FHWA/IN/JTRP-2008/19

Final Report

ALTERNATIVE LAND USE PATTERNS TO MINIMIZE CONGESTION

Volume 2: Evaluating the Feasibility of New Urbanism in an Existing Neighborhood

Huei Koh
Jon Fricker

December 2008

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ALTERNATIVE LAND USE PATTERNS TO MINIMIZE CONGESTION

Volume 2
Evaluating the Feasibility of New Urbanism in an Existing Neighborhood

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CHAPTER 1. INTRODUCTION

1.1. Background and Problem Statement

The decentralization of cities which were once bastions of population, economy and culture, has been propelled by the changing face of the transportation system and the evolution of the American lifestyle. The consequence: America, the "suburban nation". More people today live in suburban America than in rural and urban areas combined (Pollan 2000). This evolution of the way people live and travel has been named sprawl, and almost nothing positive can be said about its effects – congestion, pollution, loss of agricultural farmland, and segregation of social classes. Sprawl has even been linked to increasing obesity, crime rates and many other social ills that now plague the nation (McKee 2003, Utt 2002).

Smart Growth, the touted antidote to sprawl, is everything that sprawl is not. Where sprawl evokes images of scattered formless low-density developments devouring land on the fringes of metropolitan areas, smart growth advocates compact developments, directing growth towards areas where infrastructure is available but unused, and protecting farmland and open spaces. Where sprawl evokes images of the young, the old, and everybody in between shackled to the automobile for every travel need, smart growth describes communities where civic and commercial establishments are easily accessible, and people walk, bike or take transit to fulfill their daily needs. Sprawl is exclusionary, because the upper and middle classes can afford to flee to low-density suburbia, leaving the poor in inner city cores. Smart growth envisions a mix of housing for the upper, the middle class and the poor, all within the same community. Finally, sprawl can be unforgivably ugly, evoking images of strip malls and big bland boxes amid asphalt seas of parking lots. Smart growth, on the other hand, summons up images of quaint shops with apartments above, cars parked by the roadside, and pedestrians strolling down sidewalks amidst elegant landscaping.

In recent years, more and more states have begun to adopt Smart Growth policies for their metropolitan and rural areas. New developments based on design philosophies that embody

Smart Growth principles (such as New Urbanism), are gaining in popularity and numbers (Marshall 2000). But how effective are they? Are such neighborhoods, as some critics claim, really just a rich person's back-to-roots play toy? Can such methods be applied to real communities, communities in need of such revitalization, and not just "greenfield-type" developments, where neighborhoods are created from a clean slate? Are these neighborhoods sustainable? Will they have a significant impact on the way people travel? These are the issues that the present study hopes to address.

This study forms the second part of a research project that was initiated by the Indiana Department of Transportation (INDOT). The sponsors expressed an interest in the traffic impacts of revitalizing existing neighborhoods as opposed to building "greenfield" developments. It was thought that older neighborhoods with a higher proportion of low to medium income residents would benefit the most from the introduction of New Urbanist mixed land use principles.

The lessons of this study will be made available to planners, developers and public officials in Indiana and other states to enable the evaluation of alternative land use patterns and mechanisms to mitigate congestion (Bose and Fricker 2002) and pursue other social objectives.

1.2. Study Objectives

A previous study (Bose and Fricker 2004), analyzed a modular mixed-use neighborhood, the Reverse Engineered Neighborhood (REN) that was developed based upon travel patterns and trip behavior and was consistent with the principles of New Urbanism. In that study, a model of the REN was created within a hypothetical travel demand model called UTOWN. The present study extends that work by attempting to create a similar Smart Growth-based neighborhood, but this time within the context of a "real-world" neighborhood. The main objectives of the present study are:

A. Evaluation of the feasibility of implementing Smart Growth modifications to an existing neighborhood based upon the following criteria:
   - Public acceptance
   - Economic viability
   - Impacts on travel behavior

B. To provide a review of current planning practices in relation to Smart Growth in Indiana and other states as a basis for future research.

1.3. Structure of Study Approach

The adopted study approach is illustrated as Figure 1.1. The study begins with a literature review of the principal elements of Smart Growth and New Urbanism. In Chapter 3, a 'real-life' neighborhood is adopted as the case study neighborhood. A survey of community opinion regarding the hypothetical proposed modifications is carried out and the results reported. A market analysis is conducted in the subsequent chapter with the purpose of evaluating the economic viability of an implementation of a Smart Growth-type neighborhood. Based upon the results of the neighborhood survey and the market analysis, a travel demand model of the neighborhood is then constructed to examine the impacts of land use patterns on travel behavior. Chapter 4 then provides an overview of current Smart Growth planning practices in Indiana and other states. Finally, the last chapter presents a summary of findings and conclusions.

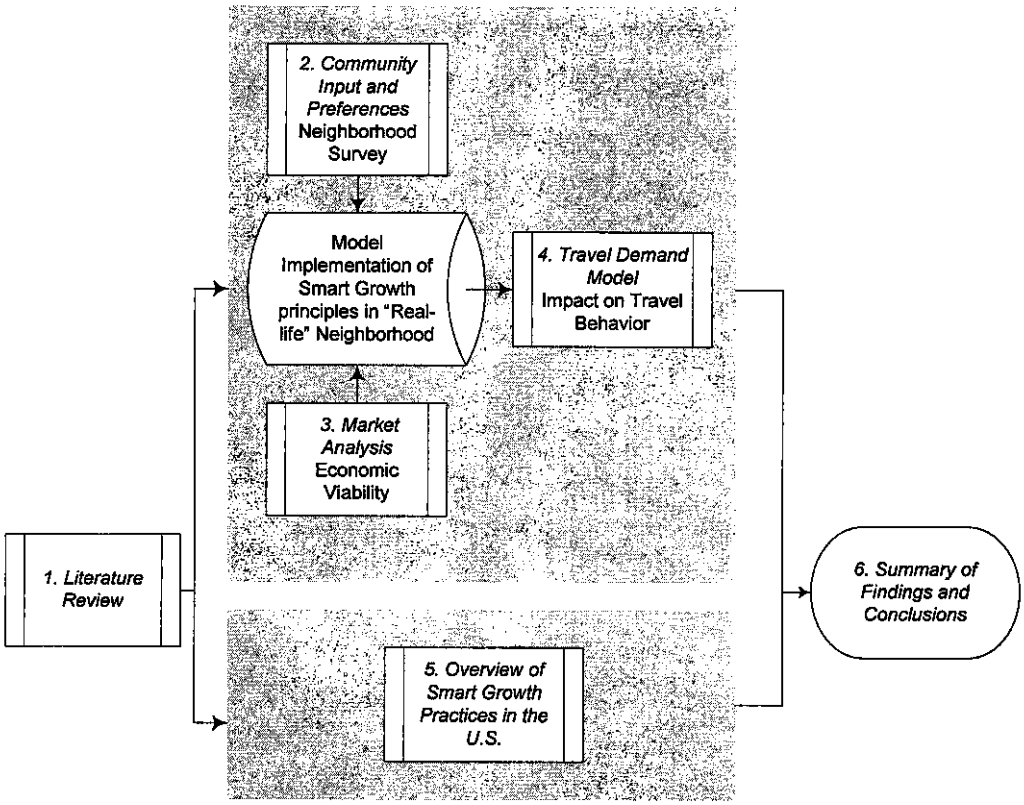

Figure 1.1 Structure of Study Approach

CHAPTER 2. LITERATURE REVIEW

2.1. Smart Growth

Smart growth is based on the premise that growth should be carefully managed to ensure efficient utilization of resources and, to enhance economic and social stability. With increases in population and the percentage of elderly, and changes in the way people live, work and travel, sprawl development has come to be recognized as an unsustainable development pattern. Unsustainable development can be described as a pattern of development that only meets current needs, but compromises the ability of future generations to meet their needs (Sustainable Communities Network 1996). Sprawl-type development is a classic example of what is considered unsustainable development because of the extreme pressures it exerts on energy and land consumption. As an antidote to sprawl, Smart Growth has emerged as the new development philosophy that is rapidly gaining popularity in states across the nation. The major components of Smart Growth are:

A. *Economics*

Sprawling low-density developments impose inefficiencies and high costs of new infrastructure and public service. Smart Growth advocates growth that is adjacent or within communities with existing infrastructure or in compact developments that will create stronger tax bases and will be more sustainable in the long run. However, many developers prefer the fringes of urban areas, because of lower land procurement costs and availability of large parcels of land.

B. *Housing*

The migration of the upper and middle class to large lot single family dwelling unit subdivisions in the suburbs have led to the deterioration of central cities. Such decentralization has led to population segregation by race and income, leading to a myriad of social issues and the physical separation of people of different social and income classes. Hence, one of the central concepts of Smart Growth is the provision of a

variety of housing choices within the same neighborhood, catering to all income groups to obtain a diverse social and income mix.

C. *Transportation*

Over the years, people have become more dependent on the automobile, while the provision of transit has become a costly and inefficient option due to low densities and low patronage. Society is now captive to the automobile. This results in limited mobility for the elderly and the young, who are not able to drive. Furthermore, traffic congestion has become an increasingly severe problem. Building more roadways to address congestion is no longer seen as a sustainable response to the problem. Smart Growth emphasizes the creation of pedestrian and bicycle friendly communities where a healthy mix of land uses within reasonable distances will result in less dependence on the automobile. Planning for the provision of transit services as an alternative to automobiles will also create more choices and flexibility for travelers and would allow the efficient movement of people.

D. *Environment*

During the period from 1987 to 1992, urbanized land areas in America grew by 47 percent, compared to an increase in population of 17 percent (Smart Growth America 2003). Such inefficient use of land, caused by the increase in land-consuming subdivisions, has resulted in the loss of prime agricultural farmland and open space as more and more of such land is converted to accommodate sprawl type developments. Smart Growth advocates the creation of higher-density developments, which will result in more efficient use of land and support the preservation of agricultural and environmentally sensitive areas.

E. *Quality of Life*

Fractured communities, a loss of sense of place, and the death of Main Street America have all been attributed to sprawl. As observed by Kunstler in his book, *Home From Nowhere* (1996), the focus of America has shifted from the public realm to the private realm of the house. In order to reestablish the connection to civic life and reinstate the importance of the public realm, Smart Growth advocates emphasizing the character and aesthetics of place as much as its functional attributes.

2.2. New Urbanism

New Urbanism can be thought of as one way to implement the philosophies of Smart Growth. New Urbanists champion a return to the neighborhood of yesteryear (Figure 2.1) as the alternative to post-war suburbia (Figure 2.2). Among the urban design patterns that have emerged from this movement are Traditional Neighborhood Developments (TNDs) and Transit-Oriented Developments (TODs).

Figure 2.1 New Urbanist Neighborhood (CNU 2003)

Figure 2.2 Suburban Sprawl (CNU 2003)

Typical characteristics of a New Urbanist neighborhood, as described in books by Andres Duany (Duany 2000) and Peter Calthorpe (Calthorpe 1993), and by the website of the Congress for the New Urbanism (CNU 2003), are:

A. *Land Use*

The typical density of a New Urbanist neighborhood ranges from 5 units per acre (McLaughlin 1996) to 15 units per acre (Calthorpe 1993). Residences are located within walking distance of retail and commercial businesses that cater primarily to the daily needs of the neighborhood.

B. *Housing*

Neighborhood residences consist of a variety of housing types, such as single family dwelling units, townhouses, duplexes and apartments that cater to all income classes. Ancillary units (e.g., "granny flats") located on the premises of single family homes are encouraged and are not confined to residential purposes.

C. *Road Network*

Streets within the neighborhood have a grid-like structure, maximizing the number of connections between streets as opposed to "pods" and "cul-de-sacs" commonly found in subdivisions. Various traffic calming measures such as roundabouts and speed bumps create a safe pedestrian environment as vehicles are forced to reduce their speeds. The functional classification of roads and their design standards must also take into consideration the area in which the roads exist.

D. *Transportation*

Infrastructure for non-motorized transportation, such as pedestrian sidewalks and bicycle paths, are provided throughout the neighborhood. Parking requirements are lowered and on-street parking is encouraged. While most New Urbanist neighborhood design concepts pay little or no explicit attention to public transit, Transit-Oriented Developments (TODs) emphasize the integration of transit on a regional basis by structuring neighborhoods around transit stops.

E. *Physical Characteristics and Aesthetics*

The neighborhood has a distinct physical center that is the focal point of retail stores, commercial businesses, and community activities. To ensure that all residents are within walking distance of the center, the neighborhood spans approximately a quarter mile, or a five-minute walk from the edge to the center. Enforcement of architectural codes ensure that the physical appearance of buildings blend in well with the environment.

2.3. Criticism of Smart Growth and New Urbanism

Critics have raised concerns over the extent of government involvement in Smart Growth programs, in the form of heavily subsidized revitalization projects, stringent development restrictions, and level of investment in Smart Growth programs (Hevesi 2002). These are valid concerns, given the vagueness of the Smart Growth definition. Legitimate questions were also raised regarding the issue of balancing efforts at land preservation and meeting consumer demand for housing. Critics further argue that the market should be the best judge of optimal land use, as opposed to the use of government regulations and controls that will reduce people's housing choices and drive up the cost of living.

Furthermore, the main premise of Smart Growth and New Urbanism philosophy, the integration of a variety of land uses, appears to be its weakest link. While buyers are willing to trade 100' x 100' lots for 65' x 100' lots (Calthorpe 1993), the reduction in lot size and the subsequent increase in residential density still does not generate an adequate amount of foot traffic to make retail operations within the neighborhood a viable business. Many New Urbanist neighborhoods fail to attract the commercial infrastructure of everyday life, and in some cases, the developers resort to subsidizing neighborhood stores through methods such as offering below-market rental rates, because the mixed-use concept was marketed as part of the package to buyers (New Urban News 2000, Marshall 2000). Even the Traditional Neighborhood Development Checklist, compiled by Andres Duany in his book, Suburban Nation (Duany 2000), states that, "A corner store – *subsidized if necessary* – is required in all neighborhoods containing at least 500 residences and/or jobs." This recognizes the necessity of having a retail shop catering to the daily necessities of residents while acknowledging that it might not be economically sustainable. Success stories of integrating commercial and retail businesses into such neighborhoods are generally confined to larger urban developments or revitalization projects such as Mizner Park in Boca Raton, Florida. Such developments relied heavily on the convenience of automobile access and its location within a very high-density residential area. In the case of Mizner Park, the average gross residential density is 9.4 units per acre (New Urban News 2000).

In the same vein, a well-known experiment in New Urbanism, Orenco Station near Portland, Oregon, was built a long walk from the train station and along a major arterial to give its businesses better access to external traffic. This compromises its stature as a compact town focused around a transit station (Ehrenhalt 2000). Other New Urbanist developments have also been criticized for being not much more than contemporary automobile suburbs masquerading as main-street style towns hanging off classic suburban arterials or highways (Marshall 2000). The culture of auto-dependence is so intertwined with daily life that people are extremely reluctant to give up the mobility and convenience provided for by the personal automobile. With few real places to shop and few employment opportunities within the neighborhoods, such developments have little impact on the way people travel and leave larger patterns of transportation untouched.

The notion of having the rich and poor live together has also been deemed too idealistic. This is a classic representation of NIMBY-ism (Not In My Backyard). While it is socially responsible to desire the integration of all social classes, nobody really wants to live next to high-

density residential apartments, usually associated with rental units. Furthermore, entry-level buyers are usually averse to purchasing homes near such units, the housing type they are seeking to escape (New Urban News 2000).

2.4. Reverse Engineered Neighborhood (REN)

The present study is an extension of previous work. Therefore a brief review of the previous study is important, in order to establish a starting point and a basis for comparison. The previous study, *Reverse-Engineered Land Use Patterns to Minimize Congestion* (Bose and Fricker 2004), developed a mixed-used land use pattern, the REN, which would accommodate most non-work trips made by locating non-residential land uses within the same neighborhood. The term "Reverse Engineered" refers to the method of accommodating land uses to travel patterns instead of the conventional manner, in which one starts from a defined set of land use patterns and then proceeds to analyze its travel characteristics.

A hypothetical travel demand model called UTOWN, was modified to accommodate REN using the GIS-based transportation planning package, TransCAD (Caliper 200X). Each neighborhood unit, which has an area of 1.0 x 1.0 mile, is called a 'module'. The REN consisted of 4 modules arranged together to form a 2.0 x 2.0 mile area (see Figure 2.3).

The results of the REN travel demand model was compared against the results obtained from EUCLID, a neighborhood that was the duplicate of REN, except for the fact that all non-residential land uses were removed from within the neighborhood. EUCLID was established as a purely residential neighborhood to allow a comparison of travel patterns between a mixed-use neighborhood and a purely residential neighborhood. Trip length distributions for REN and EUCLID are shown in Figure 2.4 and Figure 2.5. The results of the analysis show a significant shift to trips with shorter distances in the case of REN when compared to EUCLID. The study also concluded that, based on the results of the travel demand model, having a mix of non-residential and residential land uses within a neighborhood will have a significant impact on trip lengths. Therefore, diversifying land uses will have an impact on trip lengths, and hence on congestion in the network.

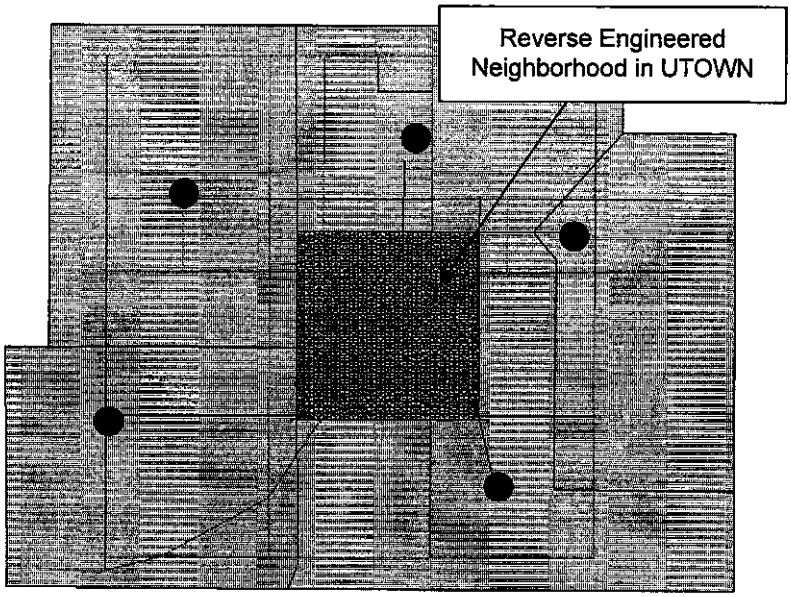

Figure 2.3 Reverse Engineered Neighborhood in UTOWN Travel Demand Model

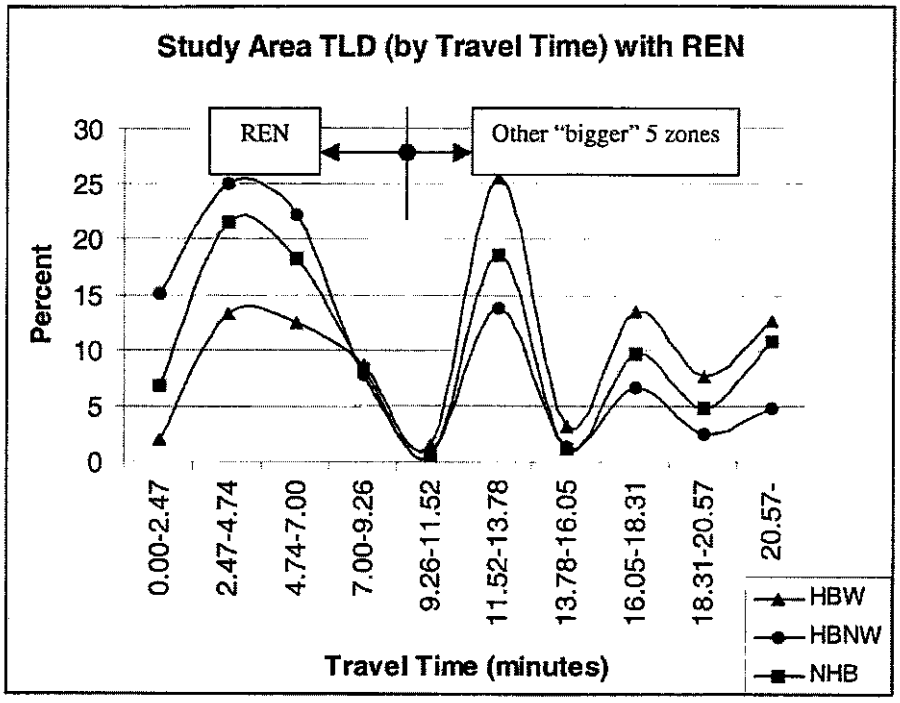

Figure 2.4 Trip Length Distribution for REN (Bose and Fricker 2002)

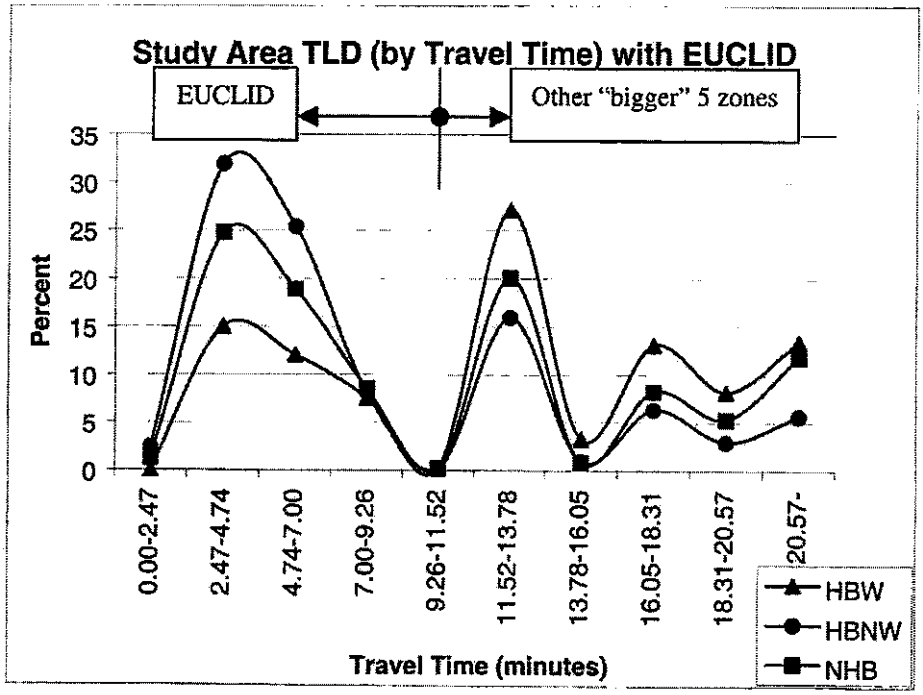

Figure 2.5 Trip Length Distribution for EUCLID (Bose and Fricker 2002)

CHAPTER 3. COMMUNITY INPUT AND PREFERENCES

The first step in the evaluating the feasibility of implementing Smart Growth measures involved conducting a community survey. The survey was conducted in order to obtain public opinion regarding what constitutes a favorable living environment and gauge the community's response towards the implementation of Smart Growth and New Urbanism in a case study neighborhood.

3.1. Study Area: St. Lawrence-McAllister Neighborhood

The St. Lawrence-McAllister neighborhood, located in northern Lafayette, Tippecanoe County, was chosen as the case study neighborhood (Figure 3.1). The neighborhood is bounded on the north side by Schuyler Avenue, a mainly commercial corridor (Figure 3.2). Greenbush Streets, which forms the southern border, has a low-density commercial center called Market Square on its east end (Figure 3.3) and is residential on its west end of the street (Figure 3.4). The central areas of the neighborhood consist primarily of single family dwelling units (Figure 3.5), although some multi-family dwelling units exist at various locations throughout the neighborhood. Railroad tracks run along the eastern border of the neighborhood, providing a physical barrier to the adjacent neighborhood.

According to Census 2000 data, 1,270 households are located within the neighborhood, which covers an area of 0.53 square miles, giving it a gross density of 3.73 households per acre. However, if the area covered by the St. Joseph cemetery is disregarded, given the unusual nature of that land use, gross density increases to a value of 3.82 households per acre. Figure 3.6 shows the income distribution of households in the neighborhood in comparison to the income distribution of the entire Tippecanoe County. From the figure, it can be observed that the St. Lawrence-McAllister Neighborhood has a higher proportion of lower to middle income residents than the rest of the county. Furthermore, as seen in Figure 3.7, the neighborhood has a significantly higher proportion of residents aged 25 to 44, and above 55 years old. The proportion

of college-age students in the neighborhood is much lower than the county average, and there exist a significant proportion of elderly residents in the neighborhood. Figure 3.8 shows that a majority of the housing units were built before 1960, and relatively few units have been built since then.

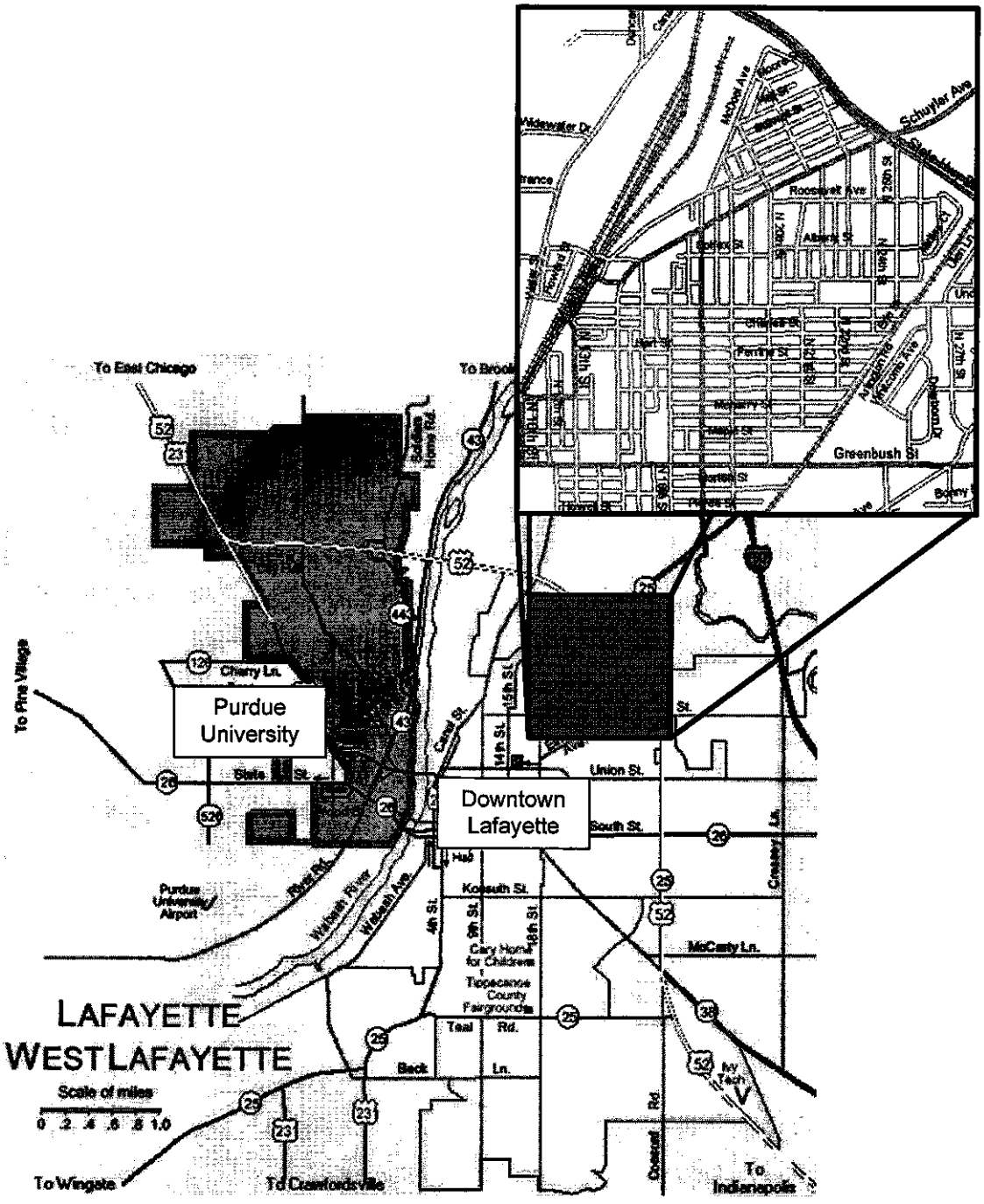

Figure 3.1 Location of St. Lawrence-McAllister Neighborhood

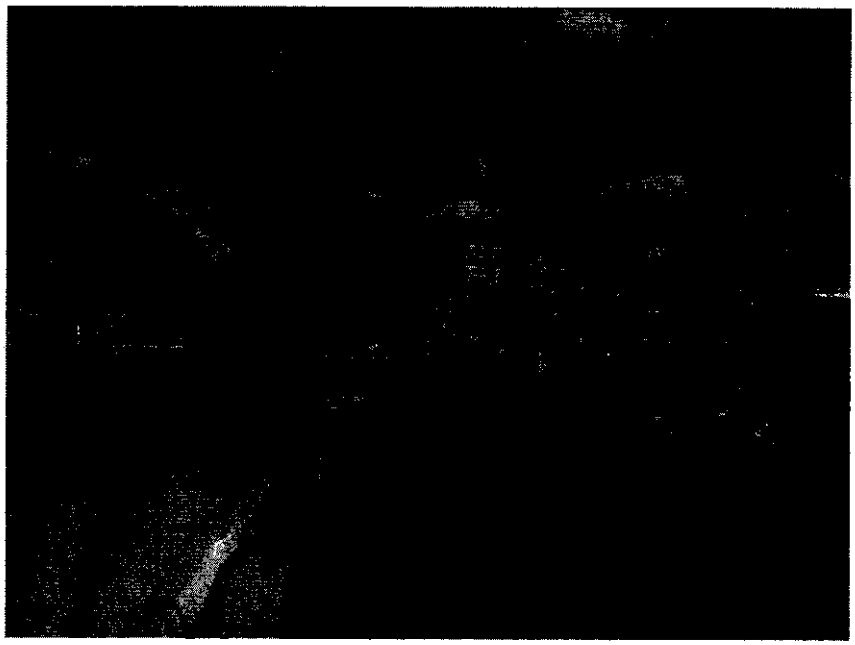

Figure 3.2 View of Commercial Area along Schuyler Avenue

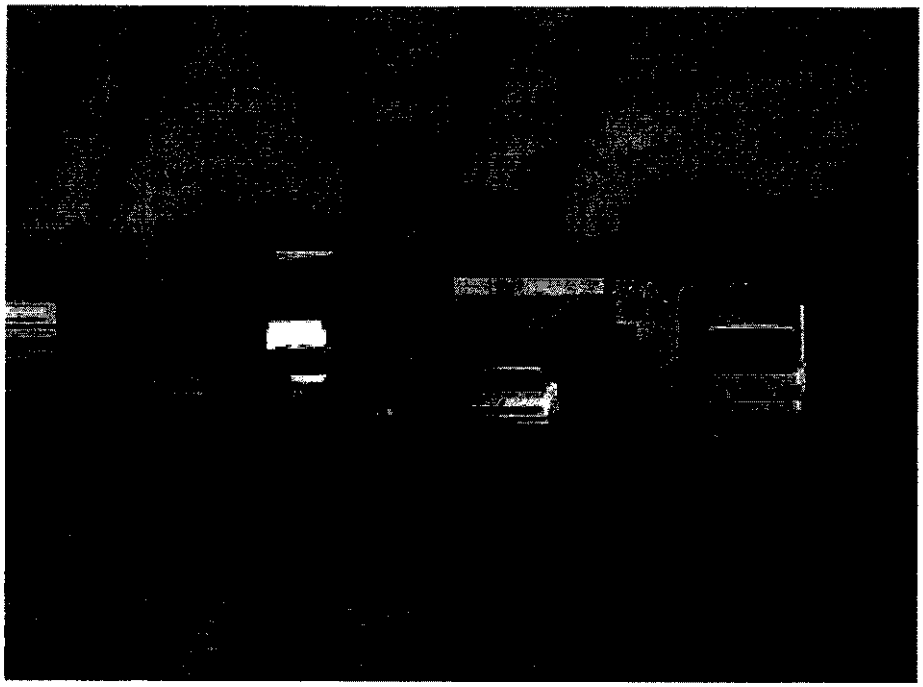

Figure 3.3 View of Market Square along Greenbush Street

Figure 3.4 View of Residences along Greenbush Street

Figure 3.5 View of Residences along Underwood Street

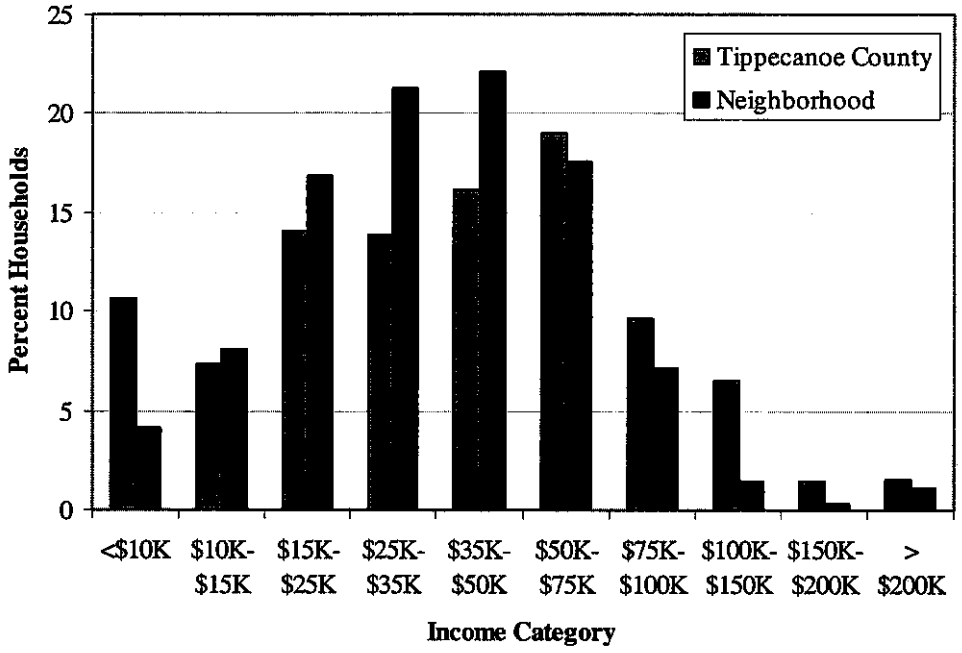

Figure 3.6 County and Neighborhood Household Income Distribution (Census 2000)

