	1.31
Red Lion Inn	371	331	1.05	0.93	1.16	1.03	64	1.12
South Coast Metro								
Westin Plaza	197	151	0.50	0.38	0.55	0.43	54	1.20
Beverly Heritage	212	130	0.89	0.55	0.96	0.59	55	1.61
Parkway Center								
Westin Galleria	292	234	0.66	0.53	0.80	0.64	51	1.25[1]
Marriott Quorum	192	138	0.35	0.25	0.37	0.27	48	1.28
Hampton Inn	92	53	0.58	0.33	0.92	0.57	37	1.35
Perimeter Center								
Hyatt Regency Ravinia	232	190	0.44	0.36	0.61	0.50	56	1.22
Marriott	426	321	1.05	0.79	1.61	1.22	56	1.32
Doubletree Hotel	137	103	0.37	0.28	0.68	0.52	60	1.33
Tysons Corner								
Hilton	395	311	0.87	0.68	1.20	0.94	35	1.27[1]
Sheraton	311	235	0.68	0.52	0.76	0.58	60	1.25
Southdale								
Radisson	312	254	0.54	0.44	0.72	0.74	57	1.15[1]
Ramada Inn	82	68	0.44	0.32	0.54	0.45	34	1.21
Hotel Seville	59	41	0.23	0.16	1.07	0.75	51	1.39

[1] Estimated from intercept surveys

Table 40. Hotel trips generated during PM peak hour.

Hotel	Total Peak Hour Trips Person	Vehicle	Trips Per Room Person	Vehicle	Trips Per Occupied Room Person	Vehicle	Percentage Inbound	Avg. Auto Occupancy
Bellevue								
Greenwood Hotel	217	168	1.23	0.95	1.32	1.02	62	1.24
Red Lion Inn	324	210	0.91	0.59	0.91	0.59	50	1.53
South Coast Metro								
Westin Plaza	129	87	0.33	0.22	0.36	0.25	54	1.43
Beverly Heritage	269	148	1.13	0.62	1.22	0.67	59	1.38
Parkway Center								
Westin Galleria	300	226	0.68	0.51	0.82	0.62	49	1.30[1]
Marriott Quorum	230	178	0.42	0.32	0.45	0.35	52	1.26
Hampton Inn	75	44	0.47	0.28	0.63	0.37	66	1.48
Perimeter Center								
Hyatt Regency Ravinia	394	315	0.74	0.59	1.04	0.83	58	1.25
Marriott	388	282	0.96	0.69	1.47	1.07	71	1.34
Doubletree Hotel	238	196	0.64	0.53	1.19	0.98	65	1.21
Tysons Corner								
Hilton	279	223	0.61	0.49	0.85	0.68	52	1.25[1]
Sheraton	419	311	0.92	0.68	1.23	0.91	51	1.27
Southdale								
Radisson	426	333	0.74	0.58	1.23	0.97	57	1.23[1]
Ramada Inn	155	120	0.83	0.64	1.03	0.79	71	1.22
Hotel Seville	68	50	0.27	0.20	0.91	0.67	50	1.32

[1] Estimated from intercept surveys

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