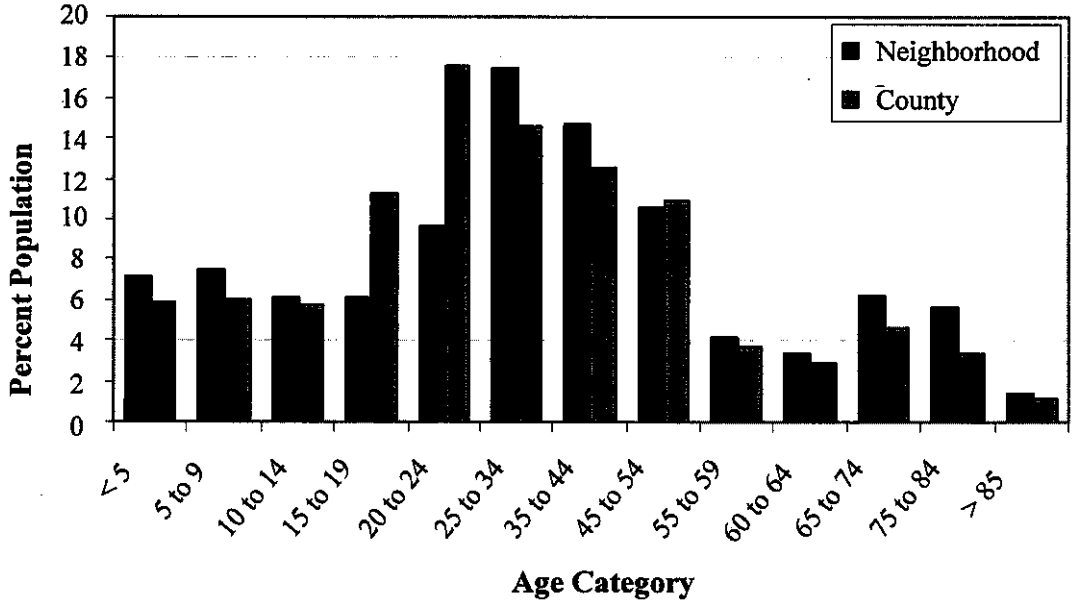

Figure 3.7 County and Neighborhood Age Distribution (Census 2000)

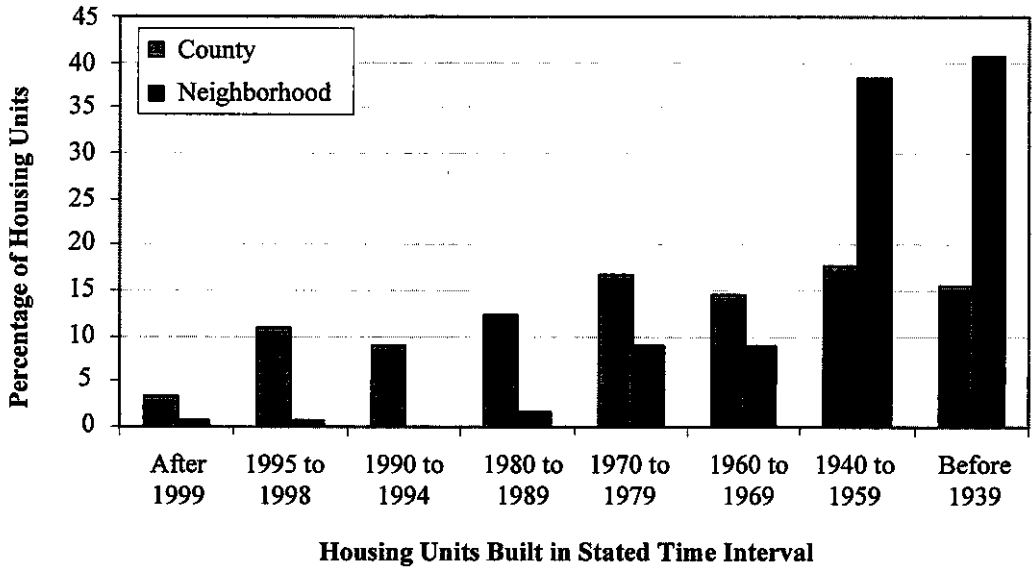

Figure 3.8 County and Neighborhood Housing Stock Age (Census 2000)

Among the attributes of the St. Lawrence-McAllister neighborhood that made it a suitable candidate for a case study are:

1. It is a relatively old neighborhood, with most housing units built before 1960, as shown in Figure 3.8, with higher proportions of lower to middle income and elderly residents. Current "greenfield" New Urbanist developments generally cater to residents in higher income categories. However, it is believed that such developments will be most beneficial to residents whose mobility is constrained due to factors such as the availability of household vehicles and the ability to drive, which are in turn linked to factors such as household income and age.
2. Existing commercial land uses along Schuyler Avenue have been declining, with many instances of neighborhood businesses shutting down over the years, such as the conversion of a neighborhood grocery store into a liquor store. Current non-residential land uses that exist within the neighborhood, such as an auto sales and auto repair shops, are scattered in commercial-strip style developments that are not conducive to non-vehicular trips.
3. The neighborhood has a relatively high gross density, with houses on smaller lots due to the age of the housing stock. Furthermore, there exists a variety of non-commercial land uses within the neighborhood, such as the McAllister Community Center, a church and a parochial

elementary school. The neighborhood's grid-like road structure conforms to New Urbanist standards of street design, making it a good candidate for revitalization purposes.

The neighborhood possesses most of the desirable attributes of a New Urbanist neighborhood, except that it lacks the crucial characteristic of having a coherent arrangement of viable commercial businesses that will provide residents with the option of shifting some of their daily trips to destinations within the neighborhood.

3.2. Survey Methodology

Before studying the impact of changes to the neighborhood, a survey was conducted among the members of the St. Lawrence-McAllister neighborhood association during a monthly neighborhood meeting. The survey sought to gain insight into residents' preferences regarding forms of developments and to obtain their views on what constitutes a desirable neighborhood. There were approximately 30 participants in the survey. The survey consisted of three major components: the Nominal Group Process, Land Use Preference Survey, and Case Study Discussion as shown in Appendix A.

3.2.1. Nominal Group Process

The nominal group process is a well-accepted and efficient method of generating creative ideas in a group situation by ensuring balanced participation. The survey participants at the neighborhood meeting were requested to form groups and select a group facilitator. They were then asked to write their opinions regarding the neighborhood's best attributes and also changes they would like to see in their neighborhood. After a suitable time, each group facilitator compiled a list containing all responses of the group members and upon doing so, presented each response to the group for discussion. The group then discussed and nominated the top three responses and submitted the results as a group to all meeting attendees.

3.2.2. Land Use Preference Survey

Survey participants were asked to rate a list of twenty four different non-residential land uses based upon how desirable or undesirable each land use would be if they were to be located

within their neighborhood. Rating was done on a scale of 1 to 5, with 1 representing very undesirable land use and 5 representing very desirable land use.

3.2.3. Case Study Discussion

The survey participants were presented with three different case studies that were meant to reflect efforts at integrating non-residential land uses into the neighborhood and creating a neighborhood faithful to the design principles of New Urbanism without any drastic modifications to the current layout of the neighborhood. Each of the proposed improvements includes mixed-use multi-story buildings, with retail on the ground floor and higher density residential on the upper floors. The three case studies differed on the basis of location, as shown in Figure 3.9, and are described as follows:

1. Case Study A: Underwood Street

   Underwood Street runs in the east-west direction through the center of the neighborhood. The rationale behind locating small-scale retail (e.g., a single mixed-use multi-story building spanning one block) on Underwood Street is its location at the physical center of the neighborhood, thus making it accessible by non-motorized forms of transportation by all residents of the neighborhood. The scale of the proposed development is illustrated in Figure 3.10. The development is relatively small scale, because it is intended to meet the needs of the neighborhood residents and not attract much external traffic. Because Underwood Street is currently a residential street, implementing this proposal would mean clearing some residences and building the multi-story mixed-use buildings.

2. Case Study B: Schuyler Avenue

   Schuyler Avenue forms the northern border of the neighborhood. It is currently a mainly commercial strip, with a variety of small-scale, low-density commercial businesses, such as a bowling alley and an automobile dealer. Because Schuyler Avenue is located close to US 52, a major 4-lane arterial, and has potential for attracting external traffic into the neighborhood, the proposed developments would be on a larger scale than in the previous case study on Underwood Street. The scale of development proposed is as shown in Figure 3.11. Minimal relocation would be required because of its current status as a commercial area.

3. Case Study C: Greenbush Street

Greenbush Street forms the southern boundary of the neighborhood and passes through a struggling commercial area to the east of the neighborhood. The proposed development would locate medium-scale multi-story mixed-use buildings along Greenbush Avenue to reinforce and enhance currently existing businesses and attract trips from outside the neighborhood. The proposed scale of development is illustrated in Figure 3.12.

After discussing the proposed case studies, the survey participants were provided with a map and asked to discuss and nominate, as a group, locations that they thought would be best suited to the form of developments proposed in the case studies.

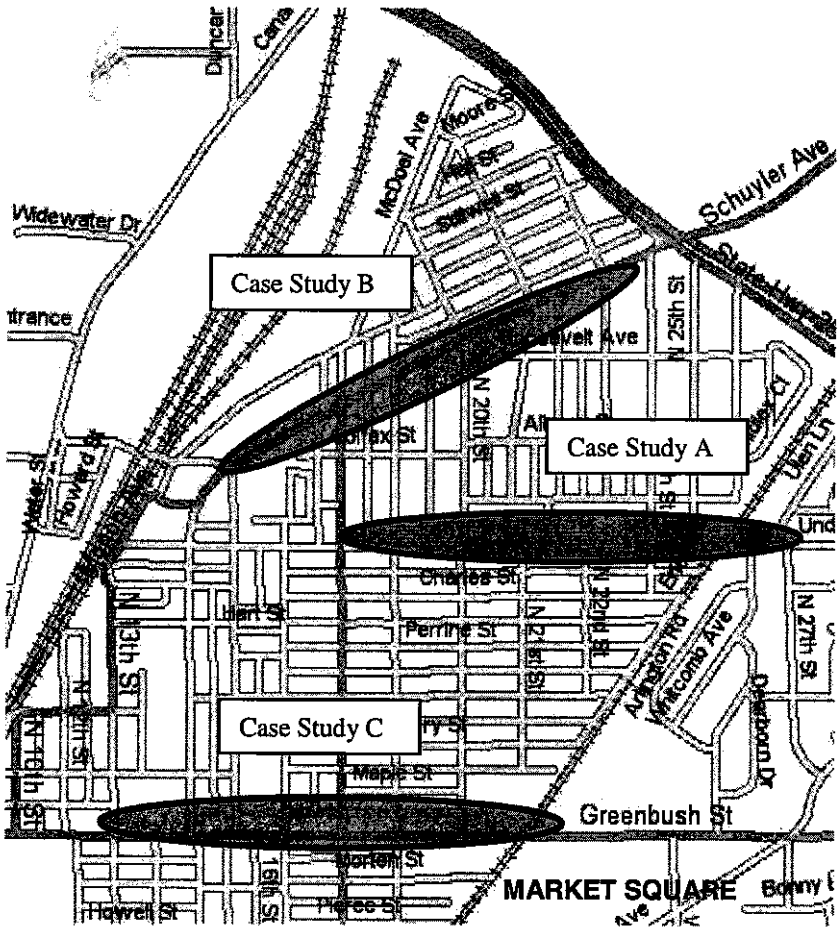

Figure 3.9 Location of Proposed Case Studies

Figure 3.10 Example of Scale of Non-Residential Development for Case Study A

Figure 3.11 Example of Scale of Non-Residential Development for Case Study B

Figure 3.12 Example of Scale of Non-Residential Development for Case Study C

3.3. Survey Results

Detailed results of the survey are shown in Appendix B. A summary of the results is given in the following sections.

3.3.1. Nominal Group Process Results

The results of the nominal group process showed that the residents of the St. Lawrence-McAllister neighborhood were very satisfied with the fact that there was a variety of land uses, such as churches, schools, retail and hospitals within close proximity to the neighborhood. This is despite the fact that most of them were not actually located within walking distance in the neighborhood, but rather on the fringes of the neighborhood, within close driving distance. New infrastructure improvements to the neighborhood, such as new sidewalks and curbs, were also cited as one of the best attributes of the neighborhood. Finally, most residents liked the fact that the existing neighborhood was a quiet, friendly neighborhood, reflecting the elusive sense of community whose demise has been lamented by New Urbanists.

The residents participating in the survey indicated that changes they would like to see include additional infrastructure improvements with regards to traffic control and sidewalks, enhancing pedestrian convenience, and increasing the traffic control devices in order to slow down current traffic in the neighborhood. Another major point of contention among the residents was the existence of high-density residences, mainly apartment units for rent, which were identified as very undesirable in the neighborhood. Higher home ownership was cited as a change many residents would like to see. This probably reflected the presumption that residents in rental units would take less interest in the well-being of the community, due to the lack of vested interest that comes with owning a part of the neighborhood. The survey respondents expressed the opinion that residents in the neighborhood's high-density rental units have had a negative influence on the community.

3.3.2. Land Use Preference Survey Results

The average scores of the land use preference survey are shown in Figure 3.13. Churches obtained the highest average score with a score of 5.0 on a scale of 1 to 5, with 1 being the least desirable land use and 5 being the most desirable land use. Liquor stores obtained the lowest

score of 1.6. These were not unexpected results. The presence of a church is generally viewed as a positive influence in a community, whether or not one attends that (or any) church, while liquor stores have a notoriously bad image. An interesting result of the survey was that land uses that were more likely to be frequented on a regular basis, such as a grocery store or restaurant, received higher ratings than less-frequented 'benign' land uses, such as an insurance sales office. This suggests a relationship between the frequency of trips taken and the desirability of a particular land use within a neighborhood.

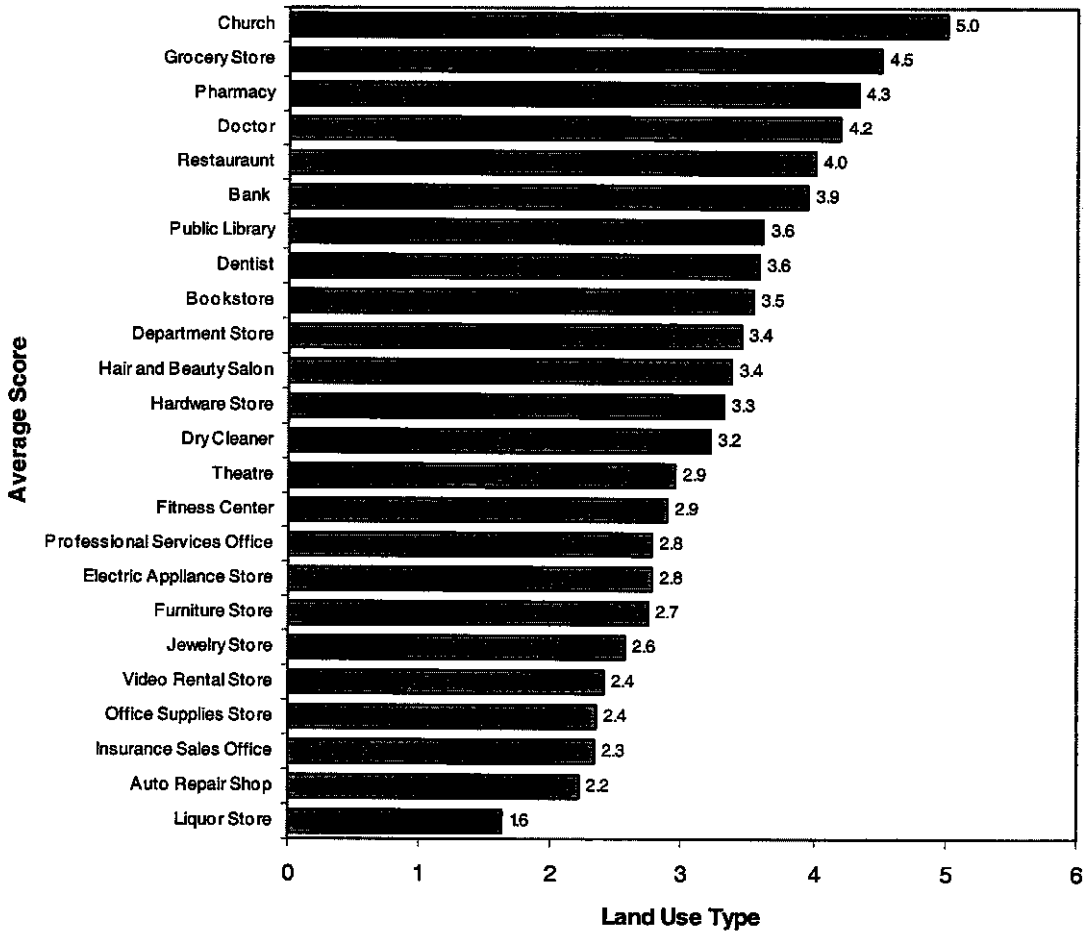

Figure 3.13 Average Scores in Land Use Preference Survey

3.3.3. Case Study Discussion Results

The first proposed case study, with development on Underwood Street, met with the most resistance and was clearly rejected by the majority of the residents participating in the survey. The residents considered the proposed development incompatible with the surrounding residential area or stated that it would not be sustainable, given the proximity of existing commercial businesses at the fringes of the neighborhood. In terms of accessibility, despite the proposed location of the proposed development at the center of the neighborhood, most residents stated that they would not consider non-motorized forms of transport to the development, although it was unclear whether they were against the idea of walking or cycling to the proposed development, or whether they were against the development itself. The increase in traffic and density, although expected to be minimal, was also seen to compromise the nature of the neighborhood.

Response towards the second case study, which proposed developments along Schuyler Avenue, was slightly more positive, because of its current status as a commercial strip and its location at the edge and not the center of the neighborhood. Interestingly enough, most residents would still not consider other forms of non-motorized transportation to access this location. At the same time, they are resistant towards any potential increase in traffic as a result of the development. Increase in residential density at this location was met with disapproval, though not as strongly as in the case of the previous case study. Overall, this proposed development was generally considered to be the best option of the three.

The third case study, which proposed developments along Greenbush Street, was generally rejected. Residents preferred to reinforce the businesses that are currently located at Market Square, a low-density commercial strip at the southeastern corner of the neighborhood. (See Figure 3.9.) Most residents stated that they would not consider alternative forms of transportation to this location and that additional traffic along Greenbush Street was highly unwelcome. The preexisting levels of traffic on Greenbush were perceived as high enough. A large majority of the residents also rejected the idea of increasing residential density along Greenbush Street.

When asked to identify potential areas for development, residents picked Schuyler Avenue and the existing Market Square area as their locations of choice, in line with their previous responses to the case studies presented. A few residents also identified locations outside

their neighborhood, such as on the other side of US 52 (a major four-lane arterial on the northeast boundary of the neighborhood), where an industrial zone could be converted into a neighborhood mall.

3.4. Lessons Learned

From the results of the neighborhood survey and the market analysis, it can be seen that the implementation of New Urbanist-style developments in neighborhood revitalization efforts faces significant community resistance. The New Urbanist ideal of a diverse mixed-use, mixed-income neighborhood was not seen as a desirable pattern of land use development.

The survey showed that people simply do not warm to the idea of having non-residential land uses in the center of their neighborhood, citing issues of incompatibility and traffic. However, similar land uses at the neighborhood periphery, are acceptable. Furthermore, even if such land uses were located within walking or cycling distance, people have become so accustomed to, and dependent on, their vehicles that they might still choose the automobile as their preferred mode of travel, no matter how long or short the trip.

In an informal survey conducted at the end of the neighborhood meeting, some participants said that they would shop at Payless (a nearby grocery store) for a gallon of milk, but would go to Wal-Mart (a big-box retailer located about 3 miles away) for a week's worth of groceries. This implies that, even with the convenience of having non-residential land uses nearby, people might still opt to travel further distances for the same services in search of lower prices, greater variety and other factors.

A more delicate issue is the goal of achieving a neighborhood with a diverse representation of people of all income classes. From the neighborhood survey conducted, it became extremely clear that the introduction of more high-density residential dwellings in the neighborhood was not only undesirable, but would be strongly opposed by the current residents of the neighborhood. Higher density residences were associated with lower income families, which are perceived to introduce undesirable social problems to the neighborhood. This is not an uncommon reaction. Jane Jacobs, in her book, *The Death and Life of Great American Cities* (1961), succinctly articulates the general impression towards high-density residences by saying,

"High density dwellings have a bad name in orthodox planning and housing theory. They are supposed to lead to every kind of difficulty and failure."

The utopian ideal of achieving optimal social balance in carefully designed neighborhoods is very promising in theory. Few people will object to noble goals such as the integration of diverse social classes, especially if it is happening to other people. However, when it becomes a matter of "my house", "my family", "my neighborhood", and "my children", people are apt to forget such ideals.

In conducting the survey, one of the researchers' major concerns was whether or not all facets of the St. Lawrence-McAllister community were adequately represented by attendees at the neighborhood meeting where the survey was conducted. Although the neighborhood has (according to Census data) a larger proportion of the elderly than compared to the age distribution of the county (see Figure 3.7), it seemed that a very large fraction of attendees at the meeting were older residents. This could result in misrepresentations of neighborhood preferences. For example, in the survey of desirable land uses, the liquor store was found to have the lowest average score of 1.6. If the survey had been conducted in a predominantly college-age crowd, the results might have been different. However, it is also likely that people who attend neighborhood meetings and participate in neighborhood activities are probably the same people who would be the most vocal in voicing their concerns should any modifications to the neighborhood be proposed.

CHAPTER 4. MARKET ANALYSIS

4.1. Retail Market Analysis

The City of Lafayette, Indiana, commissioned a downtown revitalization study that was conducted by HyettPalma Inc., a consulting firm specializing in the economic enhancements of downtowns and older business districts. As part of the Downtown Action Agenda that was produced as a result of this study, a downtown market analysis was carried out to assess the economic potentials of Downtown Lafayette in terms of retail, office and housing. The steps used by HyettPalma in analyzing the retail market (Urban Revitalization Website 2003) can be summarized as follows:

1. Define retail trade area, which is the geographic area from which the majority of retail customers are currently drawn.
2. Inventorize all retail establishments of businesses in the trade area, including square footage and Standard Industrial Classification (SIC) codes.
3. Survey consumers and assess downtown conditions using a qualitative technique.
4. Calculate sales leakage based on sales per household per year. Statistics available from the U.S. Department of Commerce
5. Calculate sales potential for downtown, based on square footage of various business types and median sales per square foot.
6. Calculate the potential for new floor area expansion based on leakage and current sales.

Such methods of retail market analysis have generally been used for downtown retail markets which are of higher density,= and tend to attract a significant number of trips that originate outside downtown (i.e., external trips). However, a slightly modified method can be used to determine the retail potential of a neighborhood, with the goal of ultimately attaining a self-sufficient neighborhood with a retail area that will attract primarily trips that originate within the neighborhood. As mentioned in previous chapters, the "Achilles Heel" of New Urbanist

neighborhoods to date has been its inability to attract and sustain economically viable retail establishments (New Urban News 2000, Marshall 2000).

The revised retail market analysis, also known as the Consumer Expenditure-based Market Analysis, is as follows:

1. Determine catchment area containing households expected to support businesses.
2. Apply proposed residential density modifications to the neighborhood and determine total number of households in catchment area by income category.
3. Determine annual household expenditure and average annual sales for each retail category.
4. Determine number of establishments that can be supported by households in catchment area.

In some cases, consumer expenditure categories were too broad to translate into categories of establishments. In these cases, the numbers of establishments supported by a catchment area were determined using a simpler method, the Household-based Market Analysis. The steps involved in this method of analysis are:

1. Determine catchment area containing households expected to support businesses.
2. Apply proposed residential density modifications to the neighborhood and determine total number of households in catchment area.
3. Determine number of establishments per household by type at the state level. State level economic data are used because data for some categories are withheld at the county level in order to avoid disclosure.
4. Factor the number of establishments per household by the annual household income at the county level divided by annual household income at the state level.
5. Determine number of establishments that can be supported by households in catchment area.

Based upon the results of the Land Use Preference survey in Section 3.3.2, a market analysis of "desirable" land uses was carried out to determine whether such land uses can be supported if modifications to the residential density of the neighborhood were made. Because the rating of land uses were carried out based on a scale of 1 to 5, any land use category that received an average score of 2.5 and above was considered 'desirable'. Three target residential densities—5, 7 and 10 households per acre – were examined. These density values fall within the range of

typical New Urbanist neighborhoods (McLaughlin 1996, Calthorpe 1993). Table 4.1 shows the calculation results of required increases in the number of households in order to achieve the desired densities.

Table 4.1 Increase in Number of Households Required to Achieve Target Densities

Target Density (HH per acre)	Target No. of Households	Increase in Households
5	1664	394
7	2330	1060
10	3329	2059

4.2. Data Preparation for Market Analysis

4.2.1. Defining Catchment Areas

The catchment area is defined as the area contained within a 0.5 mile radius of the location of retail establishments. The 0.5 mile radius was chosen based upon the New Urbanist criteria of having the neighborhood edges be one-quarter mile away from the center of the neighborhood (where retail is generally located), and taking into account the fact that residents slightly beyond the quarter-mile radius will also frequent such areas. From the results of the survey as described in Section 3.3.3, Schuyler Avenue was identified as an acceptable location for development. Hence a market analysis will be carried out for a defined catchment area along Schuyler Avenue (see
Figure 4.1).

The northern portion of the Schuyler Avenue catchment area is mostly either undeveloped or vacant. The catchment area also covers a majority of the St. Lawrence-McAllister neighborhood, the much smaller Monon neighborhood to the north of Schuyler Avenue, and little else outside. Therefore, for the purposes of this analysis, any retail or commercial businesses will be supported primarily by the residents within the St. Lawrence-McAllister neighborhood.

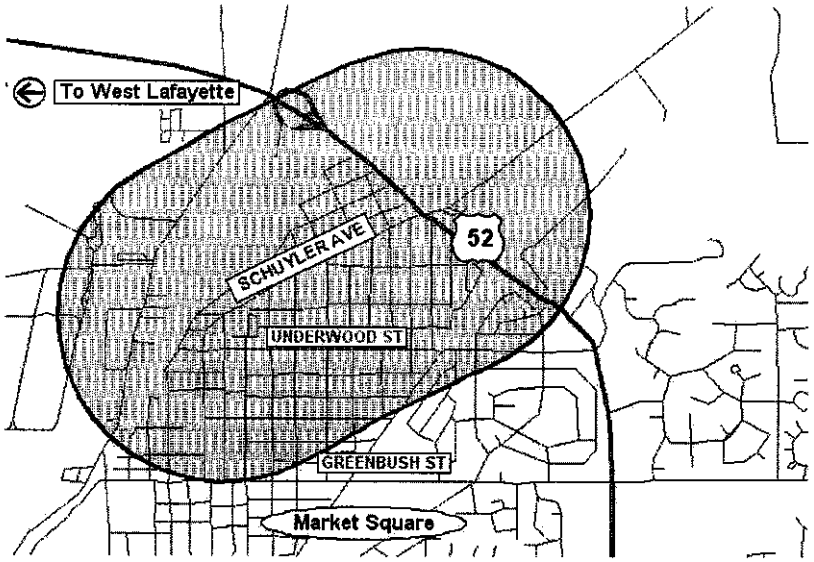

Figure 4.1 Catchment Area for Schuyler Avenue Market Analysis

4.2.2. Catchment Area Demographic Data

The neighborhood was modified in order to achieve the predefined target densities by increasing the number of households within the neighborhood. Table 4.2 shows the total number of households in the modified neighborhoods by income level. However, areas within the catchment boundaries, but outside the neighborhood boundaries do not experience a change in households. Table 4.3 shows the income distribution for households in the entire catchment area, including the modified neighborhood.

Table 4.2 Catchment Area Household Income Distribution

Income Category	Percent Households	No. of HHs for Modified Neighborhood Densities		
		5 HH/acre	7 HH/acre	10 HH/acre
<$10K	4.17	69	97	139
$10K-$15K	8.03	134	187	267
$15K-$25K	16.85	280	393	561
$25K-$35K	21.26	354	495	708
$35K-$50K	22.13	368	516	736
$50K-$75K	17.56	292	409	584
$75K-$100K	7.09	118	165	236
$100K-$150K	1.50	25	35	50
$150K-$200K	0.31	5	7	10
> $200K	1.10	18	26	37
TOTAL	100	1664	2330	3329

Table 4.3 Number of Households in Catchment Area with Modified Neighborhood Densities

	Total HHs in Catchment Area for Modified Neighborhood Densities		
Density in HH/acre	5 HH/acre	7 HH/acre	10 HH/acre
<$10K	73	101	142
$10K-$15K	139	192	272
$15K-$25K	318	431	599
$25K-$35K	391	533	745
$35K-$50K	403	551	772
$50K-$75K	328	445	621
$75K-$100K	143	190	261
$100K-$150K	36	46	61
$150K-$200K	7	9	12
> $200K	19	26	37
TOTAL	1858	2524	3523

4.3. Consumer Expenditure-based Market Analysis

For the Consumer Expenditure-based Market Analysis, national consumer expenditure data, from the 2001 Consumer Expenditure Survey broken down by income categories were obtained from the Bureau of Labor Statistics (BLS 2003). They are shown in Table 4.4. Economic retail sales data for Tippecanoe County, shown in Table 4.5 for the corresponding consumer expenditure categories, were obtained from the 1997 Economic Census (Economic Census 2003).

Table 4.4 National Consumer Expenditure Data

	Annual Household Expenditure ($)						
Income Category	Grocery and Household Supplies	Food Away From Home	Liquor	Furniture and Home Furnishing	Health and Personal Care	Amusement and Recreation	Books
<$10K	2212	1181	254	185	360	185	75
$10K-$15K	2480	1039	227	203	780	149	104
$15K-$20K	2770	1315	214	216	681	171	108
$20K-$30K	3521	1692	294	320	660	338	138
$30K-$40K	3708	1949	360	354	560	362	140
$40K-$050K	4111	2470	486	438	623	462	169
$50K-$70K	4498	3167	414	680	518	709	219
> $70K	5870	4154	684	1154	592	1509	294

Source: BLS 2003

Table 4.5 Economic Retail Trade Data for Tippecanoe County (Economic Census 2003)

Retail Trade Sector	Average Annual Sales per Establishment ($/yr)
Grocery Stores/ Supermarkets	8,003,000
Food service and drinks	660,292
Beer wine and liquor	856,714
Furniture and home furnishing	892,700
Health and personal care	1,270,417
Amusement and recreation	752,356
Bookstore	1,881,769

Source: Economic Census 1997

It is then possible to determine the number of establishments that can be supported by a given number of households in a catchment area, using the relationship shown in Equation 4.1.

$$EST_i = \Sigma (HHEXP_j * TOTHH_j) / AVGSALE_i \quad (4.1)$$

where EST_i = Units of Establishments of Type i

$HHEXP_j$ = Annual Household Expenditure for Income Category j

$TOTHH_j$ = Total Households in Income Category j

$AVGSALE_i$ = Average Annual Sales for Establishment Type i

The results of market analysis using this approach are shown in Table 4.6. A sample calculation of the method is shown in Figure 4.2.

Table 4.6 Number of Establishments Supported in Schuyler Avenue Catchment Area using Consumer Expenditure-based Market Analysis

	No. of Establishments Supported for Modified Neighborhood Densities		
Retail Trade Sector	5 HH/acre	7 HH/acre	10 HH/acre
Grocery Stores/ Supermarkets	0.8	1.2	1.7
Foodservice and drinks	5.9	8.1	11.5
Beer wine and liquor	0.8	1.1	1.6
Furniture and home furnishing	0.9	1.3	1.8
Health and Personal Care	0.9	1.2	1.7
Amusement and recreation	1.2	1.7	2.4
Bookstore	0.2	0.2	0.3

SAMPLE CALCULATIONS FOR CONSUMER EXPENDITURE-BASED MARKET ANALYSIS

1. *From Census Data, Consumer Expenditure Data, and Economic Census, obtain:*

   No. of HHs by income categories at the census block level

   Annual HH expenditure by income category of HH and type of expenditure

   Average Annual Sales per establishment by type of establishment

2. *Find no. of households if the neighborhood were modified to achieve specific target densities:*

   Area of Neighborhood = 0.52 mi = 332.8 acres

   Current No. of HHs in Neighborhood = 1270 HH

   Assume that modified neighborhood target density is 5 HH/ acre:

   No. of HH in modified neighborhood = 5 HH/acre * 339.2 acres = 1664 HH

   Assume that HH income distribution of modified neighborhood remains unchanged (see Figure 3.6):

   No. of HH with income < $10K = (% HH with income < $10K) * (Total HH in modified N'hood)

   = 4.16% * 1664 HH = 69 HH

   ∴ Obtain no. of HH by income category for modified neighborhood

3. *Determine no. of households within catchment area*

   No. of HH within unmodified catchment area = 1464 HH (from geographic overlay in TransCAD)

   No. of HH within unmodified catchment area, but not in neighborhood = 1464 – 1270 = 194 HH

   Assume income distribution for HH within catchment area but not in neighborhood remains unchanged:

   No. of HH with income < $10K in catchment area but not in neighborhood = 4 HH

   Total no. of HH for modified catchment area = 69 + 4 = 73 HH

   ∴ Obtain no. of HH by income category for entire catchment area

4. *Determine total neighborhood demand for goods*

   For consumer expenditure category "Food Away From Home":

   From Consumer Expenditure Survey, for HH with income <$10K:

   Average annual expenditure = $1181 per HH

   Total N'hood Demand = No. of HH in Income Category * Annual Expenditure

   = 73 HH * $1181/ HH = $86,213

   For all income categories:

   Total N'hood Demand

   = Demand for HH with income <$10K + ... + Demand for HH with income >$70K

= $86,213 + … + $1,205,754 = $3,889,950

∴ Obtain neighborhood demand for specific consumer expenditure categories

5. *Determine no. of establishments that can be supported by neighborhood demand*

For consumer expenditure category "Food Away From Home":

From Economic Census, for establishment type "Foodservice and Drinking Places":

Average Annual Sales per unit establishment = $660,292/ unit.

Units of establishments supported by Neighborhood Demand

= Neighborhood Demand / Average Annual Sales per unit establishment

= $3,889,950 / $660,292 per est = 5.9 unit

∴ Units of establishments that can be supported by the neighborhood

Figure 4.2 Sample Calculations for Consumer Expenditure-based Market Analysis

4.4. Household-based Market Analysis

In the Household-based Market Analysis method, the number of establishments per households is determined for the state level and then factored to account for the income differences. The number of establishments that can be supported by the households in the catchment area can be determined by using the relationship shown in Equation 4.2.

$$EST_i = EST\_HH_i * COU\_INC / ST\_INC * TOTHH \quad (4.2)$$

where EST_i = Units of Establishments of Type i

EST_HH_i = Units of Establishments of Type i per HH at the State Level

COU_INC = Average Household Income at the County Level

ST_INC = Average Household Income at the State Level

$TOTHH$ = Total No. of HH in Catchment Area

The number of establishments that can be supported by the neighborhood using the Household-based Market Analysis is shown in Table 4.7. A sample calculation for the method is shown in Figure 4.3.

Table 4.7 Number of Establishments Supported by Catchment Area using Household-based Market Analysis

Type of Establishment	Units per 1000 HH	Apply Income Factor	No. of Establishments Supported for Modified Neighborhood Densities		
			5 HH/ acre	7 HH/ acre	10 HH/acre
Building Material & Equipment	1.07	0.91	1.62	2.24	3.17
Clothing and accessories	1.25	1.06	1.89	2.61	3.69
Commercial Banking	0.87	0.74	1.31	1.82	2.57
Electronics and Appliances Store	0.41	0.35	0.62	0.86	1.22
Movie Theatre	0.07	0.06	0.10	0.14	0.19
Personal and Laundry Services	1.65	1.40	2.50	3.50	4.90
Pharmacy/ Drugstore	0.73	0.62	1.10	1.51	2.14
Public Library	0.01	0.01	0.01	0.02	0.03
Sporting Goods and Hobbies	0.65	0.55	0.98	1.35	1.91

SAMPLE CALCULATIONS FOR HOUSEHOLD-BASED MARKET ANALYSIS

1. *From Census Data and Economic Census, obtain:*
   No. of HHs at the State and County level
   Units of Establishments by type at the State Level

2. *Find no. establishments per household at the State level.*
   For establishment type "Commercial Banking":
   Units of establishments in Indiana State = 2034 units.
   No. of HH in Indiana State = 2,336,306 HH
   Units of establishments per 1000 HH = 2034 / (2,336,306 / 1000) = 0.87 units per 1000 HH
   ∴ Obtain units of establishments per 1000 HH for each establishment type

3. *Apply income factor.*
   Indiana State Average Household Income = $52,229 per yr
   Tippecanoe County Average Household Income = $44,339 per year
   Income factor = $44,339 / $52,229 = 0.8489

Factored No. of establishments per 1000 HH = 0.87 * 0.8489 = 0.74 per 1000 HH

∴ Obtain factored units of establishments per 1000 HH for each establishment type

4. *Determine no. of establishments supported by catchment area*

For establishment type "Commercial Banking" and from previous sample calculation (Figure 3.15):

No. of HH in catchment area with modified neighborhood density of 5 HH/acre

= 194 + 1664 = 1859 HH

No. of establishments supported = 0.74 units per 1000 HH * 1858 HH / 1000 = 1.31 units

∴ Obtain units of establishments supported by catchment area

Figure 4.3 Sample Calculations for Household-based Market Analysis

4.5. Discussion of Results

The results of the market analysis (see Table 4.6 and Table 4.7) are expressed in numbers of establishments that have non-integer values. For example, in Table 4.7, the number of bookstores that can be supported by a low neighborhood household density (by New Urbanist standards) of 5 households per acre is 0.2 bookstores. This implies that the neighborhood cannot support an economically viable bookstore. This does not mean that a bookstore (or establishments like it) cannot be situated in the neighborhood, but rather that a majority of its revenue would have to come from retail traffic that does not originate in the neighborhood.

As expected, the number of retail establishments that can be supported by the neighborhood increases with density. However, not all desirable establishments (see Section 3.3.2 Land Use Preference Survey) can be supported by the neighborhood, even at high residential densities. Some undesirable establishments, such as liquor stores, could have been supported at higher densities, but were not included in the subsequent analyses because their presence was not perceived by residents as being welcome.

The results of the market analysis indicate that the densities required to allow a significant number of establishments to be economically viable are still relatively high. Furthermore, this analysis was based upon the important assumption that the households in the catchment area fulfill their demand for goods only at establishments within the neighborhood and

not at competing establishments outside. For example, in the St. Lawrence-McAllister neighborhood, achieving a density of 5 households per acre, a density threshold still considered low by New Urbanist standards, would mean the introduction of 394 new households. (See Table 4.1.) Apart from a major restructuring of the neighborhood, this can only be achieved by introducing high-density dwelling units into the neighborhood, something unacceptable to the current residents of the neighborhood. At lower densities, the number of non-residential establishments that can be supported is very limited. This poses a problem, because it is necessary to have a mix of land uses to ensure the economic viability of non-residential establishments. To illustrate this point, imagine that a pharmacy is the sole retail business to be located within the neighborhood. Although some people would clearly appreciate its proximity, many others would travel farther to Wal-Mart to buy not only their prescription drugs but also to make other purchases at the same time.

Determining the economic viability of neighborhoods based upon the method of market analysis outlined previously is not without its deficiencies. Among them are:

1. *Size of establishments*

   Because calculations were made based on a national consumer expenditure and statewide employment data, these are aggregate values and do not reflect the fact that a larger establishment will require a larger number of households to support it or vice versa.
2. *Multi-good Retailers*

   The analysis assumes that each establishment is not in competition with one another. This means that there is no overlap between the types of goods and services between establishments or no establishments offer the same kind of goods or services as any other establishment. Strictly speaking, this may not be a valid assumption because some establishments, such as a supermarket, typically offer a variety of goods that overlap with other types of establishments, such as a pharmacy or a liquor store.
3. *Constraints of Catchment Area*

   The catchment area-based analysis assumes that *all* households within the catchment area support the establishments and do not shop elsewhere. This method of analysis also assumes that households outside the catchment area will not shop within the neighborhood. However, in real life, households within the catchment area will not necessarily decide to frequent only the establishments within their neighborhood to fulfill their needs. This "loss" of support can

be balanced by the fact that some households from outside the catchment area will frequent these neighborhood establishments.

4. *Agglomeration of Businesses*

   The market analysis does not account for the need of some businesses to be located in proximity to complementary or similar businesses. For example, it is common to find clothing establishments grouped together within a certain area, such as a shopping mall.

In spite of these factors, the market analysis is useful in providing a broad overview of the economic viability of non-residential land uses in a neighborhood.

CHAPTER 5. ANALYSIS OF NEIGHBORHOOD TRAVEL PATTERNS

The standard four-step sequential process was used to analyze changes in travel patterns, caused by changes in population density and the reconfiguration of land uses within a neighborhood. These are the two main premises of New Urbanist neighborhoods. The four-step approach, also known as the Urban Transportation Modelling System (Meyer 2001), predicts the number of trips made within an identified area and yields a predicted set of origin-destination flows by trip purpose as its final product. It consists of steps as shown in Figure 5.1.

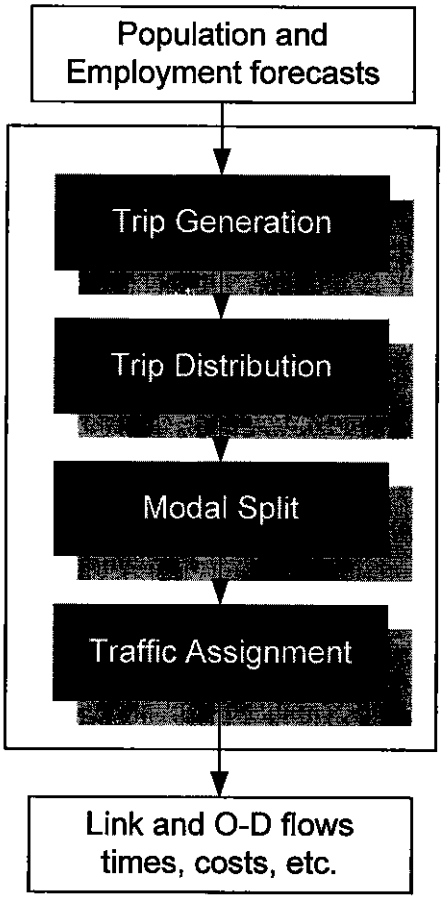

Figure 5.1 The Four-Step Travel Demand Modeling Process (Meyer 2001)

The four-step process has received criticism for its faults, including its failure to integrate trip distribution and mode choice, and its use of linear regression for trip generation (Oppenheim 1995). In spite of this, the four-step process was selected as the travel demand model of choice because it is widely accepted as a standard modeling tool used by the majority of transportation planning agencies around the world and requires a reasonable amount of data.

5.1. Data Sources

The Tippecanoe County Area Planning Commission (APC) uses the four-step approach for its transportation planning purposes. Hence, the basic model network and inputs that were obtained for the purpose of this analysis consist of actual modeling data that are used by the APC. The study area includes all of Tippecanoe County in Indiana, and covers an area of approximately 500 square miles. The model obtained consisted of 199 Traffic Analysis Zones (TAZs) and 30 external stations with 55,226 households (including households in the St. Lawrence–McAllister neighborhood) as shown in Table 5.1.

In the network obtained from the Area Planning Commission, the St. Lawrence-McAllister neighborhood was represented by five traffic analysis zones. For the purpose of this analysis, the five zones were broken up into 97 smaller zones consistent with the smallest unit of analysis available in Census data, the census block. The neighborhood has an area of approximately 0.52 square miles with almost all the 1,270 households located within the catchment area as defined in Section 4.2.1. The layouts of the TAZs for the entire study area and the neighborhood are shown in Figure 5.2.

Table 5.1 Tippecanoe County and St. Lawrence-McAllister Neighborhood Characteristics

	Tippecanoe County	Neighborhood
Households	55,226	1270
No. of TAZs	Original=199 → Modified=291	Original=5 → Modified=97
Area	499.8 sq. miles	0.52 sq. miles

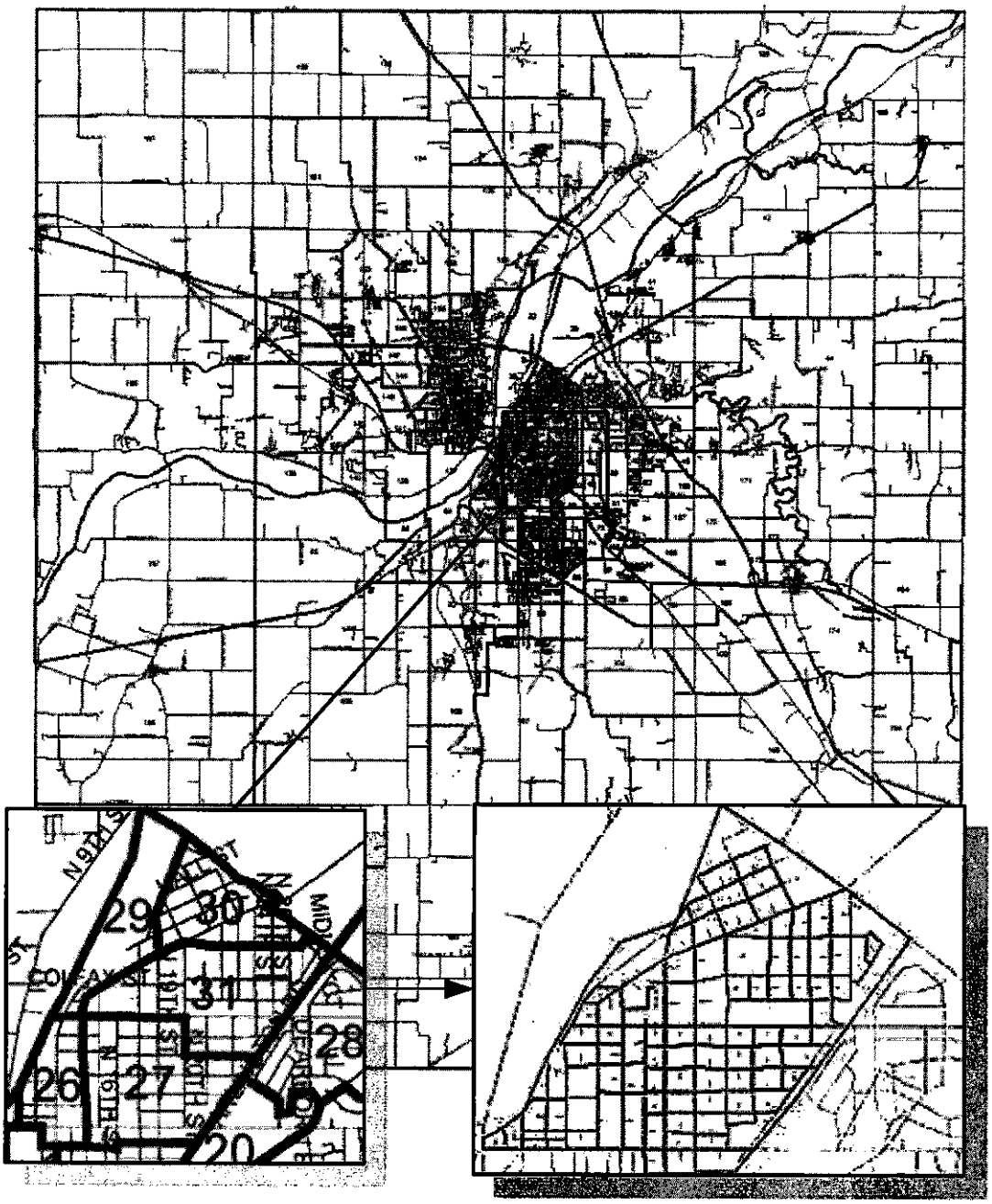

Figure 5.2 Study Area and Neighborhood Traffic Analysis Zones

5.2. Model Preparation for Analysis of Scenarios

Four different scenarios will be analyzed using the four-step process, the "Base Case" or the existing St. Lawrence- McAllister neighborhood, and four additional cases of varying neighborhood household densities and employment. Scenario formulations involved modifications to the neighborhood and were based on the results of the market analysis from Sections 4.3 and 4.4. Table 5.2 provides a description of the scenarios that were formulated for analysis. The scenarios differ from one another in the following aspects:

1. Number of households and household density
2. Number of non-commercial establishments and employment
3. Configuration of land uses

Table 5.2 Description of Scenarios Formulated

Scenario	HH† in N'hood	HH† not in N'hood	Density	No. of Non-residential units in N'hood	Description
A	1270	56015	3.8	0	Current neighborhood. All non-residential land uses removed.
B	1270	56015	3.8	38	Current neighborhood. Locations of existing non-residential land uses, which are currently scattered, remain unchanged.
C	1664	55621	5.0	47	Modified neighborhood. Non-residential land uses and additional households grouped.
D	2330	54955	7.0	52	Modified neighborhood. Non-residential land uses and additional households grouped.
E	3329	53956	10.0	62	Modified neighborhood. Non-residential land uses and additional households grouped.

† *Households*

The number of households increased by 2,059 from Scenario B (the current neighborhood) to Scenario E (the modified neighborhood with a density of 10 households per acre). Non-residential establishments increased by 24 units across Scenario B to E. The average number of households per unit increase in non-residential establishments is 86 households. This means that on average, 86 new households are required to support each additional non-residential establishment. This shows that there must be a large increase in residential density in order to allow significant increases in the number of non-residential establishments that the neighborhood can support. The following sections describe in greater detail the modifications made to the neighborhood.

In Scenarios C through E, a Neighborhood Commercial Cluster was formed within the neighborhood along the central portion of Schuyler Avenue. Currently, this location contains scattered businesses located on large lots (Figure 3.2), so converting such establishments into higher density mixed-use buildings would not require extensive demolition. Initially, a proposed alternative to the Neighborhood Commercial Cluster was to line the entire boundary of the neighborhood with mixed-use buildings to form a commercial edge. However, an analysis of the edge concept showed that this proposed design was not feasible, due to the large number of establishments that would be required to form the edge (Appendix C).

5.2.1. Residential Land Uses

5.2.1.1. Residential Land Uses at the County Level (Entire Study Area)

The number of households for Scenarios A and B reflect the actual number of households found in the neighborhood. In Scenarios C, D and E, the number of households increase to 1,664, 2,330 and 3,329 households, respectively, in order to achieve target neighborhood densities. Scenario E experienced the largest increase with a total of 3,329 new households, or 2,059 more households than in Scenario A or B. The total number of households in the county for Scenario E is 57,285 households.

In order to allow a basis of comparison between the scenarios, the "growth" occurring in Scenario E must also be represented in other scenarios. Thus, a control total of 57,285 households, the total number of households for the entire county in Scenario E, was established for all the scenarios, with a randomly assigned location for each new household. For example, in Scenario A or B, no additional households were located within the neighborhood, but 2,059 new households were randomly assigned locations outside the neighborhood to bring the total number of neighborhoods within the county to 57,285 households.

5.2.1.2. Residential Land Uses at the Neighborhood Level

Within the neighborhood, Scenario A involved no changes to the residential land uses. In that scenario, changes were made only to non-residential land uses and are described in the following section. The second scenario, Scenario B, describes the current status of the neighborhood in terms of both residential and non-residential land uses (Figure 5.3), and the density and configuration of households remain unchanged.

In order to achieve the target residential densities in the remaining three scenarios, new households had to be introduced into the neighborhood. These new households were assumed to take the form of New Urbanist-style apartments above retail or business establishments. These buildings were located within the Neighborhood Commercial Cluster (Figure 5.4).

In the process of formulating the scenarios, efforts were made to modify the neighborhood in a way that its implementation in real life would be feasible. Additional households are needed to support an economically viable New Urbanist-style retail/ commercial center. There are two alternatives available. The first is to drastically change the current housing stock in the neighborhood through demolition and reconstruction. The second is to increase housing in the form of high-density residential units in the new commercial clusters with minimal modification to current land uses. In light of the alternatives available, increasing density by the second method is less disruptive and costly.

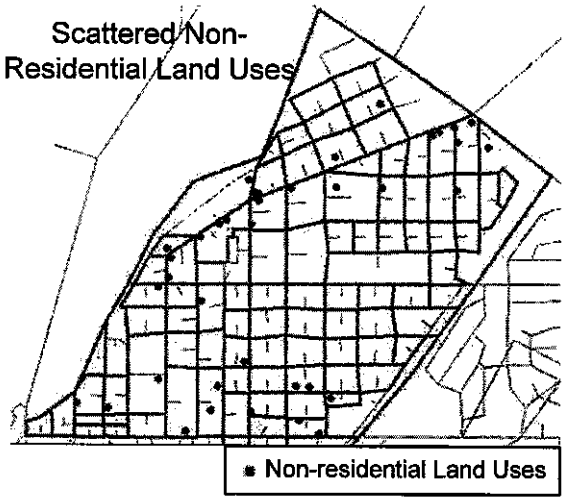

Figure 5.3 Scenario B: Original Neighborhood in which Non-residential Land Uses are Scattered

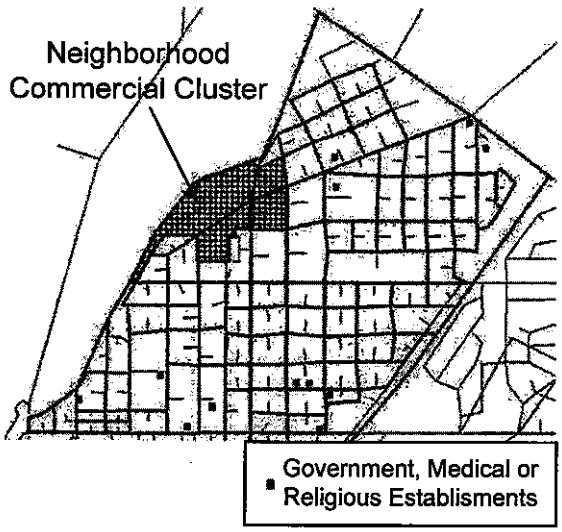

Figure 5.4 Scenario C, D and E: Modified Neighborhood with Distinct Neighborhood Commercial Cluster

5.2.2. Non-residential Land Uses

5.2.2.1. Non-residential Land Uses at the County Level (Entire Study Area)

In Scenario A, all non-residential land uses are removed from the neighborhood, while in Scenario B the status quo is maintained. Subsequent scenarios involve increases in the number of non-residential land uses as household densities increase. Scenario E has the greatest increase, with 24 additional neighborhood establishments in the neighborhood (see Table 5.4). In order to establish a basis of comparison between the scenarios, the total number of attractions (destinations) within the entire study area remains constant for all scenarios. The difference between the number of neighborhood establishments in a given scenario and Scenario E are assigned random locations throughout the study area outside the neighborhood. For example in Scenario A, because there are no establishments in the neighborhood, 62 establishments like those found in Scenario E were randomly assigned locations within the study area, but outside the neighborhood zones. In Scenario B, because there are 38 establishments in the neighborhood, the 24 excess establishments that were in Scenario E, but not in Scenario B, were assigned random locations throughout the study area.

Employment information was not readily available for the businesses, so values were approximated using average employment values from the 1997 Economic Census. The Economic Census provides values of total employment and establishments by business sectors. Where county employment averages were not available, state employment averages were used in their place. Total employment was then compared against values from the Tippecanoe County Planning Commission employment totals for each TAZ and duly adjusted. The average number of employees per establishment is shown in Table 5.3.

Table 5.3 Average Number of Employees by Type of Establishment

Non-residential Land Use Type	Average No. of Employees
Non-commercial Land Uses:	
Cemetery	15
Church	20
Clinic	35
Community Center	63
Elementary School	45
General Light Industrial	88
Hospital	45
Commercial Land Uses:	
Apparel and Accessories Retailer	8
Automotive Repair/ Sales Center	15
Convenience Store	27
Drinking Place	15
Electronics and Appliances	20
Flower Shop	6
Furniture and Home Furnishing Stores	6
Gasoline Station	16
General Service Contractors	20
Grocery Store/ Supermarket	65
Liquor Store	11
Mini-Warehouse	4
Motel	10
Personal Care Services	5
Recreation Center (e.g., bowling alley)	30
Restaurants	24
Sporting Goods and Hobby Stores	6
Bank	16
Pharmacy/ Drugstore	19
Professional Services Office (e.g., law office)	20

Source: Values based on Economic Census 1997 and APC travel demand model

5.2.2.2. Non-residential Land Uses at the Neighborhood Level

In Scenario B, a model of the existing St. Lawrence-McAllister neighborhood, a majority of the non-residential land uses are located adjacent to Schuyler Avenue (Figure 5.3). The remaining non-residential land uses are scattered throughout the neighborhood. A list of non-residential establishments within the neighborhood was obtained from the St. Lawrence-McAllister Neighborhood Association and verified with listings in the Yellow Pages and by site observation. Current non-residential establishments in the neighborhood are shown in Table 5.4.

Table 5.4 Number of Non-Residential Establishments for Each Scenario

Non-residential Land Use Type	Number of Establishments Scenario B	Scenario C	Scenario D	Scenario E
Non-commercial, Educational, Religious and Medical Land Uses:				
Cemetery	1	1	1	1
Church	5	5	5	5
Clinic	1	1	1	1
Community Center	1	1	1	1
Elementary School	1	1	1	1
General Light Industrial	1	1	1	1
Hospital	1	1	1	1
Total	11	11	11	11
Commercial Land Uses:				
Apparel and Accessories Retailer	1	2	3	4
Automotive Repair/ Sales Center	4	4	4	4
Bank	0	1	2	3
Building Material and Equipment	5	5	5	5
Convenience Store	1	1	0	0
Drinking Place	2	2	3	3
Electronics and Appliances	0	1	1	1
Flower Shop	1	1	1	1
Furniture and Home Furnishing Stores	3	3	3	3
Gasoline Station	1	1	1	1
Grocery Store/ Supermarket	0	1	1	2
Liquor Store	1	1	1	1
Mini-Warehouse	1	1	1	1
Motel	1	1	1	1
Personal Care Services	3	3	4	5
Pharmacy/ Drugstore	0	1	1	2
Professional Services Office (e.g., law office)	1	1	1	1
Recreation Center (e.g., bowling alley)	1	1	2	2
Restauraunts	0	4	5	9
Sporting Goods and Hobby Stores	1	1	1	2
Commercial Land Uses Total	27	36	41	51
ALL LAND USES TOTAL	38	47	52	62

In Scenarios C, D and E, most of the pre-existing land uses (i.e., land uses found in the actual neighborhood) were maintained. In order to achieve the New Urbanist design criterion of having a physical center of activities and businesses in the neighborhood, these land uses were assumed to relocate to the Neighborhood Commercial Cluster (see Figure 5.4). However, some land uses were not relocated. These were government, medical, and religious establishments (e.g., schools, hospitals or churches). Such land uses are usually located in larger or established buildings that

cannot be relocated for a variety of practical reasons. Non-residential establishments that can be economically supported by the corresponding increase in densities, as determined from the market analysis in Section 3.3 for each of the scenarios are shown in Table 5.4.

5.3. Modeling the Four-Step Process

5.3.1. Trip Generation

The first step of the four-step process is trip generation (Figure 5.1). Linear regression models are used to predict trip ends, or productions and attractions, generated by a zone. Typically productions and attractions are estimated by trip purposes, such as Home Based Work (HBW), Home Based Other (HBO) and Non-Home Based (NHB) trip purposes.

The Tippecanoe County Area Planning Commission runs its trip generation phase using the Indiana Reference Modeling System, or IRMS (Bernardin et al. 1995). For consistency, the travel demand model analysis was also carried out using the same parameters.

Parameters used for estimating productions values in IRMS were based on the Michiana Area Council of Governments (MACOG) Regional Survey done in 1990 (Bernardin et al. 1995). Total productions were estimated and then allocated to their respective trip purposes by applying trip purpose percentages developed from the same survey (see Table 5.5). Because the population of Tippecanoe County falls in the range of 100,000 to 250,000, values of 30.92%, 41.05% and 28.03% were used to allocate total productions to Home Based Work, Home Based Other and Non-Home Based trip purposes. The equation used for estimating total productions is:

$$2DHH\_P = -3.59856 + 9.4332\ VEH + 2.2514\ HHSIZE \qquad (5.1)$$

Where: *2DHH_P* = Total person-trips per household over a 2-day period
VEH = Average vehicles per household
HHSIZE = Average household size

Because the production equation gave results in units of total person trips over a 2-day period, values of production were divided by 2 to obtain daily productions.

Table 5.5 1990 MACOG Regional Survey Trip Purpose Percentages (Bernardin et al. 1995)

City Size	Home Based Work (HBW)	Home Based Other (HBO)	Non-Home Based (NHB)
50,000 – 100,000	26.92	45.05	28.03
100,000 – 250,000	30.92	41.05	28.03
250,000 – 750,000	30.92	39.05	30.03
750,000 – 2,000,000	25.92	38.05	26.03

Trip attraction equations used in IRMS were taken directly from the National Cooperative Highway Research Program (NCHRP) Report 187 (Bernardin et al. 1995) and are shown as follows:

$$HBW\_A = 1.7\ RET + 1.7\ NONRET \tag{5.2}$$

$$HBO\_A = 10.0\ RET + 0.5\ NONRET + 1.0\ HH \tag{5.3}$$

$$NHB\_A = 2.0\ RET + 2.5\ NONRET + 0.5\ HH \tag{5.4}$$

where: *HBW_A* = Total Home Based Work attractions
HBO_A = Total Home Based Other attractions
NHB_A = Total Non-Home Based attractions
RET = Retail employment in TAZ
NONRET = Non-retail employment in TAZ
HH = Number of households in TAZ

After estimating trip productions and attractions, an iterative "balancing" procedure is carried out. "Balancing" is a systematic scaling of trip attractions so that the sum of all attractions equals the sum of all productions.

5.3.2. Trip Distribution

Trip distribution distributes trip ends predicted in the trip generation phase into the flow of trips between two zones, zone *i* and zone *j*. After this step, the distributed productions and attractions must then be converted into directional origin-destination trips. The trip distribution model used for the purpose of this analysis is the gravity model, which has the form:

$$T_{ij} = P_i \frac{A_j F_{ij}}{\sum_{j=1} A_j F_{ij}} \tag{5.5}$$

where: T_{ij} = Number of trips from zone i to zone j

P_i = Number of trips produced in zone i

A_j = Number of trips attracted to zone j

F_{ij} = Friction factor function

5.3.2.1. Friction Factor Function Estimation

The friction factor function, F_{ij}, represents the 'cost' of travel between the zones. Typically, travel time is used to represent such costs. If productions and attractions are held equal, more trips will occur between zones with lower zone-to-zone travel times than between zones with higher zone-to-zone travel times.

In the modeling process, the free-flow travel time on each link is obtained by taking the length of the link divided by its vehicular free-flow speed. This method is not strictly accurate. Travel time on a link would have varying values, depending upon the mode of travel and traffic conditions. However, for the purpose of this analysis, it was assumed that zone-to-zone vehicular free-flow travel times would adequately represent the relative cost of traveling between zones. In the modeling process, the zone-to-zone travel time is obtained by generating a path that minimizes the travel time between two zones.

Trip length distributions, which show the percentages of trips taken by trip length, can be used to represent friction factor functions. In order to obtain trip length distributions that would accurately represent up-to-date travel patterns, data from the 2001 National Household Travel Survey (NHTS 2001) was used. To allow the estimation of functions that can be applicable to the study area, the responses were filtered to include respondents within a Metropolitan Statistical Areas with populations less than 250,000. The results of the estimation are as shown in Equations 5.6 to 5.8 and Figure 5.5 to Figure 5.7.

$$HBW\_F_{ij} = 17.06 t_{ij}^{0.44} e^{-0.09 t_{ij}} \qquad (n = 2282, R^2 = 0.8189) \tag{5.6}$$

$$HBO\_F_{ij} = 35.98 e^{-0.0785 t_{ij}} \qquad (n = 10770, R^2 = 0.8706) \tag{5.7}$$

$$NHB\_F_{ij} = 35.87 e^{-0.0831 t_{ij}} \qquad (n = 6284, R^2 = 0.8314) \tag{5.8}$$

where: HBW_F_{ij} = Friction factor for Home Based Work trips

HBO_F_{ij} = Friction factor for Home Based Other trips

NHB_F_{ij} = Friction factor for Non-Home Based trips

t_{ij} = Travel time from zone i to zone j

For HBW trip purposes, the gamma functional form provided the best fit to the data point (see Figure 5.5). However, for HBO (Figure 5.6) and NHB (Figure 5.7) trip purposes, the exponential functional form provided the most appropriate fit to the data points.

The results of the estimation were reasonable, because it reflected the fact that most people do not necessarily work extremely close to where they live. However, when there is more flexibility in choosing destinations, such as in HBO or NHB trips, people generally prefer to minimize their travel times with the proportion of trips decreasing as travel time increases.

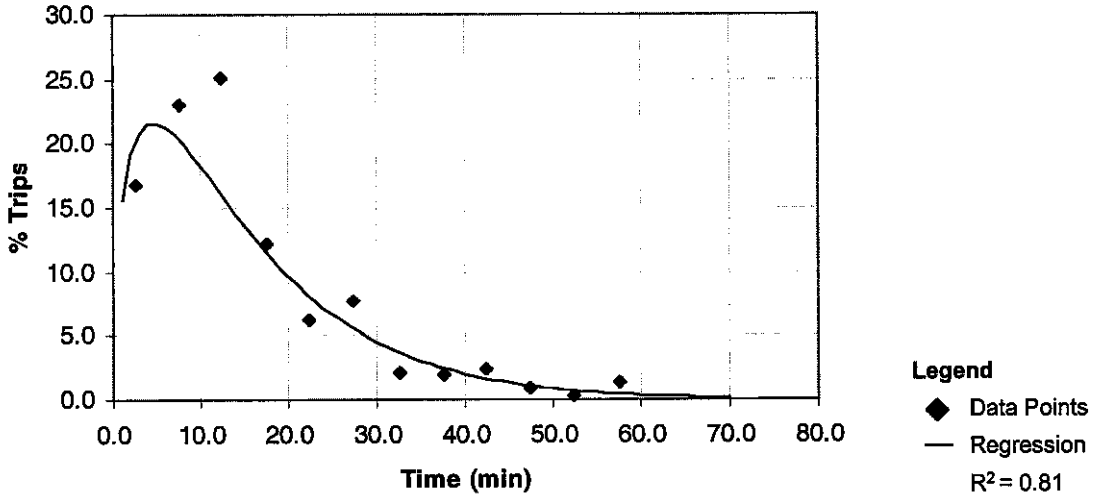

Figure 5.5 NHTS Home Based Work Trip Length Distribution

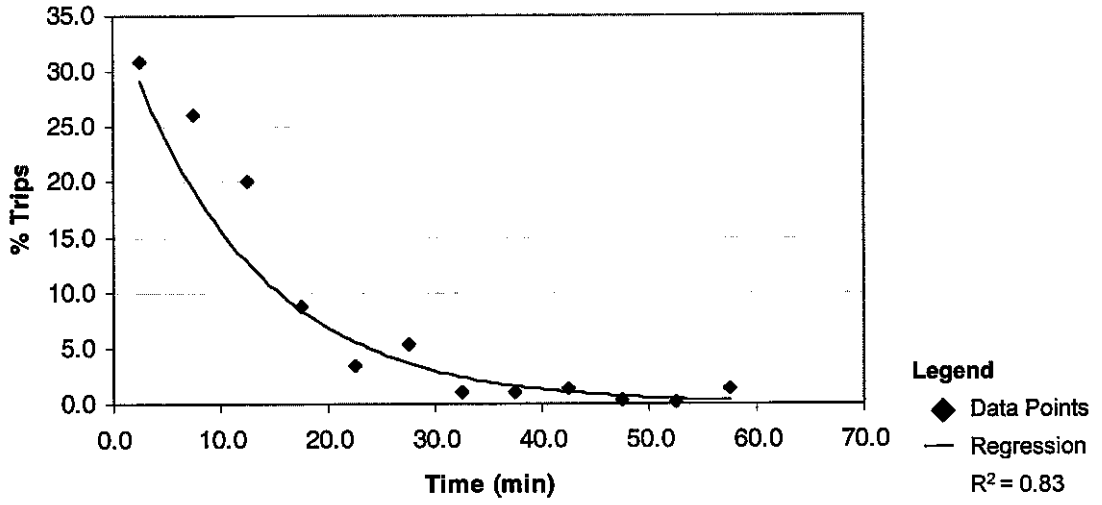

Figure 5.6 NHTS Home Based Other Trip Length Distribution

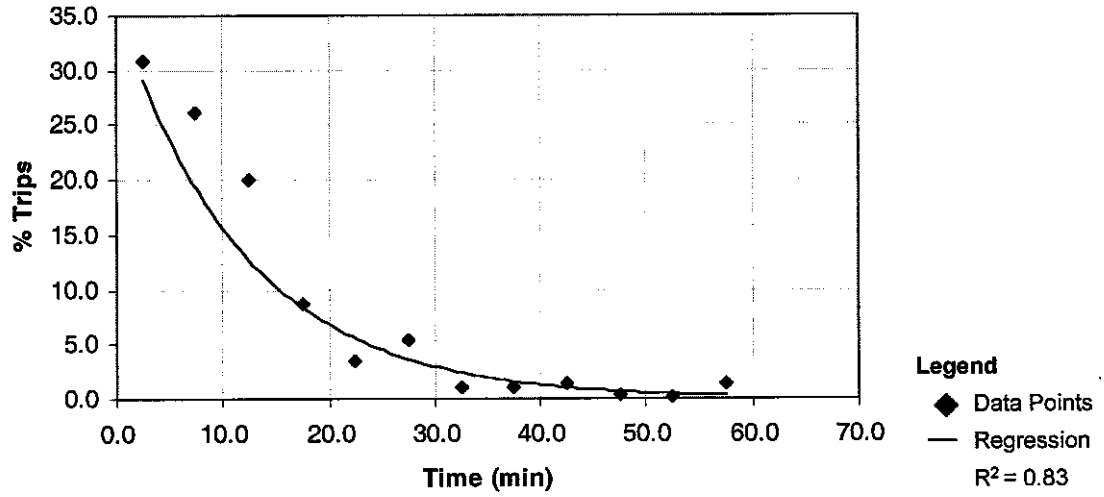

Figure 5.7 NHTS Non-Home Based Trip Length Distribution

5.3.2.2. Transforming Productions and Attractions to Origins and Destinations

The distributed productions and attractions as a result of the gravity model application are then converted into origin-destination trips. When examining trip length distributions, all trips

were maintained as person-trips and the analysis was done for the entire 24-hour day. However, in the traffic assignment phase, person-trips were converted to vehicle trips using vehicle occupancy values of 1.134, 1.626 and 1.350 passengers per vehicle for HBW, HBO and NHB trip purposes respectively. These values were consistent with the values used by the Tippecanoe County APC.

5.3.3. Traffic Assignment

Traffic assignment estimates the flow of traffic on a network by loading origin-destination pairs onto the network based upon the travel times of alternative paths that could carry the traffic. For the purpose of this research, the User Equilibrium method was used in the traffic assignment model. The standard Bureau of Public Roads (BPR) volume delay function that was used is shown in Equation 5.9 below.

$$t = t_0\left[1+0.15\left(\frac{v}{c}\right)^4\right] \tag{5.9}$$

where t = Link travel time

t_0 = Free-flow travel time

v = Volume

c = Capacity

5.3.4. Summary of Modeling Procedure

A summary of the modeling procedure described in this chapter is depicted in Figure 5.8.

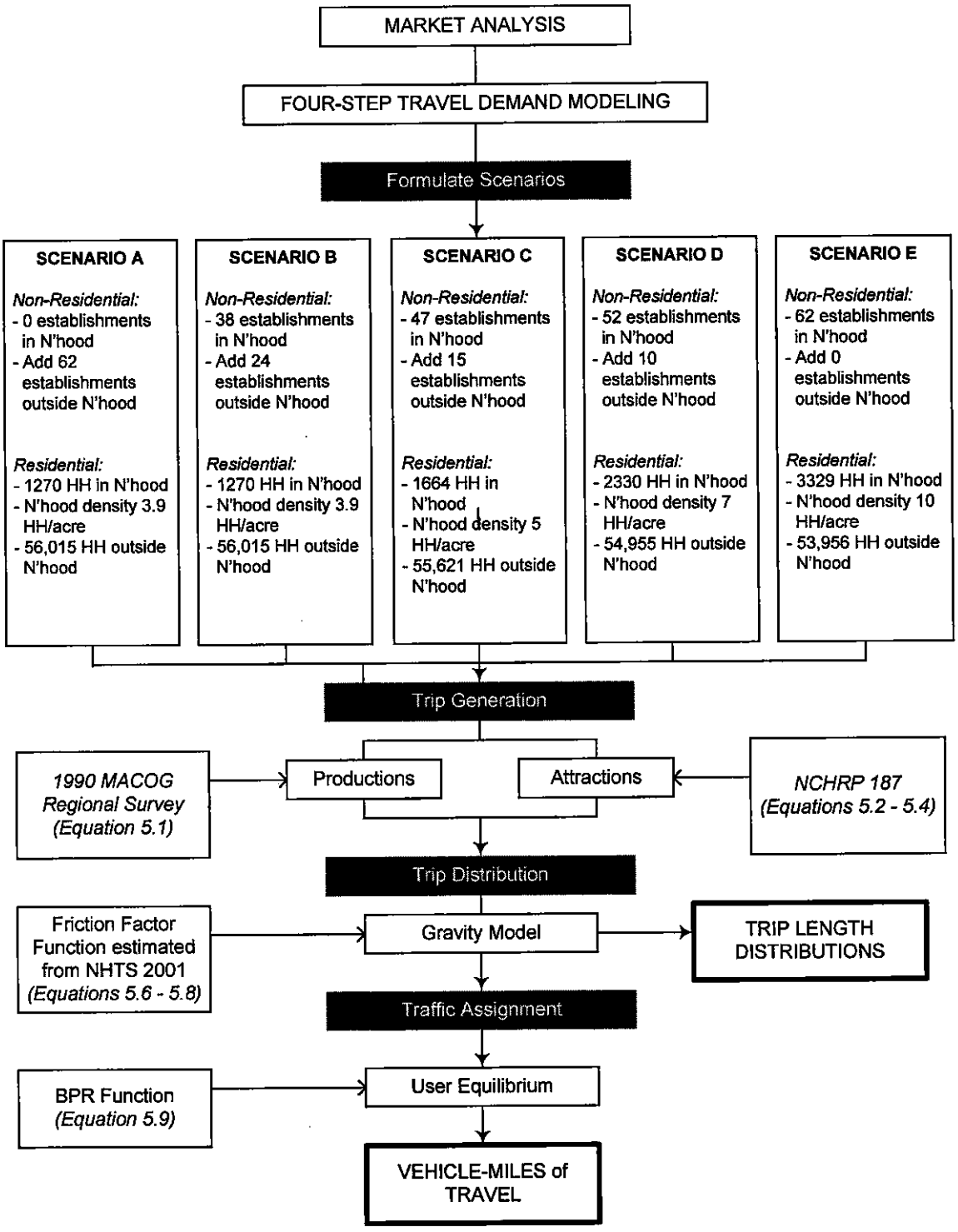

Figure 5.8 Summary of Travel Demand Modeling Procedure used for Present Study

5.4. Analysis Results

5.4.1. Trip Length Distribution Results

Origin-destination trip flows obtained from the trip distribution step were categorized by length of travel time in order to obtain trip length distributions that would allow any changes in travel patterns to be observed. For example, if the proportion of trips shifted significantly from longer travel times to shorter travel times, this would imply that higher densities and mixing land uses can cause significant changes in travel patterns. The results are divided into two sections. The first section examines trip length distributions for the entire county and the second examines trip length distributions for trips that originate from the St. Lawrence-McAllister neighborhood.

5.4.1.1. County Trip Length Distributions

Figure 5.9 through Figure 5.12 show trip length distributions by for HBW, HBO, NHB and all trip types, for the entire county. By observing the trip length distributions, any effects of densification or mixing land uses in the neighborhood can be observed by comparing each of the scenarios. A summary of all the formulated scenarios analyzed are provided in Table 5.2.

For HBW trip purposes, as shown in Figure 5.9, little to no difference in the trip length distributions between the scenarios is observed. To allow better examination of the results, the proportions of trips by travel time are also shown in Table 5.6. The most significant changes that occurred were for trips in the range of 0 – 15 minutes, which increase by 1.6 percent from Scenario A to Scenario E, as trips in the range of 15 – 30 minutes decreased by 1.5 percent for the same scenarios. Changes between scenarios were less significant, with the proportion of trips increasing or decreasing by approximately 0.2-0.3 percent from scenario to scenario.

Similarly, for HBO trip purposes, little difference exists between the trip length distributions of the various scenarios, as can be observed in Figure 5.10 and Table 5.7. The most significant changes were for trips in the range of 0-15 minutes which increased by 1.8 percent from Scenario A to Scenario E, as trips in the range of 15-30 minutes decreased by 1.3 percent for the same range. Again, changes between scenarios increased or decreased by only very small amounts (0.2 to 0.3 percent).

In the case of NHB trips (see Figure 5.11 and Table 5.8), similar changes were observed with an increase of 1.0 percent for trips within the range of 0-15 minutes and a decrease of 0.9 percent for trips within the range of 15-30 minutes from Scenario A to Scenario E.

Figure 5.12 and Table 5.9 show the trip length distributions for all trips in the county. As seen in the figures and tables for trip length distributions by trip purposes, very slight increases were observed for the percentage of trips in the range of 0-15 minutes (0.2 to 1.1 percent), with slight decreases (0.1 to 0.6 percent) for the range of 15-30 minutes from Scenario A to Scenario E.

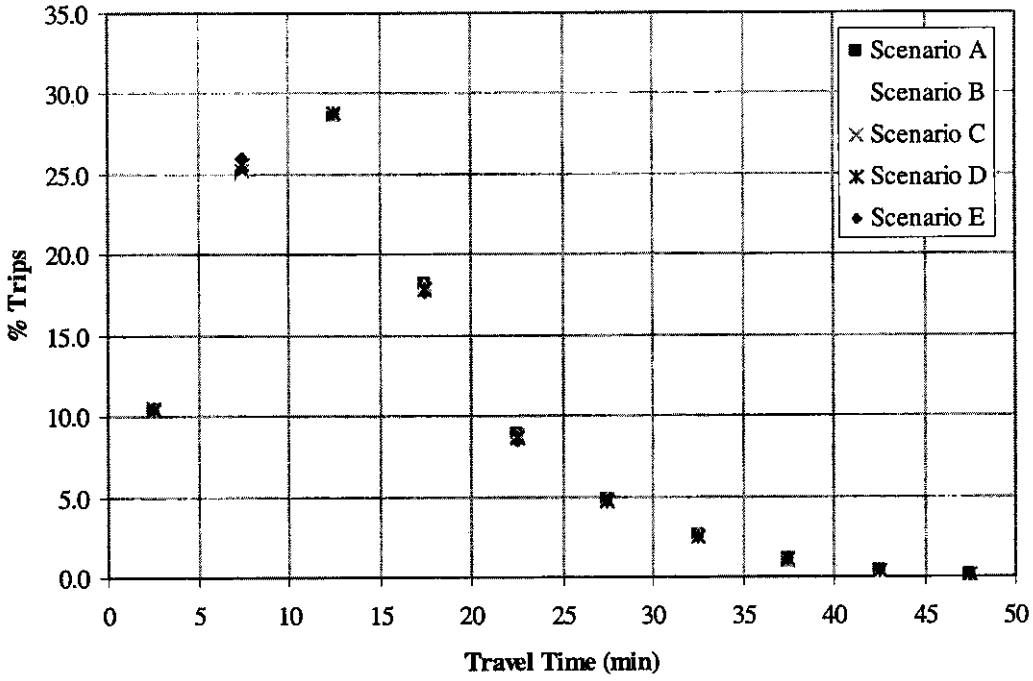

Figure 5.9 HBW Trip Length Distribution for Entire County

Table 5.6 HBW Trip Length Distribution for Entire County

Travel Time (min)	% Trips for HBW Trip Purpose				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	10.5	10.5	10.5	10.4	10.4
5-10	24.8	25.0	25.2	25.5	26.1
10-15	28.6	28.7	28.7	28.8	28.8
15-20	18.1	18.1	18.0	17.8	17.5
20-25	8.9	8.8	8.7	8.6	8.5
25-30	4.8	4.8	4.8	4.7	4.7
30-35	2.6	2.5	2.5	2.5	2.5
35-40	1.1	1.1	1.1	1.1	1.1
40-45	0.4	0.4	0.4	0.4	0.3
45-50	0.2	0.2	0.2	0.2	0.1
50-55	0.1	0.1	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0

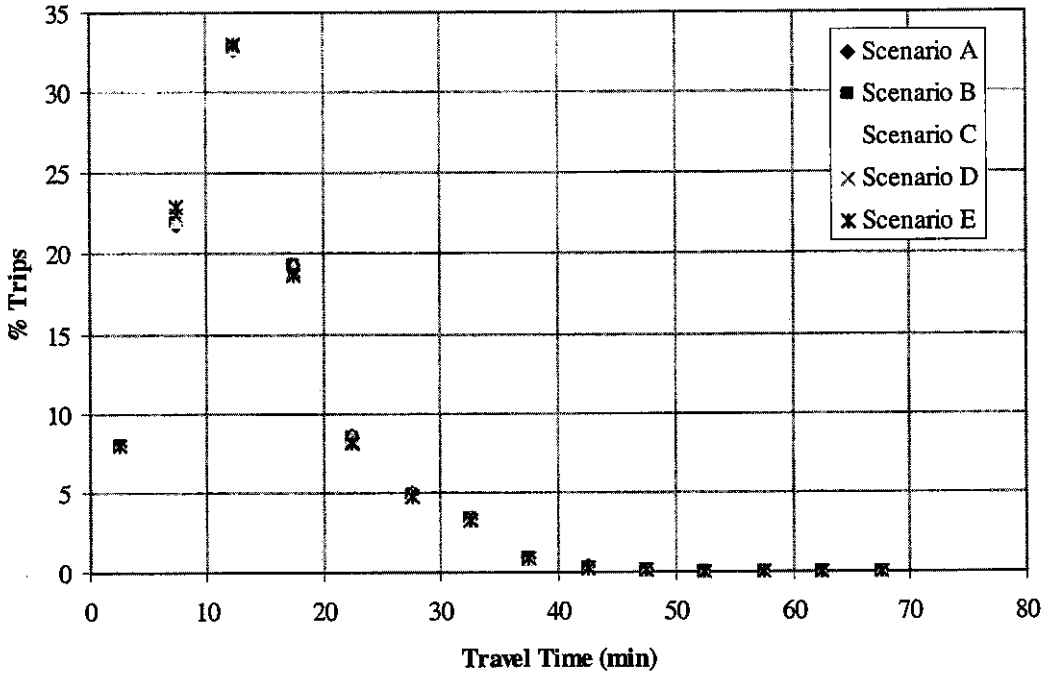

Figure 5.10 HBO Trip Length Distribution for Entire County

Table 5.7 HBO Trip Length Distribution for Entire County

Travel Time (min)	% Trips for HBO Trip Purpose				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	8.0	8.0	8.0	8.0	7.9
5-10	21.8	21.9	22.1	22.5	23.0
10-15	32.6	32.7	32.8	32.9	33.1
15-20	19.3	19.3	19.2	19.0	18.7
20-25	8.6	8.5	8.4	8.3	8.1
25-30	4.9	4.9	4.8	4.8	4.7
30-35	3.4	3.4	3.4	3.3	3.2
35-40	0.9	0.9	0.9	0.9	0.9
40-45	0.3	0.3	0.3	0.3	0.3
45-50	0.1	0.1	0.1	0.1	0.1
50-55	0.0	0.0	0.0	0.0	0.0

Total	100.0	100.0	100.0	100.0	100.0

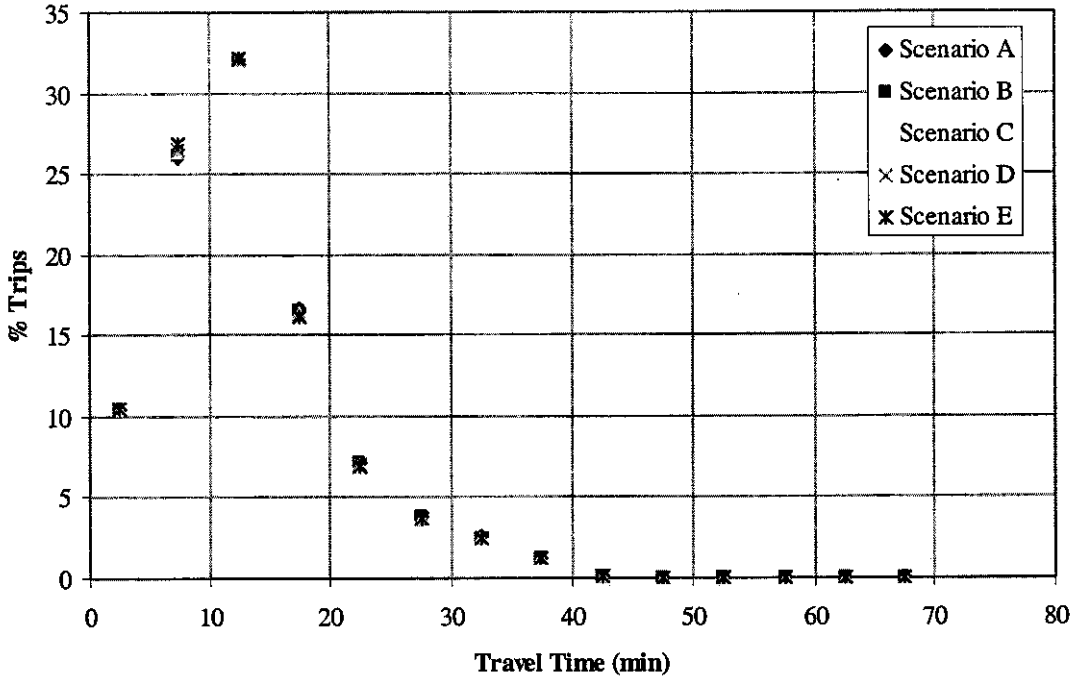

Figure 5.11 NHB Trip Length Distribution for Entire County

Table 5.8 NHB Trip Length Distribution for Entire County

Travel Time (min)	% Trips for NHB Trip Purpose				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	10.5	10.5	10.5	10.5	10.5
5-10	26.0	26.2	26.3	26.5	26.8
10-15	32.0	32.0	32.1	32.1	32.2
15-20	16.6	16.5	16.4	16.3	16.1
20-25	7.2	7.1	7.0	7.0	6.9
25-30	3.8	3.8	3.7	3.7	3.7
30-35	2.6	2.5	2.5	2.5	2.4
35-40	1.2	1.2	1.2	1.2	1.2
40-45	0.2	0.2	0.2	0.2	0.2
45-50	0.1	0.1	0.1	0.1	0.1

50-55	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0

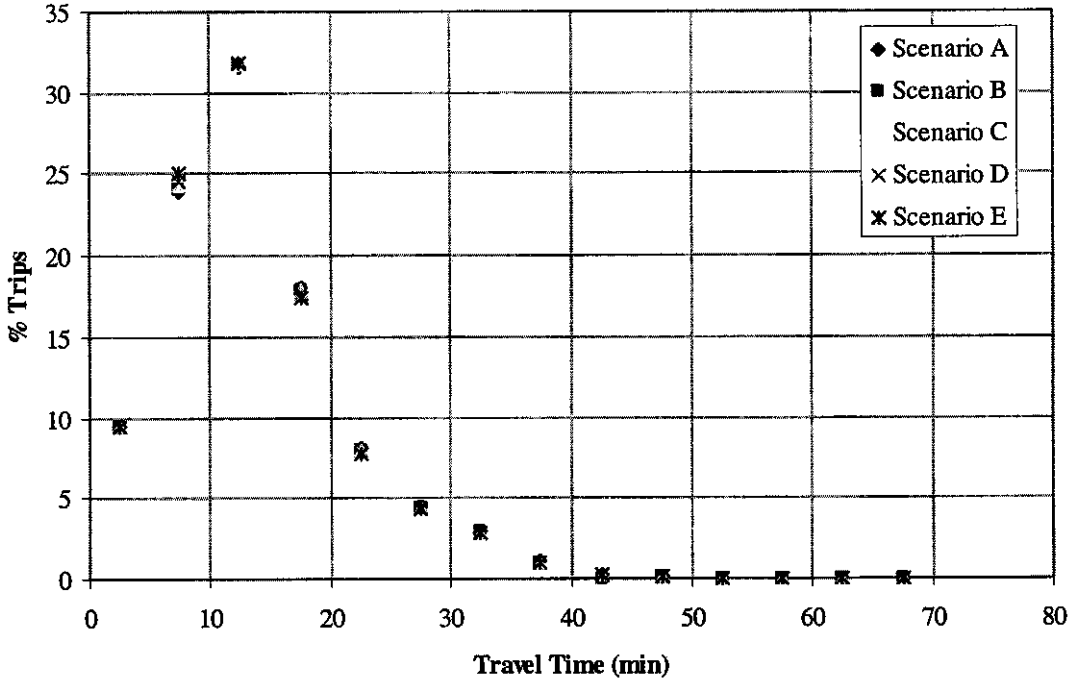

Figure 5.12 All Trip Purposes Trip Length Distribution for Entire County

Table 5.9 All Trip Purposes Trip Length Distribution for Entire County

Travel Time (min)	% Trips for All Trip Purposes				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	9.4	9.5	9.4	9.4	9.4
5-10	24.0	24.1	24.3	24.6	25.1
10-15	31.6	31.6	31.7	31.8	31.8
15-20	18.0	18.0	17.9	17.7	17.5
20-25	8.1	8.0	8.0	7.9	7.7
25-30	4.5	4.4	4.4	4.4	4.3
30-35	2.9	2.9	2.9	2.8	2.8
35-40	1.1	1.0	1.0	1.0	1.0
40-45	0.3	0.3	0.3	0.3	0.3
45-50	0.1	0.1	0.1	0.1	0.1

50-55	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0

5.4.1.2. Neighborhood Trip Length Distributions

Neighborhood trips refer to trips that start within the St. Lawrence-McAllister neighborhood. By increasing household densities, introducing more non-residential land uses, and establishing a mixed-use Neighborhood Commercial Cluster, it was expected that, instead of traveling to zones outside the neighborhood, people would shift their trips to locations within the neighborhood, especially in the case of HBO type trips. In this section, trips that begin and end within the neighborhood are referred to as "internal" trips and trips that end outside the neighborhood are referred to as "external" trips. Figure 5.13 and Table 5.10 show the percentages of internal and external neighborhood trips.

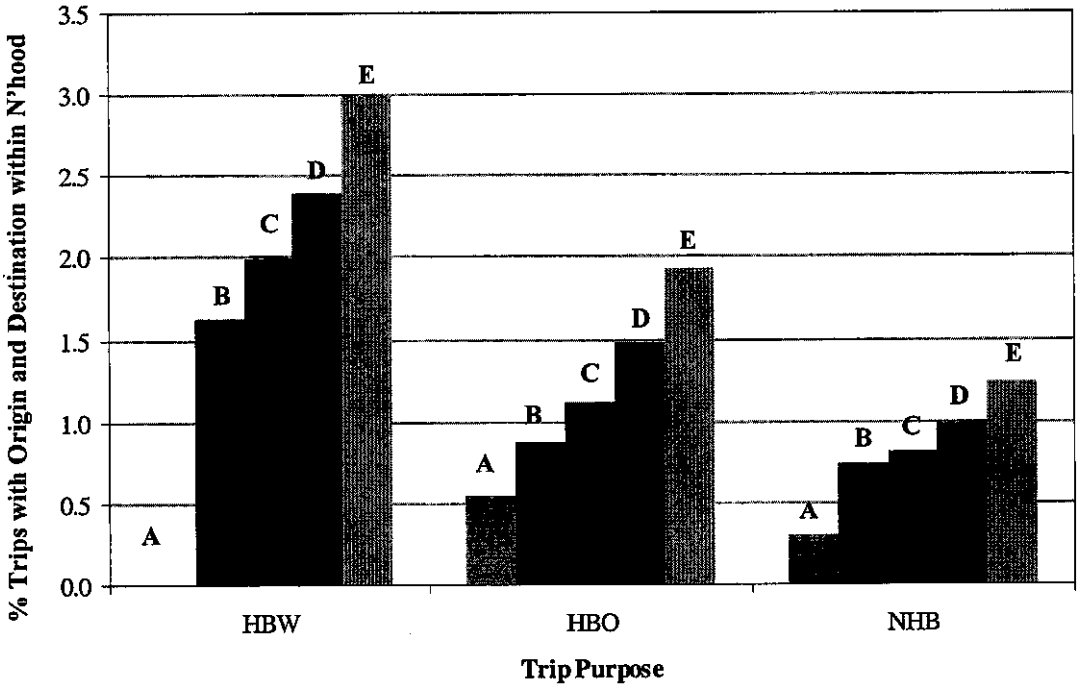

Figure 5.13 Percent Trips with Origin and Destination within Neighborhood

The results show that, although the percentages of internal neighborhood trips increases from Scenario A to Scenario E for all three trip purposes, the increases are very small. There are no HBW trips in Scenario A, which is reasonable because there are no non-residential land uses present within the neighborhood. Subsequently, the percentage of internal trips increases by only 1.4 percent, from 1.6 percent in Scenario B to 3.0 percent in Scenario C.

Table 5.10 Number of Trips with Origin (and Destination) within the Neighborhood

Trip Purpose	Trip with:	Number and Percentage of Trips per Day				
		Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
HBW	Origin and Destination in N'hood	0	49	69	106	173
	Origin in N'hood	2388	2996	3459	4442	5769
		(0.0%)	*(1.6%)*	*(2.0%)*	*(2.4%)*	*(3.0%)*
HBO	Origin and Destination in N'hood	21	40	64	112	194
	Origin within N'hood	3922	4568	5708	7547	9994
		(0.5%)	*(0.9%)*	*(1.1%)*	*(1.5%)*	*(1.9%)*
NHB	Origin and Destination in N'hood	8	24	32	49	78
	Origin within N'hood	2517	3279	3974	4928	6250
		(0.3%)	*(0.7%)*	*(0.8%)*	*(1.0%)*	*(1.2%)*

In the case of HBO trip purposes, the percentage of internal trips also increases by only 1.4 percent from Scenario A to Scenario E. In this case, Scenario A still has 21 internal trips, despite having no non-residential land uses. This could be attributed to the fact that the definition of HBO trips refer to trips that are non-work related, so trips made visiting friends and so forth would fall under this category.

The point elasticity of the percentage of internal trips with respect to household and employment density was determined, assuming that elasticity is constant over the range of values examined. In determining elasticity values, only Scenarios B through E were considered. Scenario A was not considered because the configuration of land uses in the neighborhood was not formulated based upon the market analysis method. A more detailed description of how the elasticity values were determined is given in Appendix D.

From Table 5.11, it can be seen that for HBW trip purposes, the percentage of internal neighborhood trips is inelastic with respect to household and employment densities. Because

elasticity values are less than 1, this means that a 1 percent change in household density or employment density will result in a less than 1 percent change in the percentage of internal neighborhood trips. From this, it is inferred that a very great increase in household density and/or employment density is required to cause a significant increase in internal trips.

Table 5.11 Elasticities of Percentage of Internal Trips

	Point Elasticity of % Internal Trips with respect to:	
Trip Purpose	HH Density (HH/acre)	Emp. Density (emp/acre)
HBW	0.62	0.81
HBO	0.83	1.07
NHB	1.09	1.56

For HBO trip purposes, the percentage of internal trips is inelastic with respect to household density, but elastic with respect to employment density. This implies that such trips are more sensitive to employment density than household density. In the case of NHB trips, the percentages of internal trips are elastic with respect to household and employment densities.

Figure 5.14 to Figure 5.17 and Table 5.12 to Table 5.15 show the trip length distributions for trips with an origin in the neighborhood and destinations anywhere within the study area, by trip purpose. In all cases, changes in trip length distributions are very small, with hardly any changes for trip lengths exceeding 10 minutes.

In the case of trips with a travel time of 0-5 minutes, the number of internal trips increase, but the percentage of trips in this travel time category fluctuates only a little between scenarios. This implies that the internal trips are diverted from trips that already have a relatively short travel time as employment and household densities increase only slightly across the scenarios.

For all trip purposes, the most significant changes occur for trips with travel times between 5 and 10 minutes. In general, the percentages of such trips tend to increase over the scenarios, as household and employment densities increase.

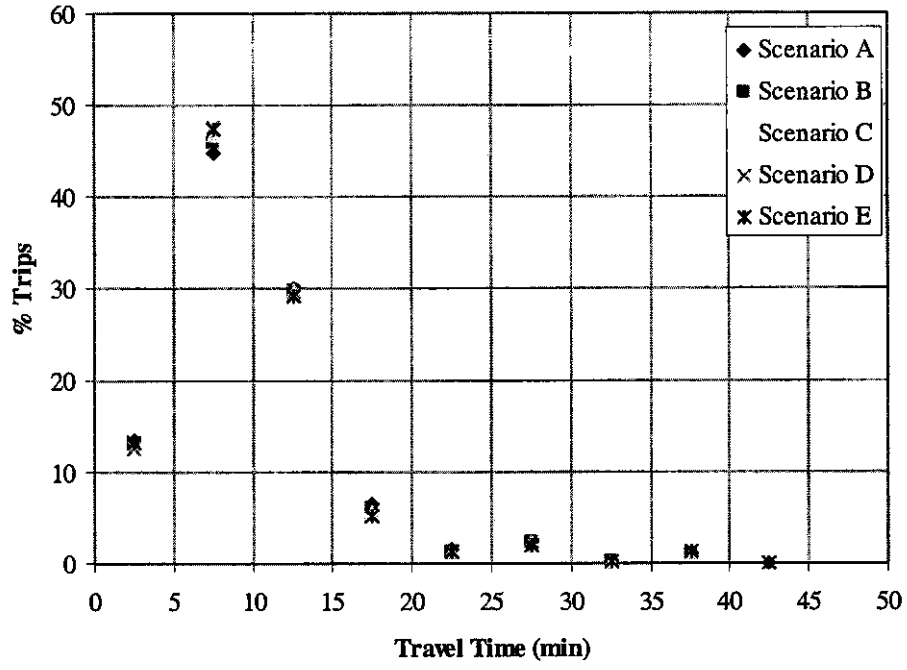

Figure 5.14 HBW Trip Length Distribution for Trips Originating within the Neighborhood

Table 5.12 HBW Trip Length Distribution for Trips Originating within the Neighborhood

Travel Time (min)	% Trips for HBW Trip Purpose				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	13.5	13.0	12.7	12.5	13.3
5-10	44.7	45.8	46.8	47.6	47.4
10-15	30.0	29.9	29.8	29.6	29.1
15-20	6.6	6.2	5.7	5.2	5.2
20-25	1.5	1.4	1.4	1.4	1.3
25-30	2.4	2.4	2.4	2.3	2.1
30-35	0.3	0.2	0.2	0.1	0.3
35-40	1.1	1.1	1.2	1.2	1.3
Total	100.0	100.0	100.0	100.0	100.0

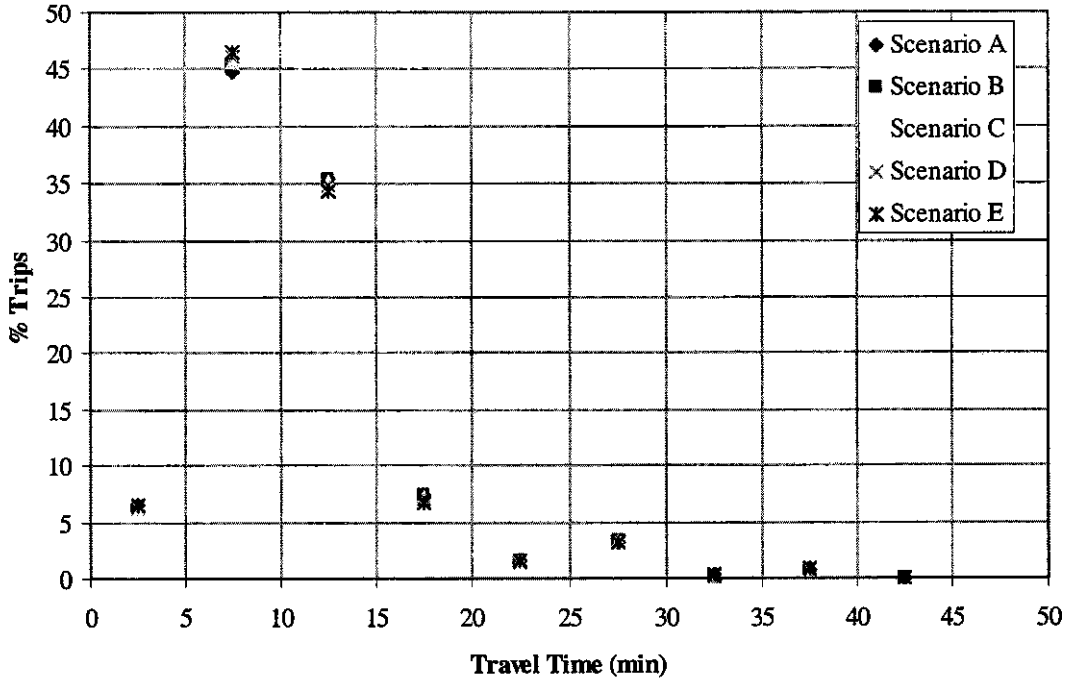

Figure 5.15 HBO Trip Length Distribution for Trips Originating within the Neighborhood

Table 5.13 HBO Trip Length Distribution for Trips Originating within the Neighborhood

Travel Time (min)	% Trips for HBO Trip Purpose				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	6.6	6.3	6.2	6.4	6.5
5-10	44.8	45.2	45.5	46.1	46.5
10-15	35.3	35.4	35.3	34.8	34.3
15-20	7.3	7.3	7.3	7.1	6.8
20-25	1.6	1.6	1.5	1.5	1.6
25-30	3.2	3.3	3.3	3.3	3.2
30-35	0.3	0.2	0.2	0.1	0.3
35-40	0.8	0.8	0.7	0.7	0.8
Total	100.0	100.0	100.0	100.0	100.0

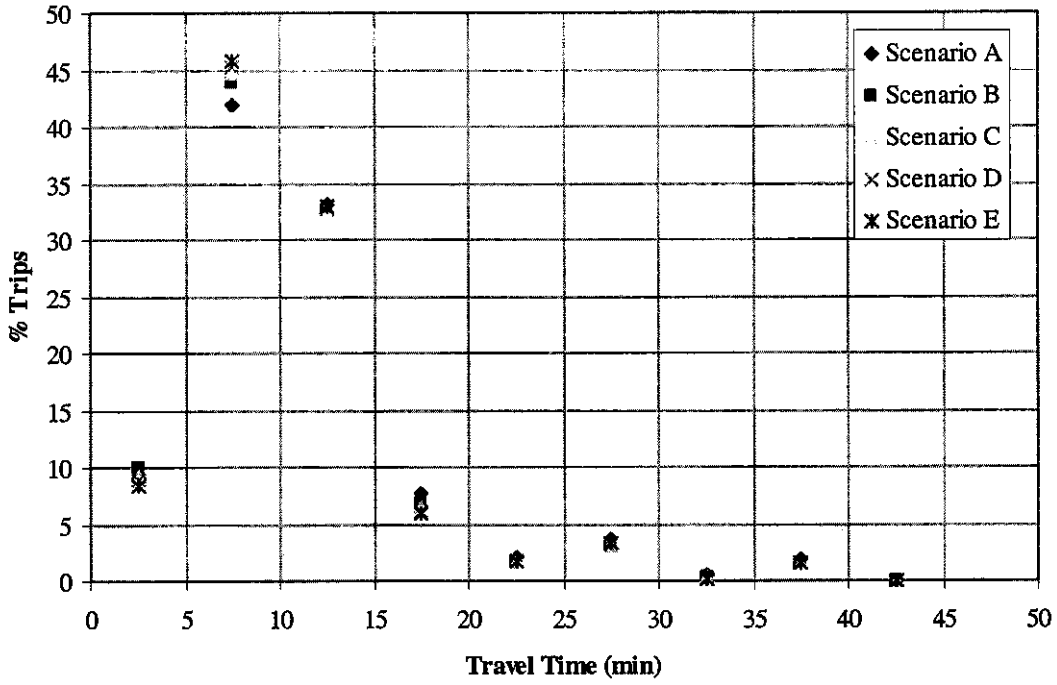

Figure 5.16 NHB Trip Length Distribution for Trips Originating within the Neighborhood

Table 5.14 NHB Trip Length Distribution for Trips Originating within the Neighborhood

Travel Time (min)	% Trips for NHB Trip Purpose				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	9.2	10.0	9.3	8.9	8.5
5-10	42.0	43.9	44.8	45.3	45.8
10-15	33.2	32.5	32.7	32.8	33.0
15-20	7.7	6.9	6.5	6.2	5.9
20-25	2.0	1.7	1.7	1.8	1.8
25-30	3.6	3.0	3.1	3.2	3.3
30-35	0.5	0.4	0.3	0.3	0.2
35-40	1.9	1.5	1.5	1.6	1.6
Total	100.0	100.0	100.0	100.0	100.0

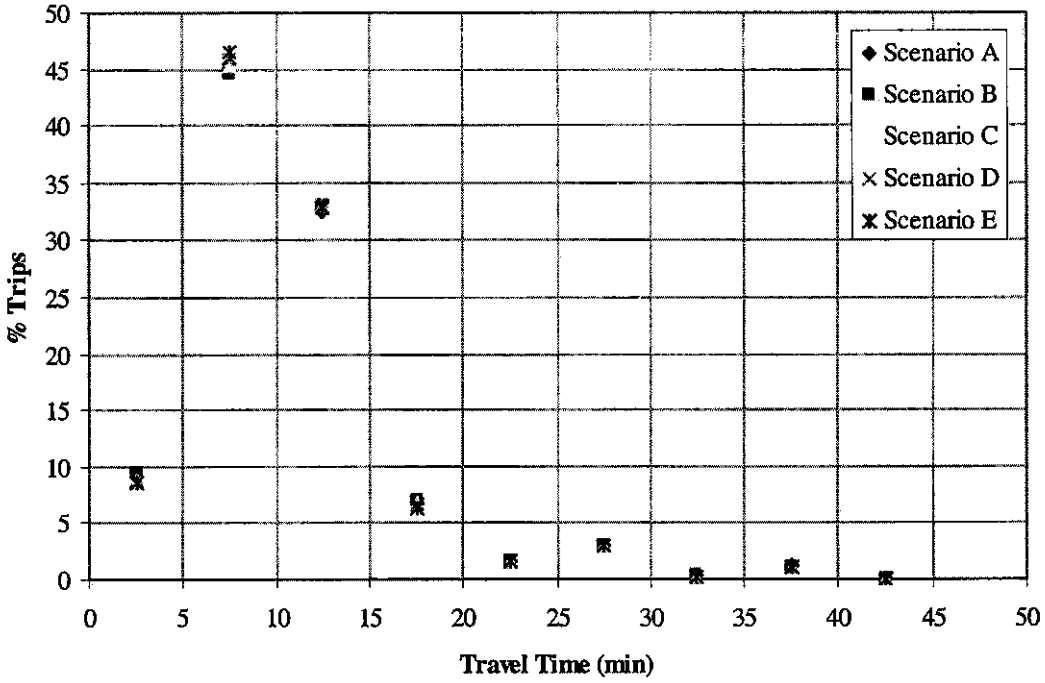

Figure 5.17 All Trip Purposes Trip Length Distribution for Trips Originating within the Neighborhood

Table 5.15 All Trip Purposes Trip Length Distribution for Trips Originating within the Neighborhood

Travel Time (min)	% Trips for All Trip Purposes				
	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
0-5	9.1	9.5	9.0	8.7	8.6
5-10	45.5	44.5	45.2	45.8	46.4
10-15	32.6	33.0	33.1	33.1	32.9
15-20	6.6	7.0	6.8	6.6	6.3
20-25	1.6	1.6	1.6	1.6	1.5
25-30	3.0	2.9	3.0	3.0	3.0
30-35	0.4	0.3	0.3	0.2	0.2
35-40	1.3	1.1	1.1	1.1	1.1

Total	100.0	100.0	100.0	100.0	100.0

5.4.2. Traffic Assignment Results

Traffic flows on each link in the network were obtained from the traffic assignment step. These flows were then converted to vehicle-miles of travel (VMT) using the lengths of individual links. Table 5.16 shows total VMT for all trip purposes for the entire study area. Overall, there was a decrease in total vehicle miles of travel. The decrease was relatively small, with VMT falling by only 1.86 percent from Scenario A to Scenario E. These results are consistent with the trip length distribution analysis (see Table 5.9) which shows only small shifts towards trips with travel times less than 15 minutes from Scenario A to Scenario E. Neighborhood VMTs were not examined because no significant changes in trip length distributions were observed, so neighborhood VMTs were expected to experience little significant change.

Table 5.16 Change in Vehicle-Miles of Travel for Entire Study Area

Scenario	VMT (per day)	% Change from Scenario A
A	3,564,780	-
B	3,550,182	-0.41
C	3,538,478	-0.74
D	3,522,197	-1.19
E	3,498,646	-1.86

In order to observe the impact on traffic flow on neighborhood roads, the flows on a few selected street sections, in and around the neighborhood (Figure 5.18) were analyzed. Figure 5.19 and Table 5.17 show the changes in traffic volume by scenario for Section A2 (see Figure 5.18) on US 52. US 52, a four-lane major arterial, is one of three routes that serve to connect the cities of Lafayette and West Lafayette, which are separated by the Wabash River (see Figure 3.1). From Scenario A to B, where a purely residential neighborhood was compared against the current neighborhood, which had a small number of non-residential land uses that were scattered, the decrease in traffic volume were relatively small. However, from Scenario B onwards, subsequent decreases in traffic volumes were larger. The decrease in traffic volume could, in part, be attributed to the increase in the number of internal neighborhood trips.

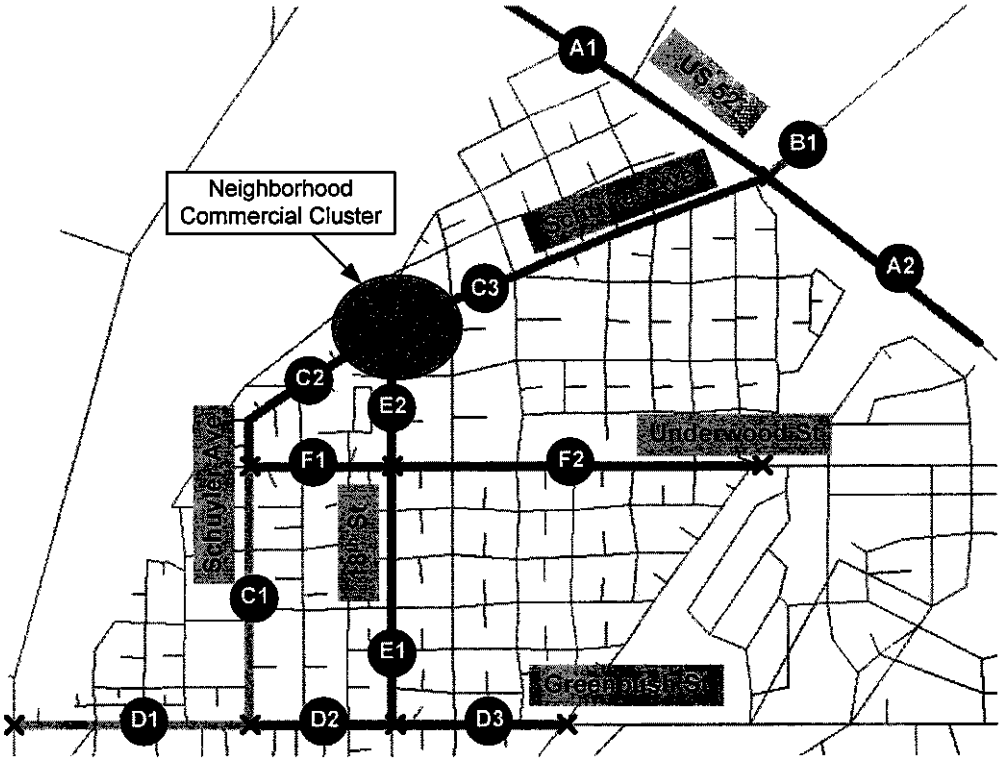

Figure 5.18 Location of Neighborhood Roadway Sections in Traffic Analysis

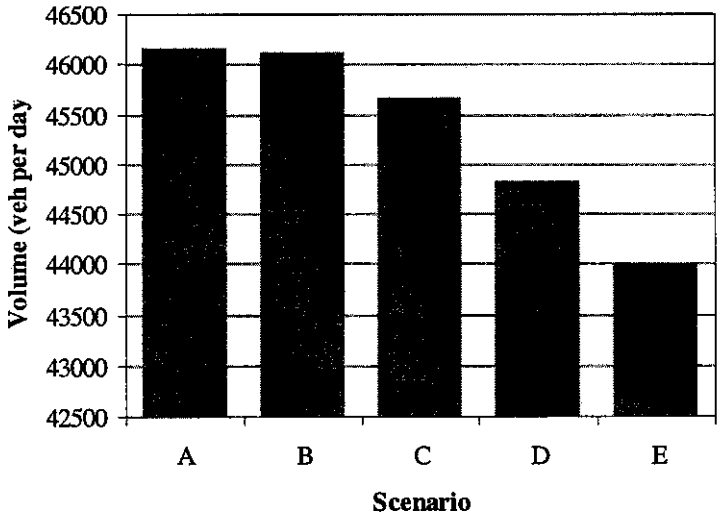

Figure 5.19 Change in Traffic Volume by Scenario for US 52 Section A2

Table 5.17 Change in Traffic Volumes by Scenario for Selected Street Sections

Road Name	Section No.	SCENARIO A	B	C	D	E
Volume (veh per day)	A1	57054	57012	56975	57005	56997
% increase w.r.t Scenario A		-	*-0.07%*	*-0.14%*	*-0.09%*	*-0.10%*
Volume (veh per day)	A2	46159	46117	45673	44832	44010
% increase w.r.t Scenario A		-	*-0.09%*	*-1.05%*	*-2.87%*	*-4.65%*
Volume (veh per day)	B1	24520	24299	24476	25029	25031
% increase w.r.t Scenario A		-	*-0.9%*	*-0.2%*	*2.1%*	*2.1%*
Volume (veh per day)	C1	1521	2067	3339	5069	7035
% increase w.r.t Scenario A		-	*35.9%*	*119.6%*	*233.3%*	*362.5%*
Volume (veh per day)	C2	930	1404	2902	4876	7019
% increase w.r.t Scenario A		-	*50.9%*	*212.0%*	*424.1%*	*654.5%*
Volume (veh per day)	C3	624	825	1272	1885	2785
% increase w.r.t Scenario A		-	*32.3%*	*104.0%*	*202.3%*	*346.6%*
Volume (veh per day)	D1	860	1018	1238	1561	1939
% increase w.r.t Scenario A		-	*18.4%*	*43.9*	*81.5*	*125.5*
Volume (veh per day)	D2	2290	2762	2566	2585	2695
% increase w.r.t Scenario A		-	*20.6%*	*12.1%*	*12.9%*	*17.7%*
Volume (veh per day)	D3	725	809	808	953	1225
% increase w.r.t Scenario A		-	*11.6%*	*11.4%*	*31.5%*	*68.9%*
Volume (veh per day)	E1	1646	1924	2052	2298	2660
% increase w.r.t Scenario A		-	*16.9%*	*24.6%*	*39.6%*	*61.6%*
Volume (veh per day)	E2	138	239	559	1085	1549
% increase w.r.t Scenario A		-	*72.9%*	*304.6%*	*684.9%*	*1020.4%*
Volume (veh per day)	F1	129	155	214	342	601
% increase w.r.t Scenario A		-	*20.1%*	*66.1%*	*164.9%*	*365.7%*
Volume (veh per day)	F2	878	1074	1521	2164	2831
% increase w.r.t Scenario A		-	*22.4%*	*73.3%*	*146.7%*	*222.7%*

Figure 5.20 and Figure 5.21 show the changes in flows by scenario for the selected street sections in the neighborhood. Schuyler Avenue and Greenbush Street are two-lane streets which connect the neighborhood with US 52. Underwood Street and 18th Street are neighborhood streets that presently have lower traffic volumes than Schuyler Avenue and Greenbush Street.

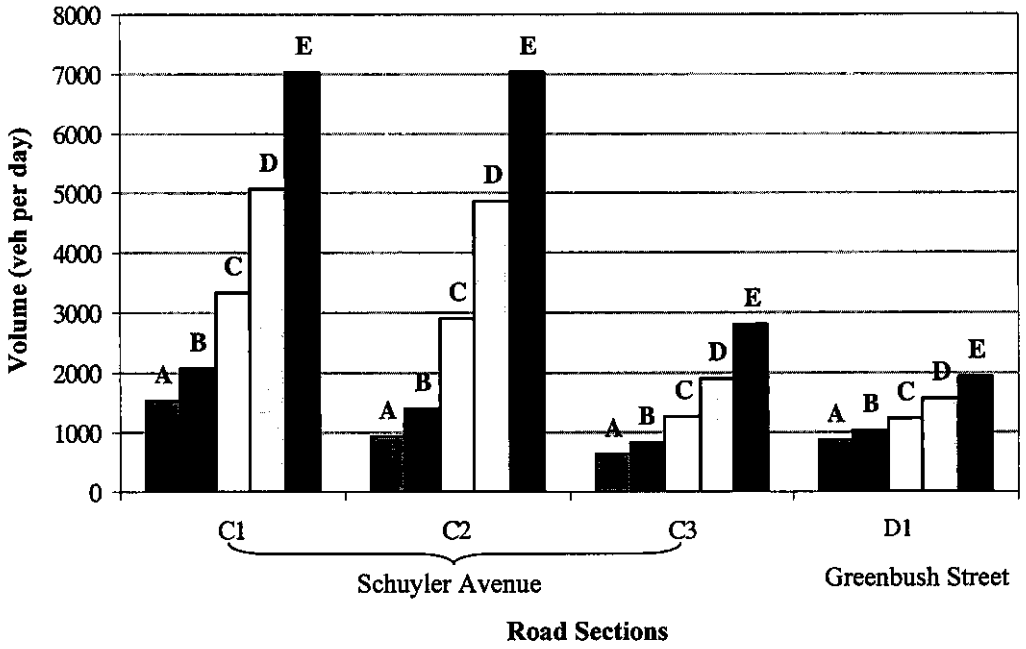

Figure 5.20 Change in Volume by Scenario for Selected Minor Arterial Road Sections

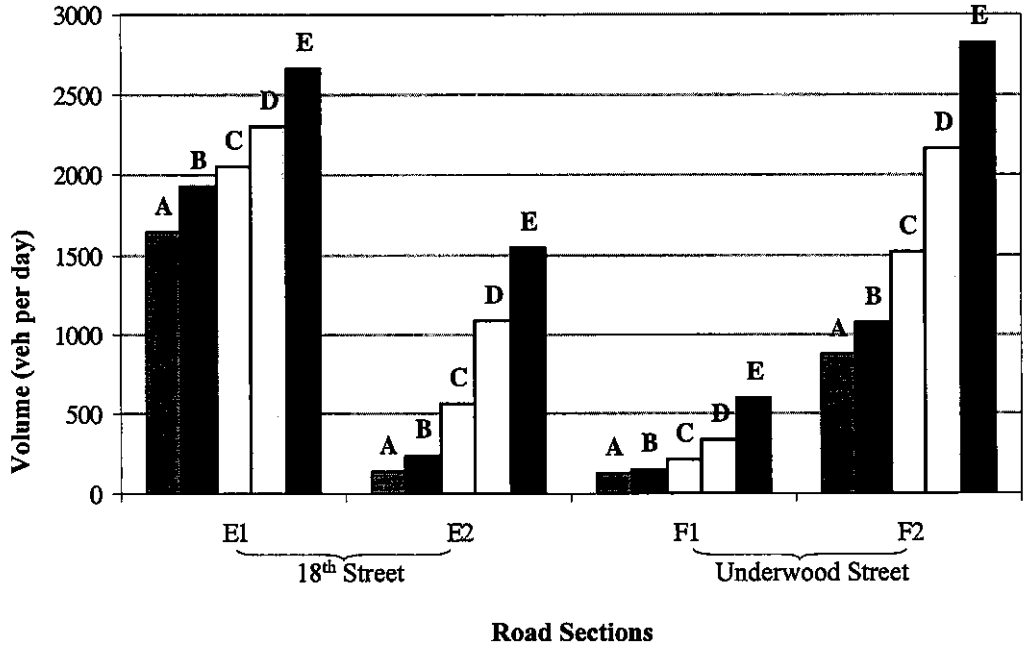

Figure 5.21 Change in Volume by Scenario for Selected Local Neighborhood Road Sections

All neighborhood street sections experienced significant increases in traffic volume. It can be seen that Schuyler Avenue experienced large increases – up to 655 percent – from Scenario A to Scenario E. This is because additional residential and commercial units were located along a Neighborhood Commercial Cluster on Schuyler Avenue (see Figure 5.18). Due to the increase in the number of households and non-residential land uses, the number of trips originating from and attracted to the zones along Schuyler Avenue increased, thus causing great increases in traffic flow. Change in traffic volume along Greenbush Street was less drastic but still significant, with a maximum increase of 126 percent from Scenario A to Scenario E. Underwood Street and 18th Street both experienced significant increases in traffic volumes, with traffic volumes reaching or exceeding the volumes on Greenbush Street. The large increase in traffic volume on Underwood Street could be because it is connected to US 52 on the east and Schuyler Avenue on the west, thus connecting the Neighborhood Commercial Cluster with a major arterial.

5.5. Discussion of Results

The results of the travel demand models described in the preceding sections show that when an isolated neighborhood within a larger study area experiences an increase in households, the number of non-residential establishments, and a change in the layout of land uses, there is little or no significant change in the travel patterns of the neighborhood residents, and residents of the entire study area. All trip length distribution changes that were observed were very small in nature, never exceeding 3 percent. Because the results showed relatively insignificant changes in trip length distributions over the scenarios, the third step of the four-step process, modal choice, was not carried out. No significant changes in the modes of travel were expected because little to no changes were observed in trip length distributions.

Even when only the trips originating from the neighborhood were examined, the changes were still too small to be significant. An examination of elasticity values implied that the percentages of internal trips are more sensitive to changes in employment than to household density. However, the problem lies with the fact that, in order to increase employment (or the number of non-residential establishments), household densities must increase substantially, as discussed in Section 4.5. The elasticity values estimated can be used to estimate the percentage of

change in internal trips for proposed modifications to residential density or additional non-residential establishments. However, these values should be used with care and should only be used to obtain a general idea of the impacts of modifications mentioned, and not as a tool for analysis.

An examination of the results of traffic assignment showed that, for the entire study area, there were only very small decreases in total vehicle-miles. Traffic volumes on the street sections in the immediate area of the neighborhood experienced a distinct increase, assuming that there was no change in the mode choice. Participants in the community survey conducted in Section 3.3.1 were very resistant towards the idea of having increased levels of traffic in their neighborhood streets. The grid-like structure of the neighborhood street network provides a larger number of alternative routes for travelers, dispersing traffic instead of channeling traffic onto one or two major streets. Neighborhood streets in purely residential subdivisions primarily serve neighborhood residents. In New Urbanist neighborhoods however, the grid-like structure of the neighborhood also provide routes for travelers going to the commercial center, thus increasing neighborhood traffic levels. The results of the traffic assignment are not precise because the four-step process is not designed to accommodate analyses conducted at such a small scale. However, for the five scenarios examined, the impact on traffic volumes can be captures to some extent by observing the relative changes in traffic flow.

The results of this analysis differ with those of the REN study described in Section 2.4. The previous study showed that trips in the mixed use neighborhood (REN) had a significantly larger proportion of shorter trips compared to the purely residential neighborhood (EUCLID), both for the entire study area, and trips at the neighborhood level. Furthermore a significant decrease in VMT was also observed when comparing the REN and EUCLID neighborhood travel patterns. The next section examines possible reasons for such differences.

5.5.1. Comparison with Reverse Engineered Neighborhood (REN) Methodology and Results

Table 5.18 compares the analyses based on REN and the market analysis approach. The results of the travel demand model using REN had shown a significantly higher percentage of

trips within the neighborhood for the REN (mixed-use neighborhood) than for the EUCLID (purely residential).

Table 5.18 Comparison of REN and Market Analysis-based Neighborhoods

	No. of HH in N'hood	% Households located in N'hood	% Attractions located in N'hood
REN and Euclid Neighborhoods:			
Euclid: 2.2 HH/acre, all residential	5622	8.20	3.35
REN : 4.4 HH/acre, mixed-use	11264	16.43	18.32
Market Analysis-based Neighborhoods:			
Scenario A: 3.82 HH/acre, all residential	1270	2.21	0.40
Scenario B: 3.82 HH/acre, mixed-use	1711	2.21	1.10
Scenario C: 5 HH/acre, mixed-use	2107	2.90	1.36
Scenario D: 7 HH/acre, mixed-use	2771	4.07	1.73
Scenario E: 10 HH/acre, mixed-use	3771	5.81	2.17

The major differences in the two modeling approaches are:

1. *Size of Neighborhood*

   The REN and EUCLID models consisted of 4 modules arranged together to cover an area of 4 square miles. In the market analysis-based scenarios, the modified neighborhood had a size of 0.52 square miles, a much smaller fraction of the entire study area than in the REN and EUCLID neighborhood analyses.

2. *Residential Density and Households*

   Gross residential densities for the REN and EUCLID models increased from 2.2 HH per acre to 4.4 HH per acre. If only residential land area is considered in density computations, REN had a density of 7 HH per acre. However, for the purpose of the present analysis, residential density refers to gross density, which considers the entire area of the neighborhood. The market analysis-based neighborhood had a higher starting density (3.82 HH per acre in Scenario A), which increased to 10 HH per acre in Scenario E. Furthermore, the percentage of households located in the neighborhood (out of the total households in the entire study area) in the REN and EUCLID cases were 8.2 percent and 16.4 percent, respectively. This is significantly higher than the values in the market analysis-based approach (see Table 5.18).

3. *Attractions*

   The percentage of attractions, a proxy for the number of non-residential establishments, located in the neighborhood for the REN and EUCLID cases was 3.4 percent and 18.3 percent, respectively. The market analysis-based scenarios had percentages ranging from 0.4 percent to 2.2 percent.

4. *Hypothetical versus Real Neighborhood*

   The REN and EUCLID models were based upon a hypothetical study area, UTOWN, that was available as a sample travel demand model in TransCAD. The market analysis-based method, however, modeled a real neighborhood. Modeling the real neighborhood had more constraints, because of factors such as not being able to arbitrarily determine the sizes, shapes, and locations of the modifications.

5. *Friction Factor, F_{ij}*

   The choice of friction factor functions, F_{ij}, had a significant impact on the way trips were distributed in the REN and EUCLID models versus the market analysis-based models. In the REN and EUCLID models, an inverse power function was used. (See Equation 5.10 below.)

$$F_{ij} = t_{ij}^{-b} \tag{5.10}$$

   where: F_{ij} = Friction factor

   t_{ij} = Travel time from zone i to zone j

   b_{HBW} = Home Based Work trips parameter = 1.4

   b_{HBO} = Home Based Other trips parameter = 3.3

   b_{NHB} = Non-Home Based trips parameter = 3.3

   The form and parameters of the friction factor functions used in the market analysis-based method were shown in Equations 5.6 to 5.8 in Section 5.3.2.1. The inverse power function gave more weight to trips of shorter distance than the functions used in the market analysis-based method. This could be the reason why a significant number of trips were diverted to neighborhood attractions in the REN model when it was compared to the EUCLID model.

6. *Configuration of Non-residential Land Use*

   In both the REN and EUCLID models, the non-residential land uses were randomly scattered across each 1.0 x 1.0 mile module. However, in the market analysis-based approach, an attempt was made to have a New Urbanist-style focal point of non-residential activities for the scenarios with increased household densities. Apart from Scenarios A and B which

describe the current land use pattern in the neighborhood, the rest of the scenarios had non-residential land uses grouped within a Neighborhood Commercial Cluster.

From the discussion above, it can be seen that the scale of the market analysis-based model, based upon a real-life study area, was much larger than the scale of the REN and EUCLID models, which were based upon UTOWN, a hypothetical model. The high percentage of households and attractions located within REN caused a significant shift towards shorter trip lengths.

The trip distribution method using the gravity model allocates trips based on the relative attractiveness of zones weighted by the relative costs of travel. Zones with larger numbers of establishments, and hence a more diverse variety of non-residential land uses, will attract more trips. Non-residential land uses located in proximity to the neighborhood are convenient in terms of travel time, but inconvenient due to the limited number and types of establishments that a neighborhood can support.

To illustrate this point, residents of the neighborhood might prefer to travel about a 3 mile distance to a commercial strip where restaurants, a mall and big-box retailers are located within close driving distance of one another. This will allow them to conduct a variety of tasks conveniently or, to use to the transportation term, to trip-chain. This might be preferred over conducting some tasks in neighborhood stores and still having to travel to the commercial strip to accomplish other things that cannot be done in the neighborhood due to the limited number of establishments.

The illustration above serves to further reinforce the findings of the market analysis-based approach by implying that modifying or revitalizing isolated pockets of neighborhoods within the context of a larger study area will not cause a significant change in travel behavior. However, if such modifications can be applied on a larger scale (e.g., a series of high-density mixed-use neighborhoods) or combined with other Smart Growth measures, such as growth control and mass transit investments, then significant shifts towards shorter trips could be expected.

Modeling travel demand using the four-step process has its limitations, as previously described in Section 5.3. One of the major concerns was that, given the large size of the study area, the model might not be sensitive enough to capture shifts in travel patterns that might occur in real-life. However, using all of Tippecanoe County is acceptable, because most of the attractions in the study area are concentrated within the cities of West Lafayette and Lafayette. Most of the trips produced in the case study neighborhood will find attraction ends within the county-sized study area.

CHAPTER 6. SMART GROWTH IMPLEMENTATION

6.1. Planning in The United States

A good description of the government's role in the making of places is provided by Alex Marshall, in his book, *How Cities Work*. Marshall writes, "The relationship of government to cities is like that of a computer operating system to its software. Government establishes the operating system by laying out a freeway, railroad, streetcar line, a subway, or a road system. Private developers establish the software: the shopping center, the factory, or the individual business or store" (Marshall 2000). Thus, state and local governments are expected to guide communities towards sustainable developments by launching initiatives that will advance the philosophies of Smart Growth, encouraging public acceptance through education and awareness programs, and creating interest in private developers to invest in such developments.

The traditional tools of planning used by governments to guide the growth of communities are public capital investments, such as the construction and maintenance of transportation, sewer and water systems, and land use controls, such as subdivision regulations and zoning controls (Levy 2000). Public capital investments are acknowledged drivers of growth. New roads increase the accessibility of previously inaccessible areas, making such areas more attractive as a recipient of growth. The provision of sewer and water systems allows construction of residential developments. Zoning laws, which were initially formed to protect the public's health, safety and welfare by enforcing the strict segregation of incompatible land uses, dictate the type and density of developments that are allowed occur in designated areas.

Many advocates of Smart Growth have criticized the fashion in which these traditional planning tools are used to induce and shape growth. Capital investments in transportation are largely made in favor of the automobile at the expense of alternative forms of transportation. Lack of planning and control over investments in infrastructure has allowed growth to creep to the fringes of metropolitan areas, where increasing tax dollars are used to extend existing infrastructure to support low-density developments. Furthermore, zoning laws have been blamed

for making commuters car-dependent, encouraging suburban sprawl and causing socially exclusionary housing practices by enforcing low development densities and the rigid separation of land uses.

Concerned over the sustainability of such growth patterns, many state and local governments have adopted Smart Growth programs and policies that seek to retard or halt sprawl-dominated development patterns. The goals of Smart Growth are ultimately to create efficient communities that are sustainable in the long run. Figure 6.1 to Figure 6.3 show a summary of the goals and objectives of smart growth and methods of achieving them developed for the purpose of this study (Sustainable Communities Network 1996, Smart Growth America 2000). A recent survey of state planning reforms published by the American Planning Association (APA 2002) found that 74 percent of the states, not including Indiana, had already implemented or were pursuing major statewide planning reforms for smart growth.

The subsequent sections aim to provide insight into a successful implementation of Smart Growth on a state level and local level and to provide a brief overview regarding the state of planning in Indiana.

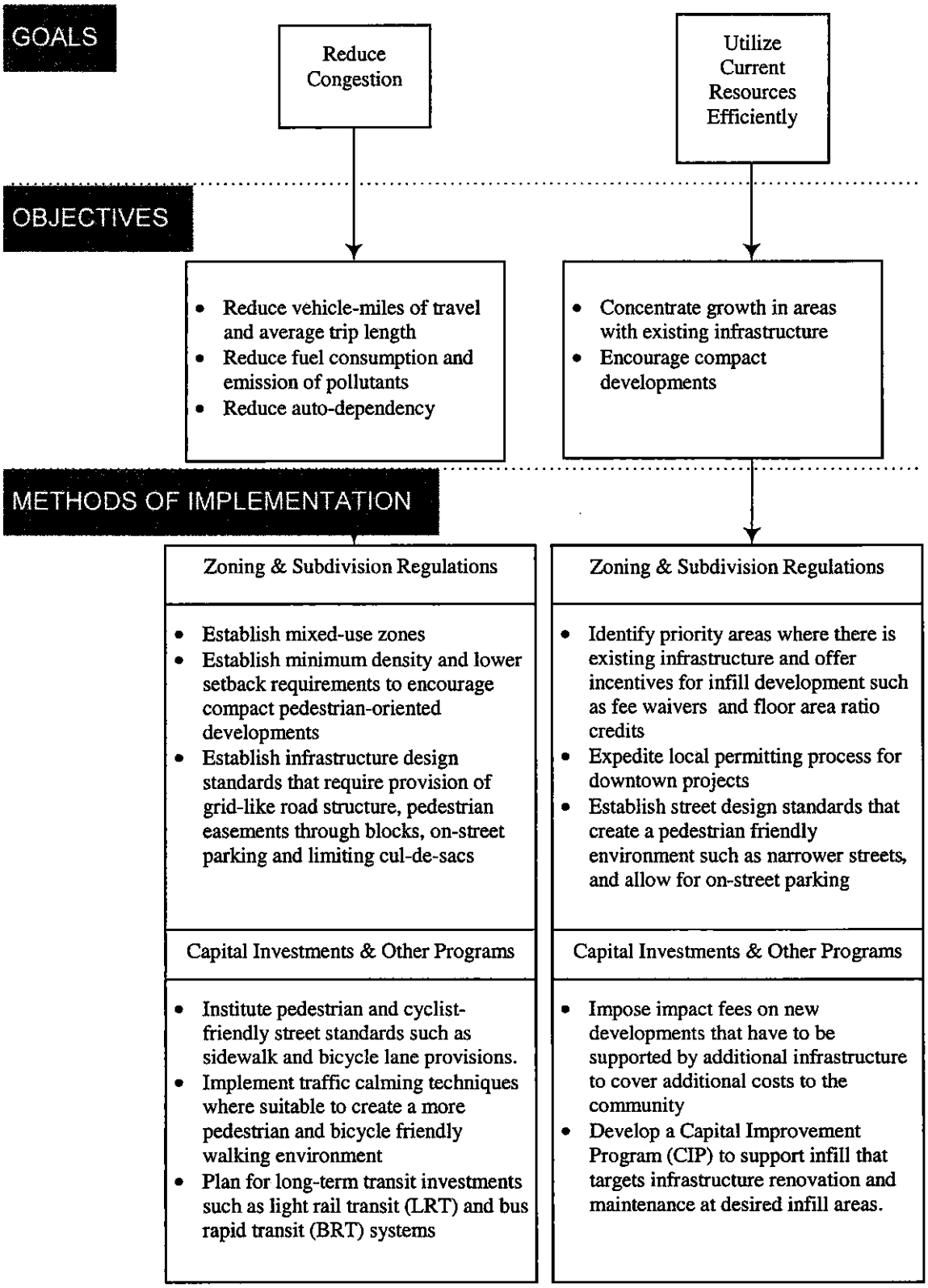
GOALS
Reduce Congestion
Utilize Current Resources Efficiently
OBJECTIVES
• Reduce vehicle-miles of travel and average trip length
• Reduce fuel consumption and emission of pollutants
• Reduce auto-dependency
• Concentrate growth in areas with existing infrastructure
• Encourage compact developments
METHODS OF IMPLEMENTATION
Zoning & Subdivision Regulations
• Establish mixed-use zones
• Establish minimum density and lower setback requirements to encourage compact pedestrian-oriented developments
• Establish infrastructure design standards that require provision of grid-like road structure, pedestrian easements through blocks, on-street parking and limiting cul-de-sacs
Zoning & Subdivision Regulations
• Identify priority areas where there is existing infrastructure and offer incentives for infill development such as fee waivers and floor area ratio credits
• Expedite local permitting process for downtown projects
• Establish street design standards that create a pedestrian friendly environment such as narrower streets, and allow for on-street parking
Capital Investments & Other Programs
• Institute pedestrian and cyclist-friendly street standards such as sidewalk and bicycle lane provisions.
• Implement traffic calming techniques where suitable to create a more pedestrian and bicycle friendly walking environment
• Plan for long-term transit investments such as light rail transit (LRT) and bus rapid transit (BRT) systems
Capital Investments & Other Programs
• Impose impact fees on new developments that have to be supported by additional infrastructure to cover additional costs to the community
• Develop a Capital Improvement Program (CIP) to support infill that targets infrastructure renovation and maintenance at desired infill areas.

Figure 6.1 Smart Growth Goals, Objectives and Implementation Methods Part I

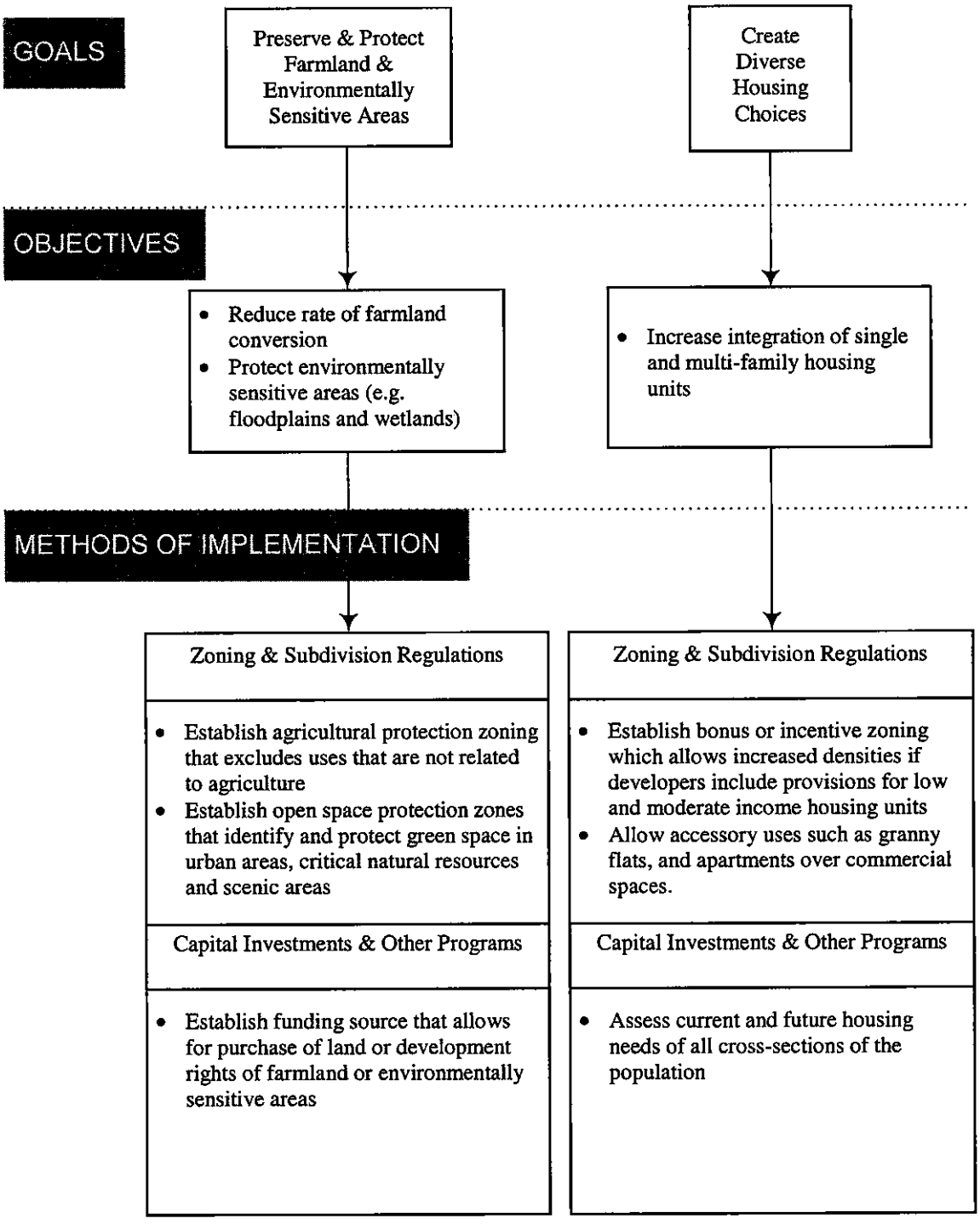

Figure 6.2 Smart Growth Goals, Objectives and Implementation Methods Part II

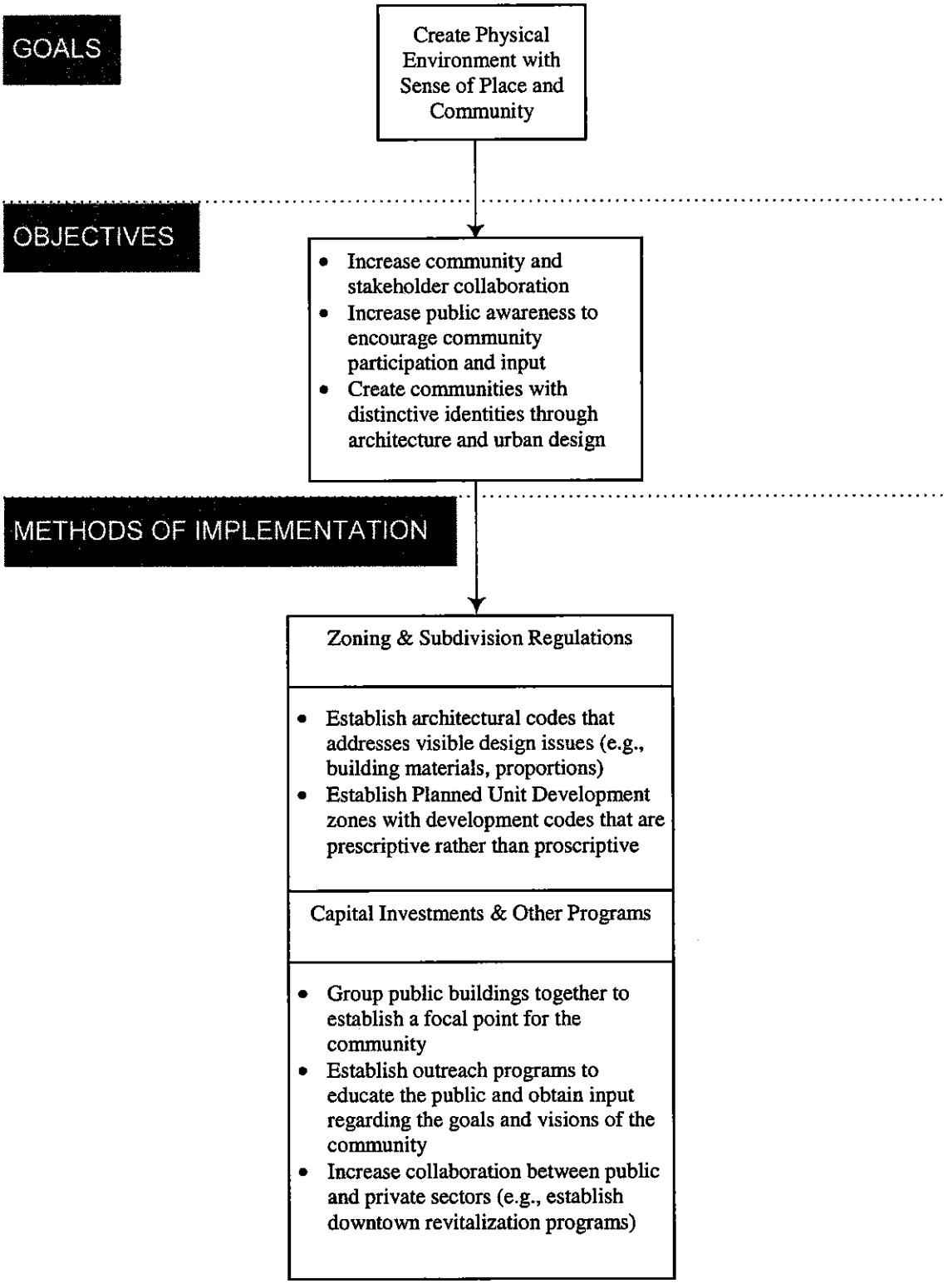

Figure 6.3 Smart Growth Goals, Objectives and Implementation Methods Part III

6.2. Smart Growth Implementation Case Study

6.2.1. State Level: Maryland

The state of Maryland covers a land area of 9,775 square miles. It is the 42nd largest state in the country, but the 19th largest in terms of population. The Smart Growth movement in Maryland essentially began in 1992 when the state passed the Maryland Economic Growth, Resource Protection and Planning Act, under which local governments were required to formulate comprehensive plans to implement seven visions. Among the visions are to direct growth in rural areas to existing population centers and to concentrate growth towards suitable areas. Local comprehensive plans were also required to contain a transportation element and encourage land development patterns that were compatible with alternative forms of transportation, such as mixed-use zoning and transit-oriented developments (Johnson 2002).

The Smart Growth movement gained significant momentum in 1997 with the launching of the Smart Growth and Neighborhood Conservation initiatives. The key feature of these initiatives was the Priority Funding Areas Act. Under this act, designated Priority Funding Areas received state infrastructure funding along with a match from the local government. Such areas were required to meet state-set guidelines for adequacy of sewer and water systems and current land use zoning designations with minimum density requirements for residential zones (Maryland Office of Smart Growth 2003). By directing growth towards areas with existing investments in infrastructure, this encouraged more efficient use of tax dollars and avoided higher taxes that would be required to fund new infrastructure for sprawl development. An overview of Maryland's Smart Growth programs is shown in Figure 6.4.

Since the inception of its Smart Growth programs, Maryland's efforts have achieved great success. For the first time since 1981, the amount of land in preservation programs exceeded the amount of developed land during the period from 1996 to 2000, as shown in Figure 6.5 (MDP 2003). Furthermore, as a result of the state's policy to direct funds towards the

rehabilitation and upgrading of existing urban areas, an increasing proportion of expenditures on school construction since 1995 have been allocated towards renovation and upgrades of existing schools in older neighborhoods, as opposed to spending on the construction of new schools in the suburbs as shown in Figure 6.6 (MDP 2003).

Transportation	*Efficient Resource Utilization*
• State funding to encourage development around transit stations • Incentive program for employees to purchase homes near workplace • State funding for road improvements such as street-scaping and lighting to help with revitalization efforts • Expansion of the Maryland Commuter Rail system (MARC)	• Economic incentives to purchase underutilized brownfield sites in densely populated areas • Provision of free site assessments for property owners on vacant or underutilized sites • Economic incentives for businesses to invest in Priority Funding Areas
Farmland and Environmental Preservation	*Diversity in Housing*
• purchase of easement and development rights of contiguous tracts of land and protect it from sprawl development • Encourage use of transfer of development rights program at the local level	• Provision of low-interest mortgages to prospective homeowners in identified areas to achieve more mixed income housing distribution • Replacement of low income public housing in declining urban areas with mixed-use, mixed income properties to disperse concentrations of low income residents

Physical Place and Community
• Adoption and revision of smart building codes to promote infill and preservation of older buildings • Allocation of state funds for education and outreach programs about the costs of sprawl and benefits of smart growth • Establishing award programs to recognize local communities that make substantial efforts at implementing Smart Growth

Figure 6.4 Smart Growth Efforts at the State Level in Maryland

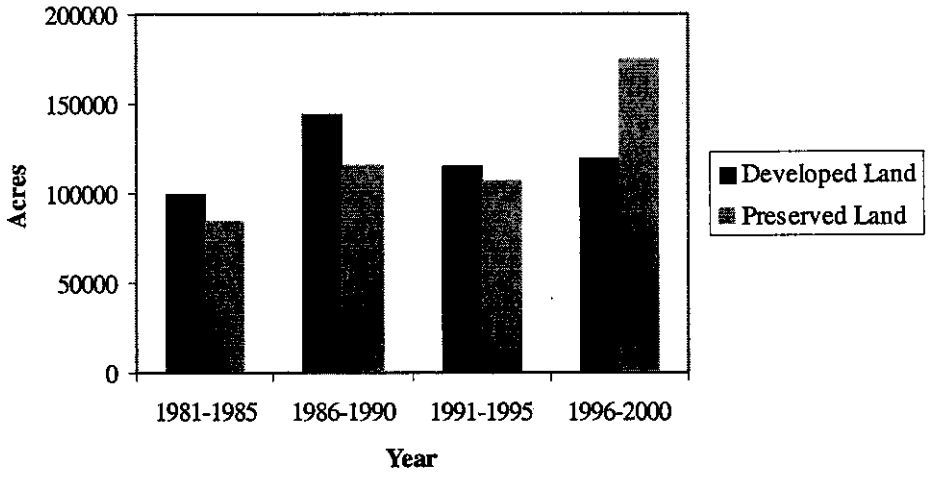

Figure 6.5 Acres of Land Developed and Land in Preservation Programs in Maryland (MDP 2003)

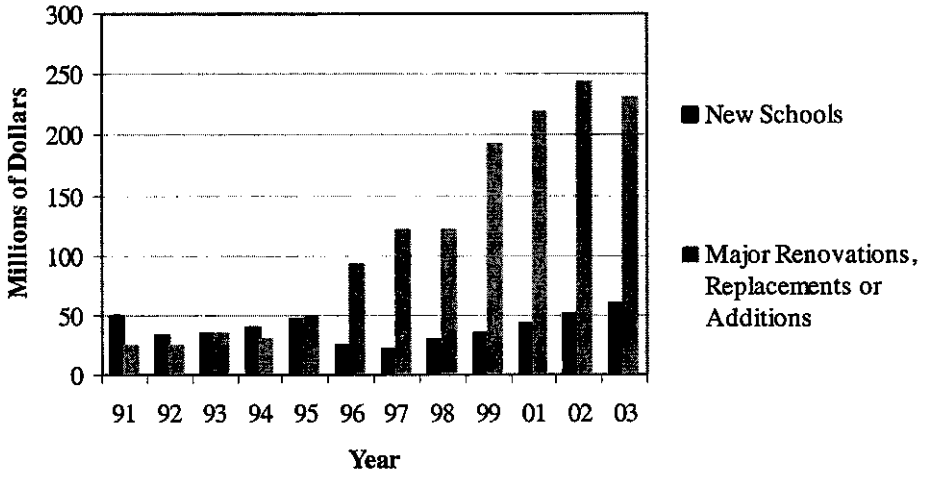

Figure 6.6 Construction Expenditures on New Schools and Upgrades of Existing Schools (MDP 2003)

6.2.2. Local Level: Calvert County, Maryland

With a land are of 213 square miles, Calvert County is the smallest county in Maryland. It had a population of 76,575 in the year 2000, which is projected to grow to 110,375 in the year 2010 (Calvert County Factsheet 2003). As people increasingly chose to move away from central cities to the rural fringes of metropolitan areas, Calvert County, located only 46 miles away from Washington D.C., faced increasing sprawl development.

Local planners updated the comprehensive plan in 1997 to reflect the seven visions of growth outlined by the Maryland Economic Growth, Resource Protection and Planning Act in 1992. The plan outlined the pursuit of two goals: promoting strong economic growth by directing growth into suitable areas, and preserving the county's rural character by protecting prime farmland, historic resources and sensitive areas (Calvert County Planning Commission 1997).

As early as 1983, the county had created special zoning districts named Town Center Districts with the intention of creating attractive mixed-use developments that would serve as the focal point of economic and residential growth of the county. Permitted residential densities in areas within a 1-mile radius of Town Centers were raised as part of a Transfer of Development Rights program which was intended to channel growth away from rural areas and to concentrate it around Town Centers.

Furthermore, Calvert County planners had a very specific stand regarding "spot" or "strip" developments in areas adjacent to the highway and outlined methods in the comprehensive plan to prevent such developments from occurring further. Capital investments in transportation improvements were directed towards the construction and upgrading of roads in designated growth areas. However, although transit was mentioned in the comprehensive plan, no specific efforts were outlined apart from plans to prepare and regularly update long range transportation system plans, which would include public transit system maintenance and improvement plans. A summary of the Smart Growth efforts, as found in the Calvert County Comprehensive Plan (Calvert County Planning Commission 1997) and the Calvert County Zoning Ordinance (Calvert County Planning Commission 2003), is provided in Figure 6.7.

Since the adoption of the 1983 Comprehensive Plan (when Town Center Districts were introduced), virtually all commercial growth in Calvert County has been directed towards Town

Centers and "spot" commercial zoning has ceased along major highways. By 1997, Town Centers had achieved a good mix of households, with over 200 units of low income housing and 475 units of elderly housing being built in seven Town Centers over the County.

Transportation	*Resource Utilization*
• Reduction in parking and roadway level of service requirements (from traffic impacts) within the Town Center • Impose road impact fees to fund construction of roads that are required as a result of new developments • Encourage the provision of pedestrian and bicycle routes to connect residential, commercial, employment and open space areas	• Require employment centers to be located adjacent to or within Town Centers to create mixed-use environment • Direct growth by increasing density limitations in areas surrounding Town Centers • Prohibit strip and "spot" developments along highways outside Town Centers through the use of zoning laws
Farmland and Environmental Preservation	*Diversity in Housing*
• Encouraged use of Transfer of Development rights to direct growth away from rural areas to areas within a 1-mile radius of Town Centers • Creation of overlay districts to allow purchase of easement and development rights of rural land	• Encouraged multi-family housing in Town Centers and permitted the use of accessory units and duplexes. • Conduct study of "inclusionary zoning" (which requires developers to set aside a percentage of lots on a subdivision for moderate and low income families)

Physical Place and Community
• Visible structures are subject to an architectural code and required to be compatible with the quality of surrounding areas • Promote Town Centers as focal point of community cultural and activity centers by locating public buildings within or adjacent to Town Centers.

Figure 6.7 Smart Growth Efforts at the Local Level in Calvert County, Maryland

6.3. State of Planning in Indiana

6.3.1. State Level

During the period from 1969 to 1997, agricultural land in Indiana decreased at an average rate of 2.47 percent per year or an average of 87,922 acres per year (USDA 1997). However, population in Indiana has been experiencing a steady increase of 2.67 percent per year, with a projected population of 7,110,000 in the year 2020 (Woods and Poole Economics 2002), as shown in Figure 6.8. In a study published by the Center for Urban Policy and Environment at IUPUI, sprawl type development was increasingly prevalent in Indiana. The percentage of land with low-density developments increased by 10.5 percent from 1990 to 2000 (Ottensmann 2002).

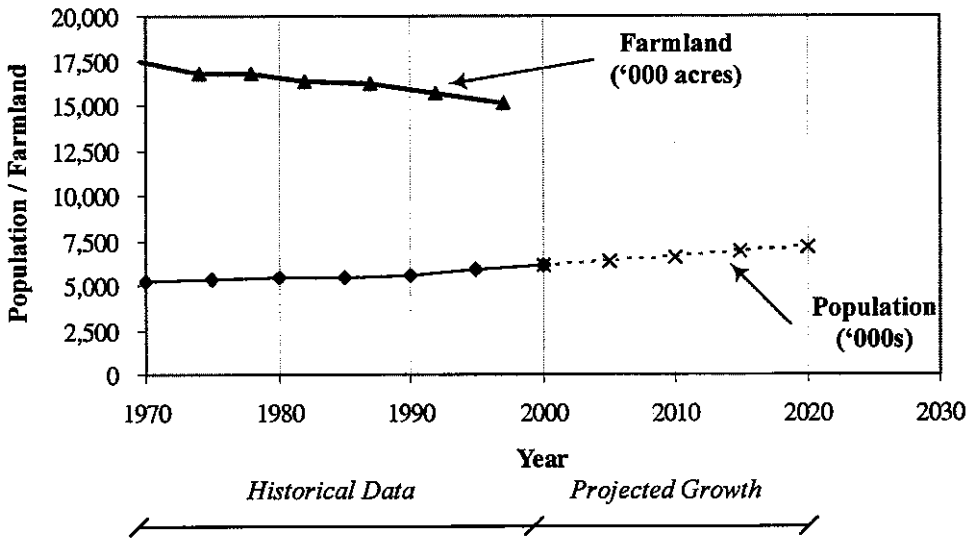

Figure 6.8 Population Growth and Agricultural Land Area in Indiana

To date, Smart Growth planning at the state level in Indiana has largely been focused on agricultural land preservation efforts, through the purchase of conservation easements and development rights (USDA-NRCS 2003). The Indiana Farmland Protection Technical Advisory Community and the Indiana Land Use Resource Council (ILRC) were established as a result of increasing concerns over the high rate of farmland conversion. The purpose of these agencies was to provide technical assistance and to coordinate cooperation between various levels of the government and the private sector. While the state government has adopted programs to

discourage growth in agricultural land, there are currently no programs in place to direct growth towards established urban areas (infill development) or to implement measures to allow and encourage more efficient denser forms of development (Palmer 2001).

In addition to agricultural preservation efforts, Indiana has a successful brownfields program which provides funding for assessment and remediation of brownfield sites, along with programs to encourage investment in vacant sites (IDEM 2003).

6.3.2. Local Level

A recent review of planning practices at the county level in Indiana by the Center of Urban Policy and Environment showed that the majority of the counties in Indiana had not adopted any Smart Growth policies or programs. Fifteen counties had no plan commissions and therefore no comprehensive plans, while 31 counties had no transportation or capital investment plans, as shown in Figure 6.9. Of the 52 comprehensive plans that were analyzed in the survey, 24 had been updated since 1995, while more than a quarter of the plans were at least 10 years old. Eight counties had comprehensive plans that were over than 20 years old (Palmer 2001).

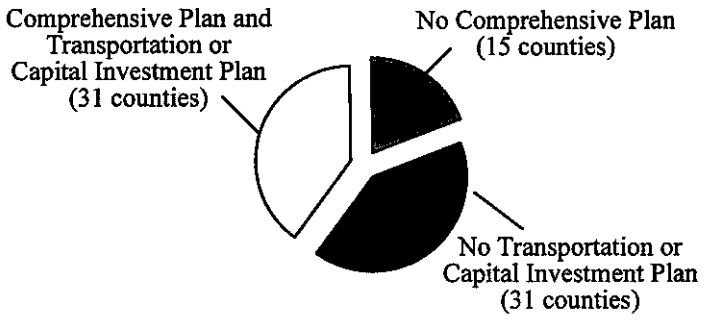

Figure 6.9 Number of Counties with or without Transportation and Capital Improvement Plans

In a more detailed survey of zoning ordinances conducted for the counties in Central Indiana, representatives were asked a series of questions regarding planning and zoning practices in their counties with respect to Smart Growth-type initiatives (e.g., mixed-use zoning and infill development programs). Although most counties were found to have good zoning practices where

agricultural protection were concerned, most of the counties did not have any other Smart Growth practices in place. In a large proportion of the counties, zoning regulations still did not permit mixed-use zoning. Some counties used Planned Unit Developments (PUDs) as a tool to provide greater flexibility for developments. However, the lack of guidelines for PUDs discourages developers. There is a high level of uncertainty, risk and cost that they must bear when investing in such developments. A good summary of zoning practices at the county level in Central Indiana is provided in a report, "Central Indiana Counties Rely on Traditional Land Use Controls" (Palmer et al. 2001).

A few areas in Indiana have begun to incorporate Smart Growth philosophies in their comprehensive plans. Monroe County, home to Indiana University has established urban service boundaries, beyond which major waste disposal infrastructure improvements would not be provided, as a method of directing sprawling growth at the edge of Bloomington to smaller existing communities (Monroe County Planning Commission 1996). The comprehensive plan of the Delaware-Muncie metropolitan area recognized the adverse effects of sprawl and developed plans to establish concentrations of developments with mixed-use, mixed-income housing, and provisions for alternate modes of transportation. The comprehensive plan also outlined plans to prevent further strip development and to concentrate future growth in "development nodes" around transportation access points (Delaware-Muncie Comprehensive Plan 1999). The City of Fort Wayne also launched a downtown revitalization program, with plans for mixed-use neighborhoods, the installation of traffic calming devices, and pedestrian improvements (Downtown Initiative 2003).

CHAPTER 7. SUMMARY AND CONCLUSION

7.1. Summary of Results

The results of the neighborhood survey in Chapter 2 showed significant community resistance towards two major tenets of New Urbanism: the mixing of land uses and increasing residential density. The general view regarding non-residential land uses located at the geographic center of neighborhoods was that they would be incompatible with their surroundings, and that the additional traffic generated through the neighborhood would be disruptive to the community. Discussions of increasing residential density incited strong opposition toward what was viewed as a form of development that would have negative social impacts on the community. When surveyed about their transportation choices, respondents indicated that, even if non-residential land uses were located close by, driving to these locations might still be the mode of choice, because they are accustomed to the flexibility and convenience provided by the automobile.

The market analysis conducted in Chapter 3 served to further strengthen the argument that the "Achilles Heel" of New Urbanism is its inability to sustain economically viable businesses (Marshall 2000, New Urban News 2000). This is a particularly important point considering that mixing land uses is the driving force behind the concept of getting people out of their cars to other modes of travel such as walking, biking, or using public transportation. The analysis found that significant increases in residential densities are required to generate adequate traffic to support the integration of non-residential uses into neighborhoods.

Based on the results of the neighborhood survey and the market analysis, hypothetical conversions of the neighborhood surveyed to New Urbanist-style neighborhoods were modeled to examine the travel impacts of such modifications. The results of the analysis showed that no significant changes in travel patterns occurred despite increasing residential densities and the number of non-residential land uses in the neighborhood. When compared to the results of a previous study (Bose and Fricker 2004), it was concluded that small-scale conversions of isolated

pockets of neighborhoods into New Urbanist neighborhoods are likely to have little to no impact on trip length distributions, both at the neighborhood level and for the entire study area at large. Examination of traffic volumes showed little change in vehicle-miles of travel for the entire study area. However, significant increases in traffic volumes on neighborhood streets were observed.

Smart Growth measures are being adopted by many states across the nation. Chapter 6 reviews the progress of such efforts in Maryland at both the state and local levels. Smart Growth in Maryland essentially began at the state level with the passing of the Maryland Economic Growth, Resource Protection and Planning Act that emphasized infill developments and environmental protection. Following the passing of the Act, local governments were required to adopt policies and programs that would further Smart Growth through the use of zoning laws, impact fees, and other such measures. The state of planning in Indiana, with respect to Smart Growth measures, was then reviewed. The study found that to date, Smart Growth measures in Indiana have, to date, been largely confined to agricultural land protection and brownfield programs.

7.2. Conclusion

The pervasive problem of sprawl continues to grow and cannot be ignored. Smart Growth provides a good system of solutions that can alleviate, if not eliminate the pressures exerted by sprawl developments exert on people, energy and the environment. However, the design philosophies of New Urbanism cannot stand alone. The concepts promoted by New Urbanists are sound and are based upon the same ideals of Smart Growth. However, if the pattern of New Urbanist developments continues to be isolated from other broader measures such regional growth control and investment in mass transit, it will have little to no impact in the larger system of sprawl. New Urbanist developments today should accept the fact that the pleasures of urbanism come hand-in-hand with its pains.

In her book, *The Life and Death of Great American Cities*, Jane Jacobs (1961) suggested that while the diversity of land uses is a necessary component in cities, it is natural for suburbia to be served by large shopping centers, because the thin spread of population cannot support a similar variety of non-residential establishments. This further reinforces the fact that, for New Urbanism to work, more emphasis must be placed on "urbanism", which really comes into being

as a result of the pressures of concentrating people and places. Growth controls must be put into place, densities must be sufficiently high in order to sustain commercial and retail establishments, and mass transit must no longer be considered as something that other people take.

One of the major obstacles to implementing Smart Growth and New Urbanism is overcoming community resistance towards increasing residential density and the introduction of non-residential land uses into a residential neighborhood. The sentiments expressed by the residents of the case study neighborhood are not unique, and attempts at implementing New Urbanism are commonly met with public opposition. For example, proposed mixed use development of Arbor Chase in West Lafayette, Indiana, was successfully opposed by residents in an adjacent development. Residents argued that the commercial elements of the development would cause increases in traffic, noise and lighting that would be detrimental to the quality of their life (Showalter 2003).

The success or failure of Smart Growth and New Urbanism hinges largely on public opinion. Ultimately, it is a matter of personal choice. Some people are attracted to the nostalgic charm of New Urbanist neighborhoods, and some really like living in suburbia. People should be given options to choose the manner in which they live, work and travel. To the largest extent possible, such choices should be informed ones. Education and awareness programs should help inform communities about the realistic advantages and limitations of such choices.

If Smart Growth and New Urbanist measures were implemented on a larger, coordinated scale, the integration of residential and non-residential uses could cause a shift towards shorter trip lengths. This would then increase the competitiveness or attractiveness of other modes relative to the automobile. Even if people still chose to drive, there could be a decrease in vehicle-miles of travel, as shown in the REN study. However, this could also raise further questions about the environmental impacts of shorter trips, where there would be a higher percentage of hot and cold starts.

Smart Growth and New Urbanist measures not only create environments that increase the convenience of non-motorized transportation and mass transit, but also reduce the convenience of the automobile (e.g., by advocating narrower streets and reducing parking availability). A major obstacle in implementing Smart Growth and New Urbanism is the reluctance of people to get out

of their cars, onto sidewalks, into buses, and onto bicycles. People must realize that they cannot experience the benefits of Smart Growth and New Urbanism without sacrificing some comforts of the automobile that have long been taken for granted. For example, people will be able to walk to the neighborhood grocery store, but they might have trouble finding parking on the street if they had used a car. Many people also feel that the most effective way to reduce the number of vehicles on the road is by improving transit services. However, the provision of transit services is most effective in cities with big population concentrations such as New York City or Chicago. Providing the same level of services found in such cities, which traditionally boast high percentages of transit riders, in areas of lower population concentrations would be economically inefficient. In such areas, the best alternative to the personal automobile are non-motorized forms of transportation, such as walking or cycling.

It is important to note that this case study was conducted in Tippecanoe County, Indiana. The study area is smaller than areas with larger population where sprawl is more severe, such as the suburbs of Los Angeles and Chicago. Unlike such areas, residents in Tippecanoe are not faced with severe congestion or hour-long commutes and may be less enthused about Smart Growth and New Urbanism, compared to big city residents. In Indiana, efforts at reversing the adverse effects of sprawl should be concentrated in areas of higher populations, such as the suburbs of Indianapolis, where the impacts of sprawl are more tangible in people's daily lives. However this does not imply that medium-sized cities, where the negative effects of sprawl are not as apparent, should be ignored. In such cases, Smart Growth measures should be more pre-emptive in nature, with the objective of preventing sprawl from occurring instead of mitigating its ill effects. For example, in the suburbs of Indianapolis, emphasis could be placed upon coordinating land developments with investments in mass transit (e.g., Transit-Oriented Developments). In mid-sized cities however, where large investments in mass transit are not cost-effective, greater emphasis could be placed upon directing growth towards established areas (e.g., infill development) to ensure the efficient use of existing infrastructure.

7.3. Future Work

Future work could be dedicated to developing a guide that presents and evaluates alternative land use patterns and mechanisms for planners, developers and public officials in Indiana. A system of recommendations consisting of the alternatives available to local and state

agencies categorized by the population size of an area could be developed. This would help balance measures at implementing Smart Growth with the level of need in the targeted areas. Counties or metropolitan areas in Indiana could be identified by either population size or the rate of agricultural to residential land conversions in order to prioritize efforts at implementing any Smart Growth-type measures.

Based upon the methods used in the present study, a step-by-step Smart Growth implementation guide could then be developed. A proposed outline of such a guide would be as follows:

1. *Community Input*

   Conduct community survey to establish community preferences and priorities. This step will also help identify and target specific problems faced by the community.

2. *Education and Awareness*

   Conduct workshops and education programs to increase awareness of the community regarding the issue of sprawl and to provide a fair and balanced view about the advantages and limitations of Smart Growth and New Urbanist developments.

3. *Develop Proposal*

   Using the toolkit mentioned previously, develop a set of measures that will best suit the community in terms of the level of need and also community goals identified in the first step.

4. *Evaluate Proposal*

   Evaluate the proposal in terms of economic feasibility and community acceptance. The community should be involved in the evaluation until a consensus can be reached.

5. *Implementation*

   Implement the proposed measures and evaluate the results.

The guide should also distinctly identify the responsibilities and level of participation by state and local governments, and the public and private sector. Furthermore, the guide could also provide methods of increasing collaboration and cooperation between all government agencies to ensure smooth and efficient implementation of any Smart Growth measures.

The impact of New Urbanist neighborhoods on modal choice, specifically possible shifts to non-motorized forms of transportation should also be examined. Surveying established and thriving communities with New Urbanist characteristics could provide insight into what makes

such neighborhoods work, and how people in such neighborhoods choose to travel. Such surveys could provide further insight into how to "export" the proven successes of New Urbanism to existing neighborhoods in need of revitalization. Some areas that could possible be examined through the survey include:

1. *Physical Attributes*

   Does the neighborhood have a grid-like street network, sidewalks, on-street parking and other physical attributes typical of a New Urbanist neighborhood? Are the non-residential land uses clustered in a commercial center of activity?
2. *Non-residential Land Uses*

   Which previous destinations, if any, have been replaced by current destinations at commercial nodes? What are the nearest competing commercial areas not located within the neighborhood? Do the non-residential land uses attract mostly trips that originate from the neighborhood or from outside the neighborhood?
3. *Travel Patterns and Modal Split*

   How do the residents travel to the non-residential land uses in their neighborhood? Is there a significantly higher proportion of short trips? Do they depend on the automobile for short trips? What are the acceptable walking distances by destination type and personal characteristics? What is the frequency of trips to the commercial nodes by destination type and mode?
4. *Traffic Volumes*

   What are the traffic volumes on neighborhood streets? Do the non-residential land uses attract a significantly high amount of traffic?

The survey could be conducted in three parts:

1. *Interview of Business Owners at Commercial Nodes*

   Business owners interviewed about their customers to obtain an idea of what proportion of customer trips originate from within or from outside the neighborhood.
2. *In-person Survey at Commercial Nodes*

   Surveys of customers at the commercial nodes with respect to their origin and destination mode choice, and frequency of trips to the commercial nodes.

3. *Mailback Survey of Sample of Neighborhood Households*

   Mailback surveys to gain insight on mode choice and frequency of travel to the commercial nodes and other relevant questions.

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APPENDIX A. SURVEY FORM

St. Lawrence-McAllister Neighborhood Meeting
McAllister Center

Smart Growth and the Communi
October 7 20

PART I: NOMINAL GROUP PROCESS (Group Discussion)

Community Goals and Visions

1. Discuss Best Neighborhood Attributes

2. Discuss Changes Most Liked To Be Seen

Figure A.1 Survey Part I: Group Survey Community Goals and Visions

PART I: NOMINAL GROUP PROCESS (Group Results)

Community Goals and Visions

1. From Group Discussion, list the THREE best attributes of your neighborhood

A. _____

_____

B. _____

_____

C. _____

_____

2. From Group Discussion, list THREE changes you would most like seen in your neighborhood

A. _____

_____

B. _____

_____

C. _____

_____

Figure A.2 Survey Part I: Group Survey (Group Response)

PART I: NOMINAL GROUP PROCESS (Individual Results)

Community Goals and Visions

1. List the THREE best attributes of your neighborhood

A. _____

_____

B. _____

_____

C. _____

_____

2. List THREE changes you would most like seen in your neighborhood

A. _____

_____

B. _____

_____

C. _____

_____

Figure A.3 Survey Part I: Group Survey (Individual Response)

PART II: INDIVIDUAL SURVEY

Desirable Land Uses in A Neighborhood

Rate each of the following land use type on a scale of 1 to 5 based on how desirable each of them would be if they were located within your neighborhood

Desirable ——————— *Undesirable*

	1	2	3	4	5
1 Auto Repair Shop					
3 Book Store					
5 Dentist					
7 Doctor					
9 Electric Appliance					
11 Furniture Store					
13 Hair/ Beauty Salon					
15 Insurance Sales Office					
17 Liquor Store					
19 Pharmacy					
21 Public Library					
23 Theatre					

Figure A.4 Survey Part II: Land Use Preference Survey

PART III: CASE STUDIES

Hypothetical Developments in The Neighborhood

You will be presented with three hypothetical case studies of proposed developments within or around your neighborhood. Please provide your comments for each of the proposed developments

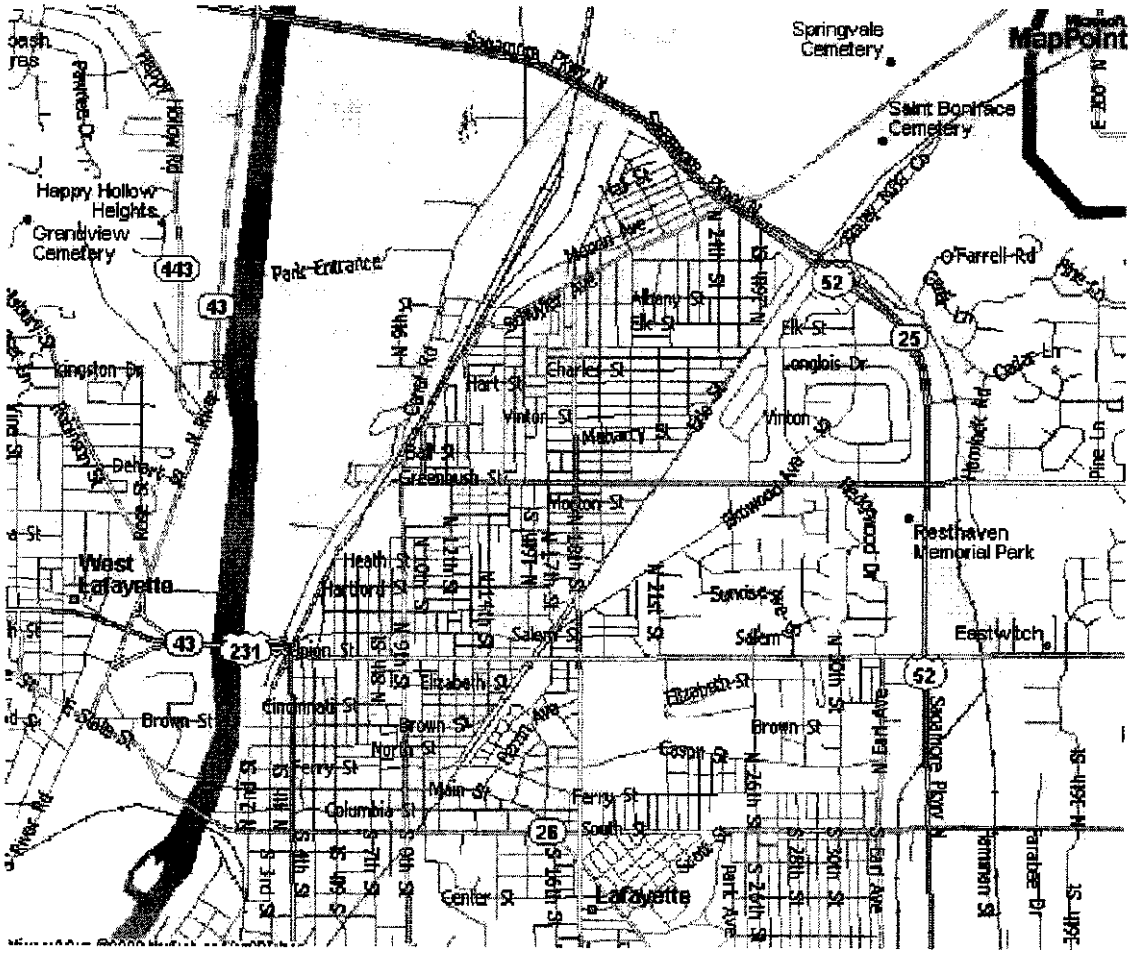
	Case Study I: ***Underwood Street***	***Case Study II:*** ***Schuyler Avenue***	***Case Study III:*** ***Greenbush Street***
Suitability *How compatible is the development with its adjacent area?*			
Accessibility *Would you consider walking, cycling or driving to this place?*			
Traffic *How would you feel about the increase in traffic?*			
Increase in density ***How would you feel about having high density residences in the area?***			

Figure A.5 Survey Part III: Case Study Evaluation 1 of 3

PART III: CASE STUDIES

Proposed Developments in The Neighborhood

The following is a map of your neighborhood and the surrounding areas. Please mark on the map where you think further developments like the ones described in previous case studies should be located.



Continued on Next Page

Figure A.6 Survey Part III: Case Study Evaluation 2 of 3

PART III: CASE STUDIES

Proposed Developments in The Neighborhood

Please provide your comments on the location you have indicated in the previous map. Please keep in mind the following when providing your comments:

- Reason for choosing location
- Type of developments at location: small, medium or large scale businesses
- Acceptable residential developments: Apartments, townhouses, duplexes, single family homes
- Parking requirements: On-street parking, parking lots in front, parking lots in back
- Traffic: presence of neighborhood traffic, presence of external traffic?

THANK YOU FOR PARTICIPATING

Figure A.7 Survey Part III: Case Study Evaluation 3 of 3

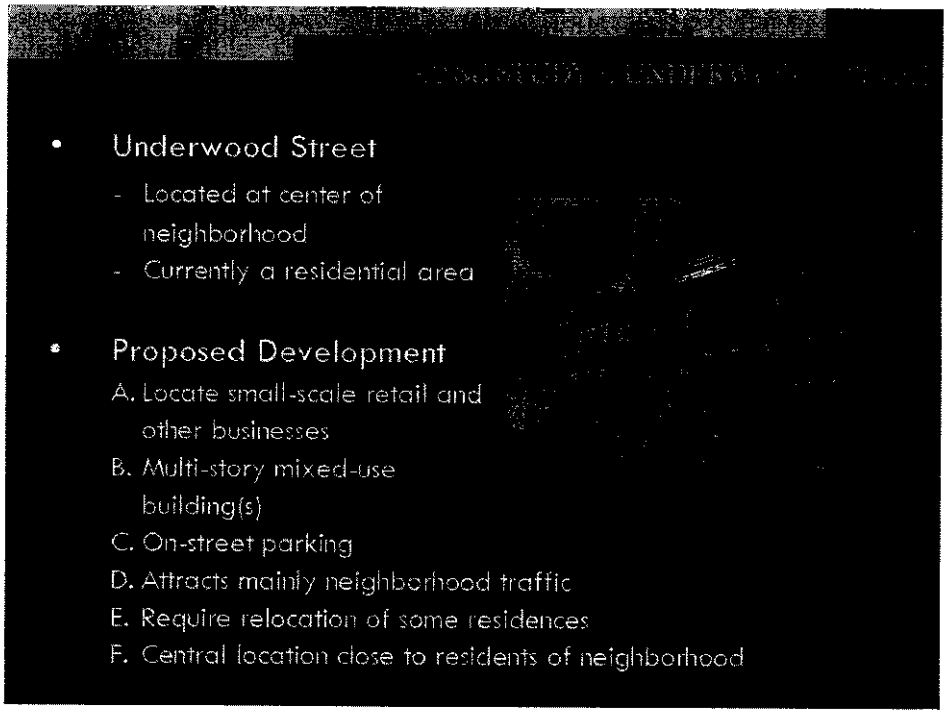


Figure A.8 Presentation of Case Study I: Underwood Street

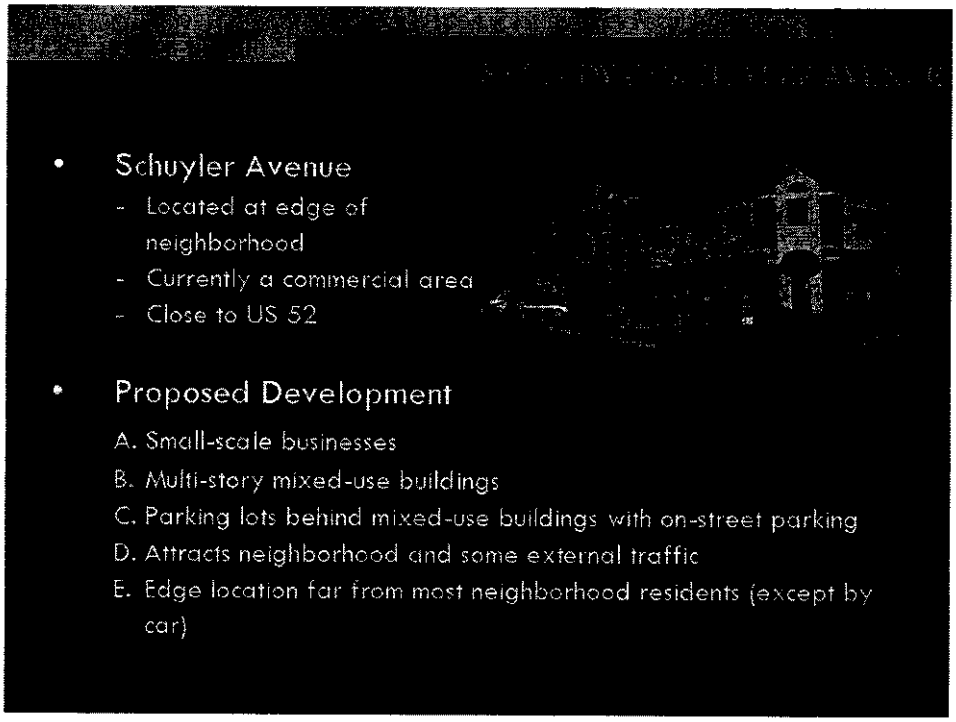


Figure A.9 Presentation of Case Study II: Schuyler Avenue

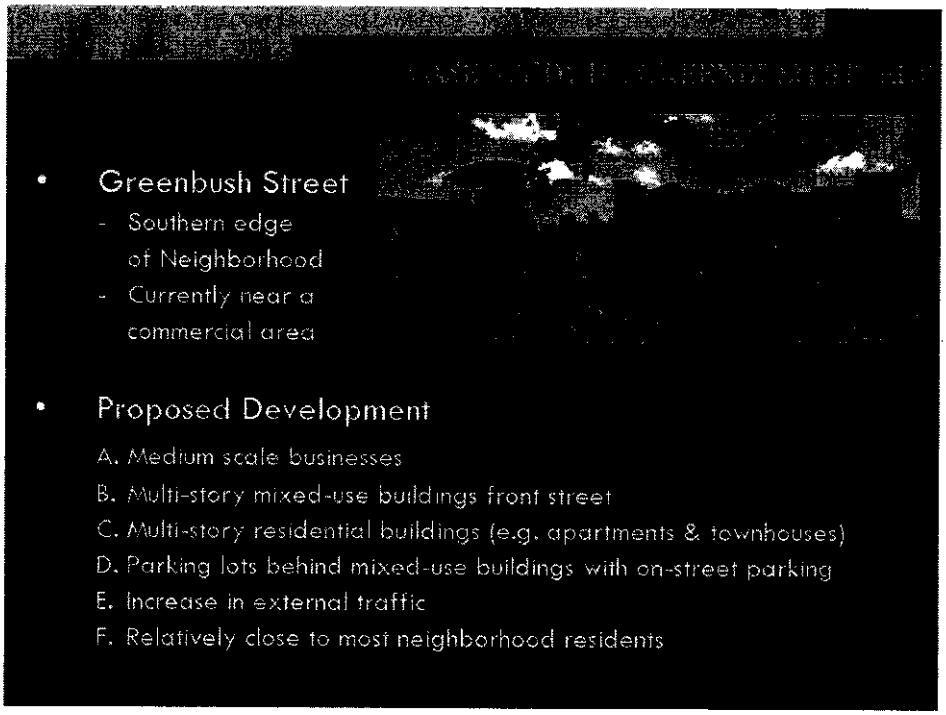


Figure A.10 Presentation of Case Study III: Greenbush Street

PART I: GROUP SURVEY RESULTS

Best Neighborhood Attributes (* if voted chosen by group)

Proximity to Other Land Uses:

- Close to Church, School, Clinic and Hospital**
- Close to Market Square, Menards and other businesses (on outskirts)****
- Close to McAllister Center*

Transportation and Infrastructure:

- New sidewalks, curbs, streets*
- Clean streets (Well-kept neighborhood)*
- Tree-lined streets
- Little (limited) traffic
- Bus route

Community:

- Quiet neighborhood*
- Established Neighborhood, Neighborhood history*
- Good, friendly neighbors**
- Longevity of people
- Variety/Diversity
- *Housing*
- Owner-occupied (owners nice people)

Changes They Would Like To See (* if voted chosen by group)

Transportation and Infrastructure:

- Speed bump on 18th and Underwood
- Traffic control/ enforcement*
- Infrastructure improvements – sidewalks, streetlights, stop signs***
- Better parking, even if on one side of street

Community:

- Noise from subdivision cleared up
- Take better care of place (weeds)
- Pride (more)*

Housing

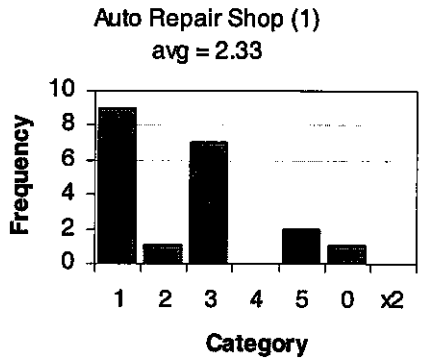
- No rentals, more home ownership***
- Ordinance enforcement – noise, apartment number*
- Property value reassessment*

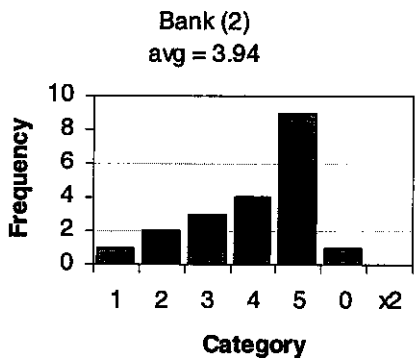
Misc

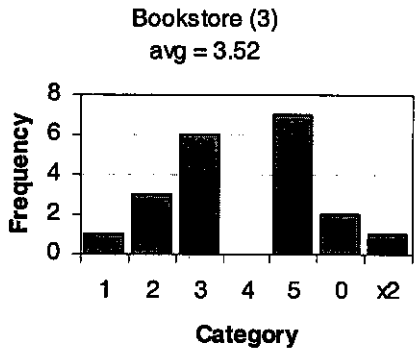
- Taxes went up*
- Park
- Close neighborhood bars
- Encourage businesses to increase landscaping
- Less junk cars
- Run down buildings
- No barking dogs*
- Pets kept in own yard

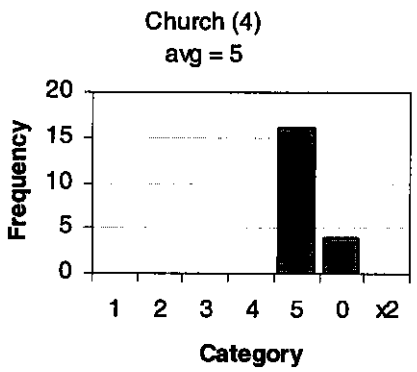
Figure B.1 Results of Group Survey

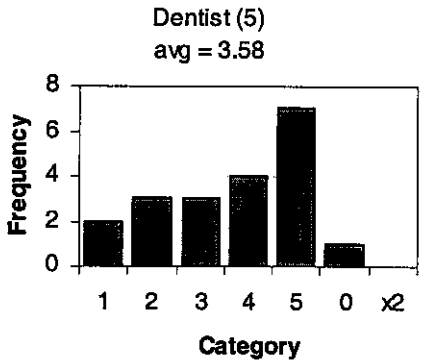
PART II LAND USE PREFERENCE SURVEY RESULTS

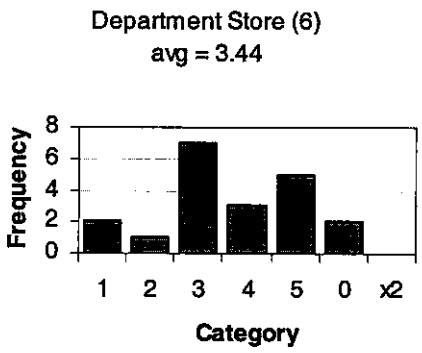






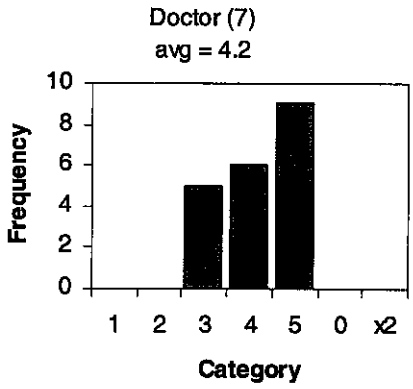


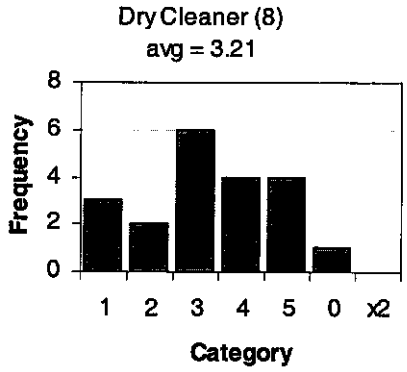


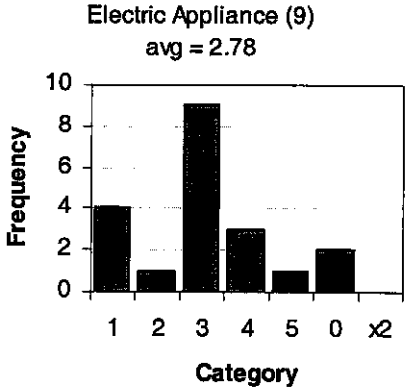


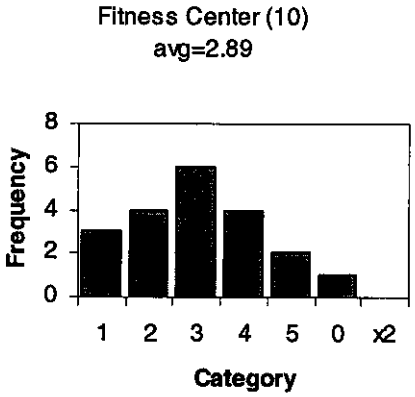
* x2 indicates responses that could not be used.

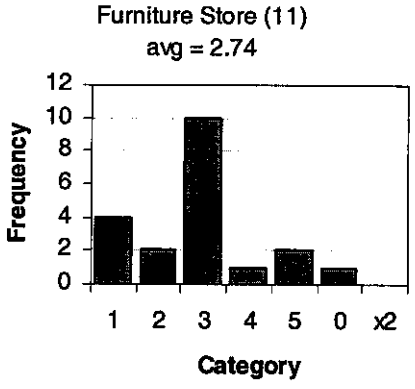
Figure B.2 Results for Land Use Preference Survey Part 1 of 4

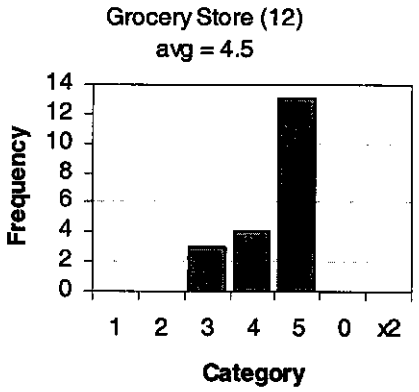






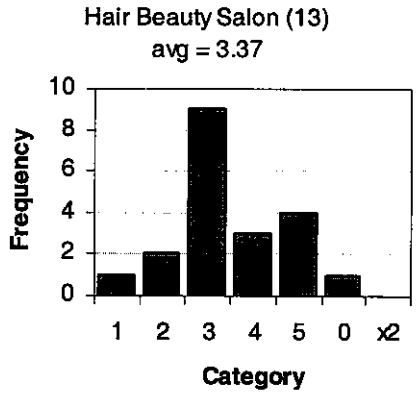


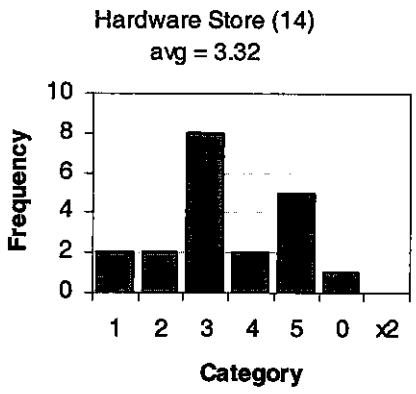


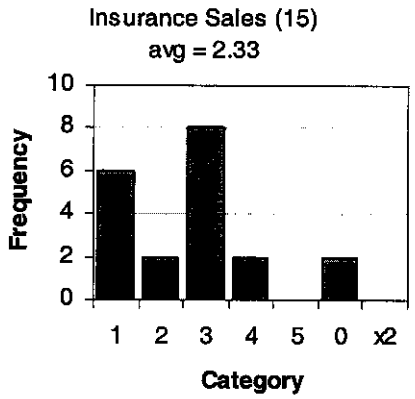


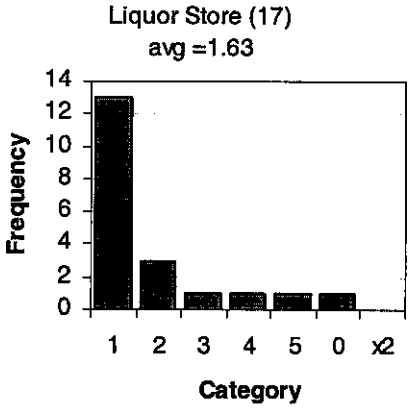
* x2 indicates responses that could not be used.

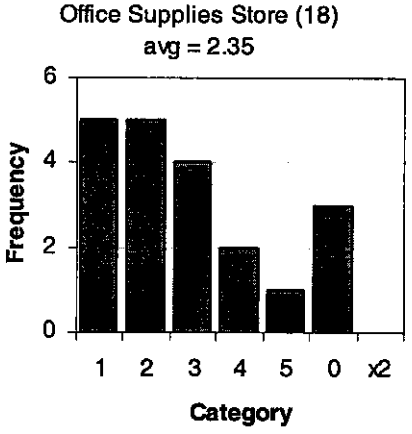
Figure B.3 Results for Land Use Preference Survey Part 2 of 4





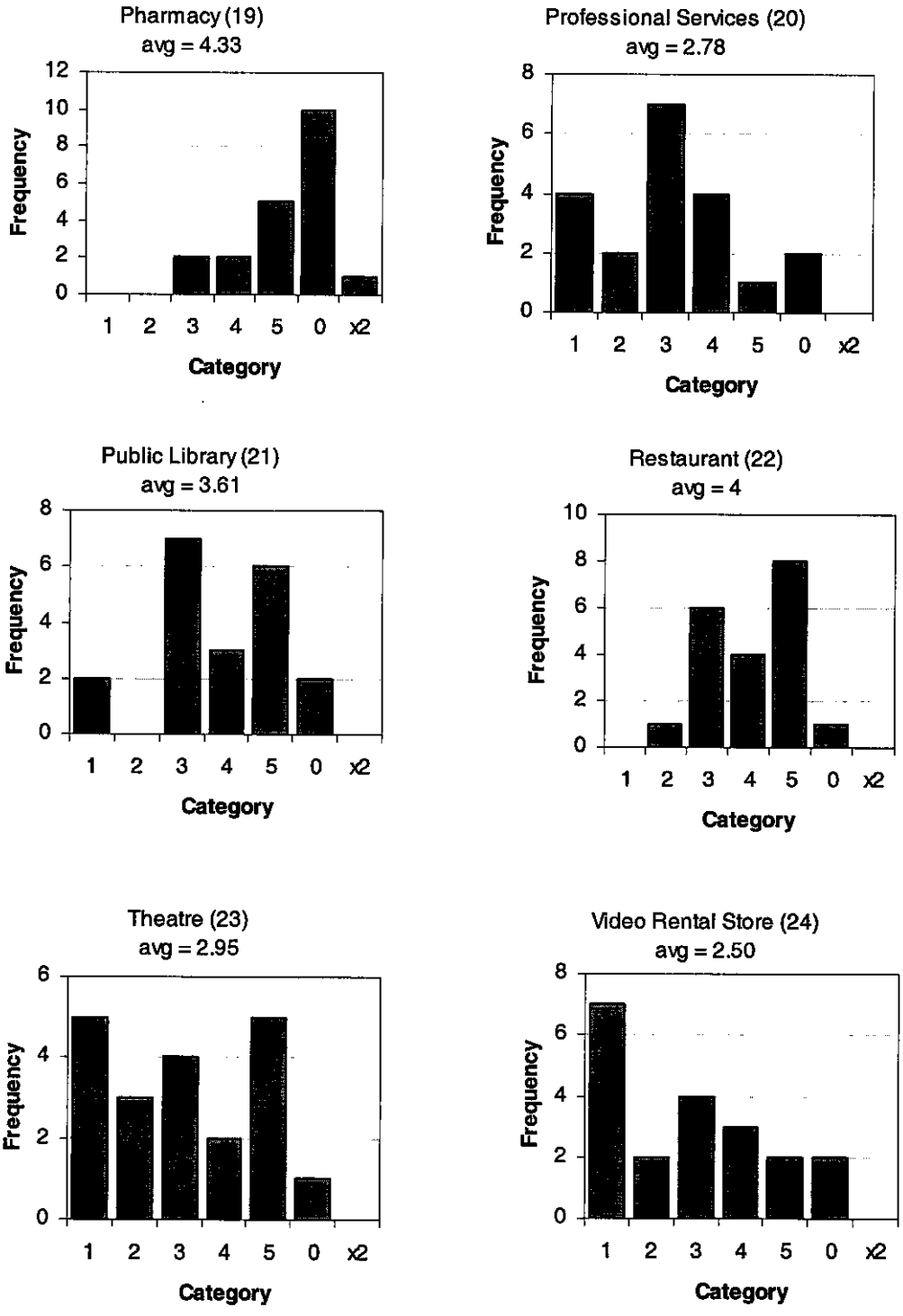






* x2 indicates responses that could not be used.

Figure B.4 Results for Land Use Preference Survey Part 3 of 4



* x2 indicates responses that could not be used.

Figure B.5 Results for Land Use Preference Survey Part 4 of 4

CASE STUDY 1 UNDERWOOD STREET

Suitability

- No (not compatible) **********
- Not in a residential area*
- No rental apartments*
- Leave as is*
- Probably ok*
- No, it will not be able to compete*
- This could eventually bring too many ppl to residential*

Accessibility

- No**********
- Yes, would consider walking cycling ***
- Drive**
- Probably ok*
- Not necessary*

Traffic

- No**********
- Don't want increase****
- Bad*
- I would fight it*
- Not necessary, therefore not acceptable*

Increase in Density

- No**********
- No rentals***
- Bad*
- Would fight it*
- Ok*

Figure B.6 Results for Case Study 1: Underwood Street

CASE STUDY II SCHUYLER AVENUE

Suitability

- No *****
- Yes I think Schuyler could be the gateway to this end of the city*
- Could live with more businesses on Schuyler*
- On certain blocks that already have businesses*
- No, half the businesses there are run-down or a security risk*
- Best Option of three, good**
- Somewhat compatible*
- Marginally, probably ok, acceptable ******

Accessibility

- Yes, driving***
- Yes, easily, do already*
- No, too far *********
- Yes, depends on what businesses you have****
- Best Option of three*
- Probably ok***

Traffic

- Don't want it**********
- Concerned about any increase*
- Would welcome it – better control than current*
- Already lots of traffic*
- Best Option of three*
- Would fight it*
- Ok, wouldn't bother me ***

Increase in Density

- Ok with me******
- Would create a great opportunity for new neighbors*
- Absolutely not, no **********
- Best Option of three*
- Would fight it, no rentals**

Figure B.7 Results for Case Study 2: Schuyler Avenue

CASE STUDY III GREENBUSH STREET

Suitability

- Use Market Square and Menard's area, maybe move a little west of the old railroad, we already have Wabash center and the apartments**
- Doesn't keep up with adjacent areas**
- Would rather put more stores in Market Square*
- Needs to be developed only in areas zoned for business**
- Not in residential area*
- Possible, ok***
- No*********
- Yes, I think it would be great*

Accessibility

- No**********
- Yes, I would walk and drive****
- I could walk*
- Not necessary*

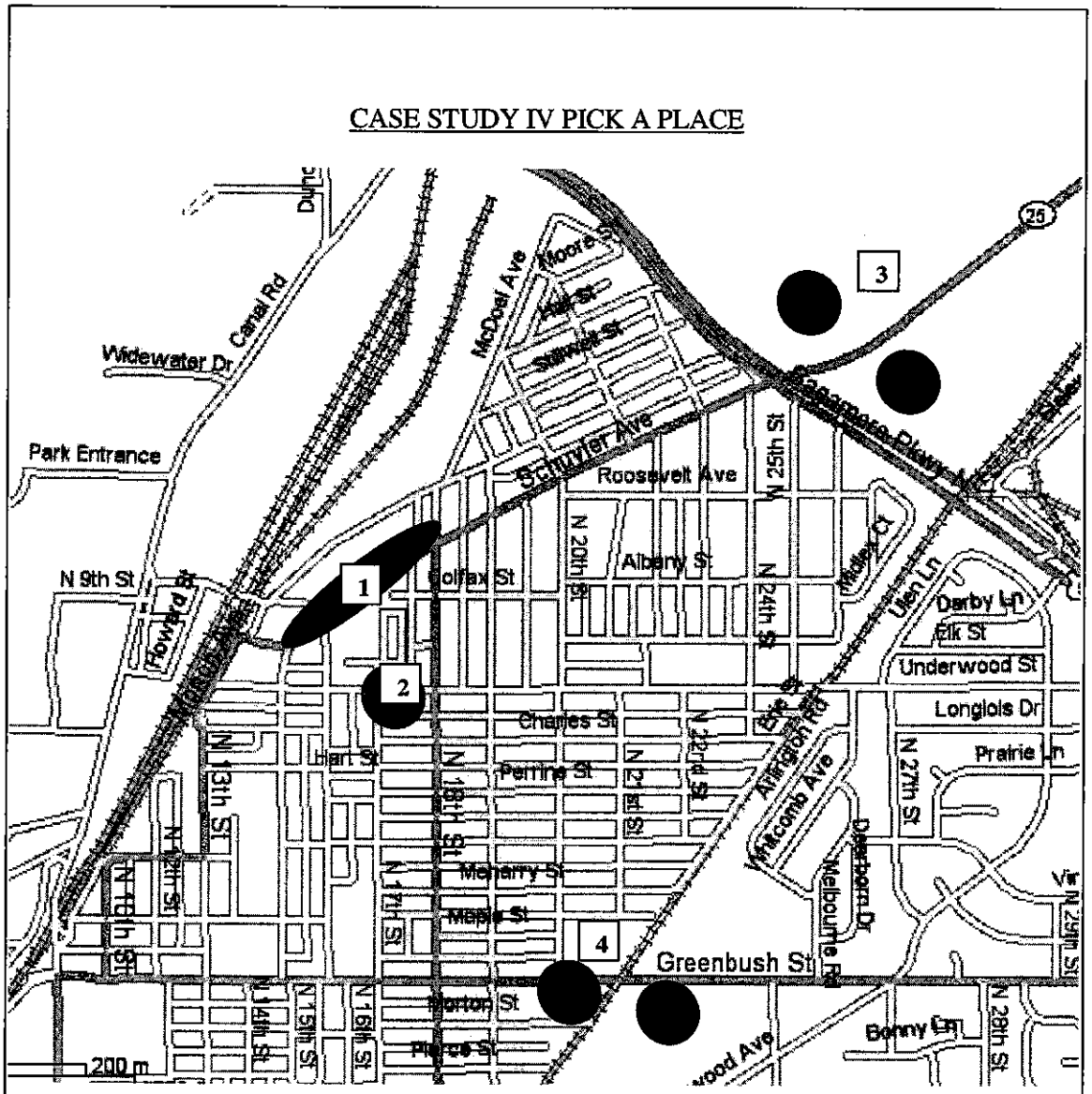
Traffic

- Bad, have too much traffic now, don't want anymore***************
- Yes*
- Would fight it*
- As long as they redo the roads, it would be okay**

Increase in Density

- No, heck no**********
- No more apartments***
- Yes*
- Would fight it*
- I think it would create great unity*
- Ok with me*

Figure B.8 Results of Case Study 3: Greenbush Street



DISCUSSION TOPICS:

1. Schuyler Avenue: Better Businesses
2. Need play area (Northfield)
3. Baldwin going here, develop the Blitz corner, replace Staley's with a neighborhood mall ****
4. Abandoned gas station? Owner refuses to sell**

Figure B.9 Results of Case Study 4 Pick-A-Place

APPENDIX C. ANALYSIS OF THE EDGE CONCEPT

The Edge Concept proposes a series of multi-story mixed-use buildings with retail on the ground floor and apartments above as shown in Figure .

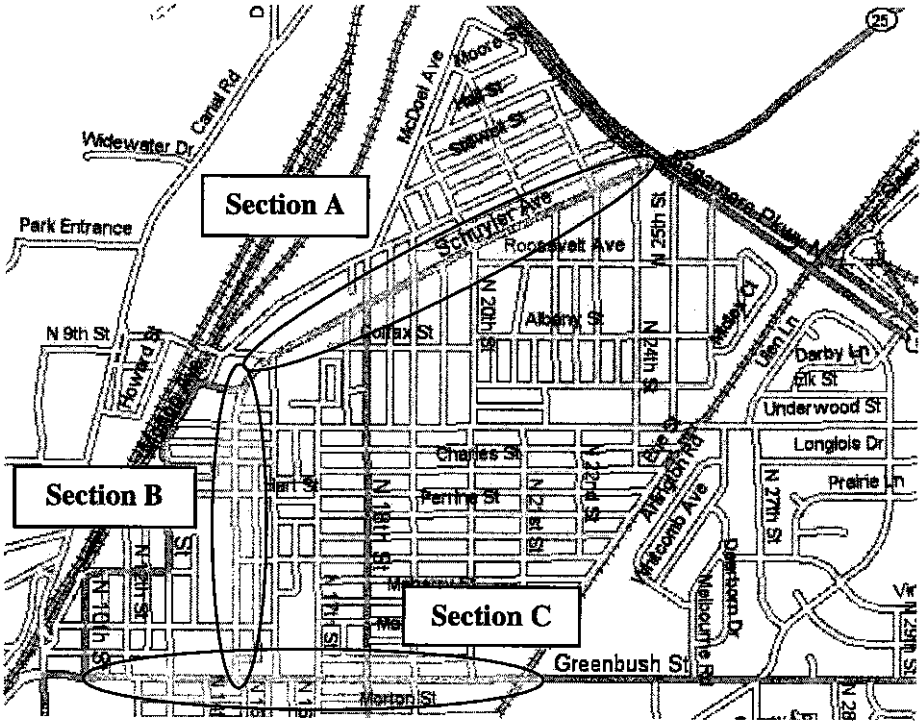


Figure C.1 Edge Concept in St. Lawrence-McAllister Neighborhood

To find the total non-residential units that required to form an edge:

Length of Section A = 0.74 mi = 3907.2 ft

Length of Section B = 0.48 mi = 2534.4 ft

Length of Section C = 0.74 mi = 3907.2 ft

Total Edge Length = 3907 + 2534 + 3907 = 10,348 ft

Assuming that each non-residential establishment has a footprint of 60 x 50 ft, then there is one unit per 60 ft of length.

Therefore, the number of units along the entire edge = 10,348 ft / 60 ft ~ 172 units

The assumption of the frontage length of each unit is generous, to allow for curbs, sidewalks, crossing streets and so forth. Based upon this rough analysis, the neighborhood cannot economically support the 172 non-residential units required to form the non-residential edge in the neighborhood.

APPENDIX D. DETERMINING ELASTICITIES OF PERCENTAGE OF INTERNAL TRIPS

Assuming that elasticity is constant over the range of household and employment densities, this implies that the demand function has the form:

$$y = a\,x^{b} \tag{D.1}$$

where: y = percentage of internal neighborhood trips

x = household density or employment density

a, b = coefficients of the demand function

It can then be shown that:

$$\text{Elasticity, } e_x = b = \frac{\log D_1 - \log D_0}{\log x_1 - \log x_0} \tag{D.2}$$

The percentage of internal neighborhood trips (see Table D.1) were then fitted to a function of the form shown in Equation D.2 where the coefficient 'b' is the elasticity. The results are shown in Figure D.1 to D.2.

Table D.1 Percentage of Internal Neighborhood Trips with respect to Household and Employment Densities

Scenario	HH Density (HH/acre)	Employment Density (emp/acre)	Percentage of Internal Neighborhood Trips		
			HBW	HBO	NHB
B	3.8	1.22	0.87	1.63	0.31
C	5.0	1.76	1.11	2.00	0.74
D	7.0	1.97	1.49	2.39	0.82
E	10.0	2.62	1.94	2.99	0.99

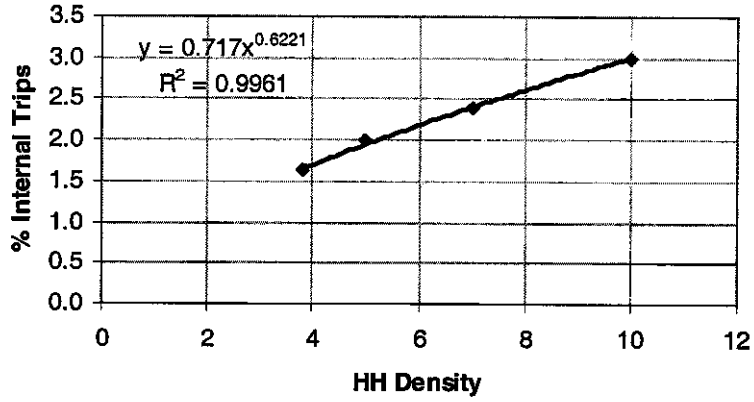


Figure D.1 Percent HBW Internal Trips versus Household Density (HH/acre)

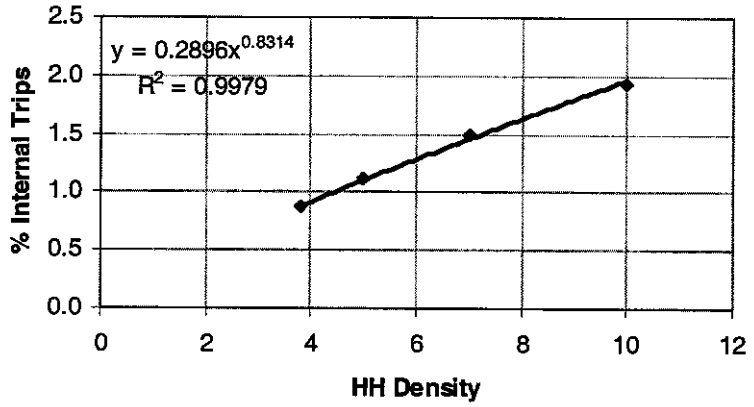


Figure D.2 Percent HBO Internal Trips versus Household Density (HH/acre)

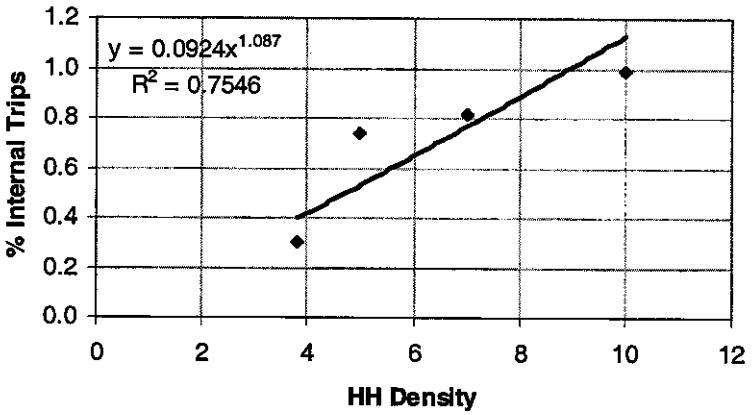


Figure D.3 Percent NHB Internal Trips versus Household Density (HH/acre)

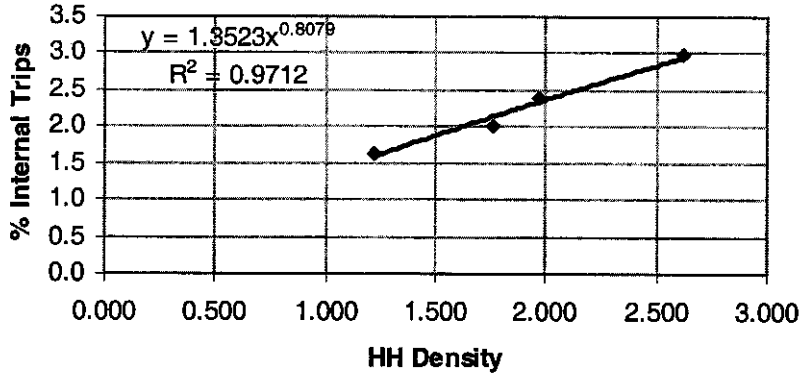


Figure D.4 Percent HBW Internal Trips versus Employment Density (emp/acre)

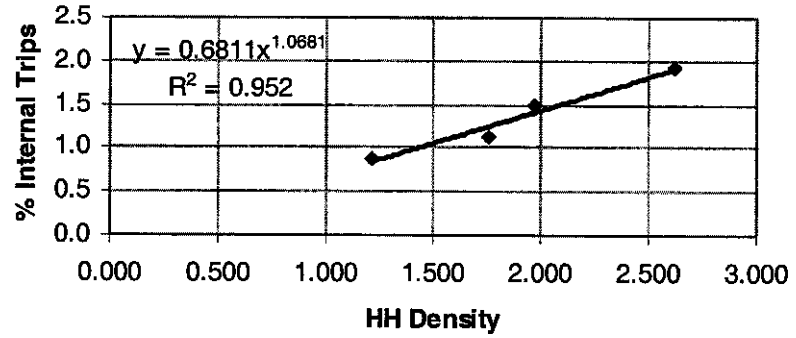


Figure D.5 Percent HBO Internal Trips versus Employment Density (emp/acre)

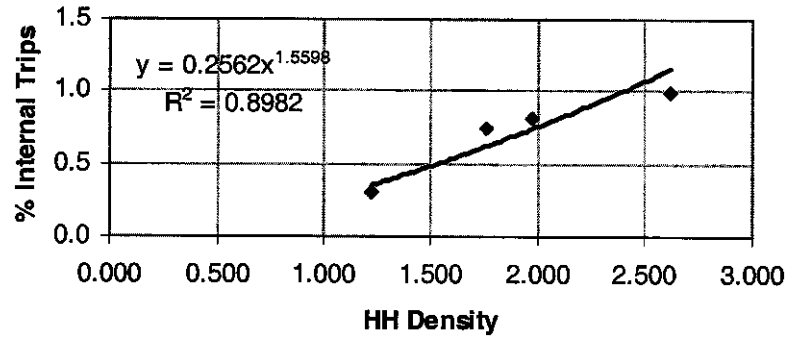


Figure D.6 Percent NHB Internal Trips versus Employment Density (emp/acre)