Reverse Commuting in Detroit, Michigan

Determining the Feasibility of a Neighborhood-Based Vanpool Program in Detroit, Michigan

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Executive Summary.

Even though Detroit has a high, inner city unemployment rate, there are many available, low-skilled jobs in its suburban areas. This study assumes that one reason why inner city residents are not taking suburban jobs is that commuting costs are too high.

In an effort to reduce commuting costs and to bolster neighborhood development, a neighborhood-based vanpool program was developed. The neighborhood would initially buy the van through some type of grant. Twelve to fifteen people would split insurance, maintenance, van payments, and drivers salaries. Essentially those twelve to fifteen people would own the van for reverse commuting purposes.

In comparing the vanpool to the existing commuting options, the thesis of this study contends that a neighborhood-based vanpool will provide quality service at a lower cost to its riders.

The methodology used included an inventory of existing modes, a spatial analysis, and a cost analysis. Applicable routes were defined and various commuting options were developed. Costs, which were broken into out-of-pocket and time, were assigned to each of the commuting options. Finally, the options were ranked based on the percentage of income used for each option for a given work week (40 hour, 30 hour, 20 hour) at an assumed wage rate of $6.00 per hour.

The existing modes included automobile, bus, cab, and reverse commuting programs. The "Subcommunity" of Mack was used as the neighborhood. Troy was used as the suburban employment area.

The findings indicate that the neighborhood vanpool does not offer lower user costs per person than all of the existing modes. Given that time costs are zero, several points need to be stressed:
• In the forty- and thirty-hour week, the vanpool was grouped with the automobile and the reverse commuting programs.

• Since the vanpool could provide additional services such as job finding and child care, it might be more preferred by the residents than the other two because of its close proximity.

• Given the twenty-hour week, the vanpool options rank second to the public bus operations. However, it does take up 35% of the net income.

• If the automobile could be used in a carpooling effort, even with just two people per automobile, a viable reverse commuting option could possibly be realized. Initial vehicle payments would need to be solved.

With the perceived costs (includes time = $2.00 per hour), one major finding developed:

• Given all three work weeks, at least 42% of the individual's net income would be used in commuting. This provides more evidence that the commuting costs are too high given the existing return ($6.00 per hour).
Foreword.

Brandon Rubens, a Detroit resident, commutes to work as do the majority of Americans today. Brandon, however, travels three hours every day to work. He does not work in Ohio; he does not work in Indiana. Brandon Rubens is an inner city resident and he works in the suburbs of Detroit. The work trip that he takes every morning from the central city to the suburbs has been defined in transportation literature as "reverse commuting" and many of Detroit's inner city residents share the same experience as Brandon (Henderson; 1993, p. 1A).

The phenomenon of reverse commuting developed from the decentralization processes that people and businesses have been going through since World War II. The more commonly used terms for the decentralization process include "urban sprawl" and "white flight." Essentially, these two terms describe the phenomenon of the formation of suburban America. They were the direct result of the overall rise in living standards that most Americans shared in the decades following the war.

During the race to the suburbs some American citizens were left behind. The poor, who could not afford new houses in the suburbs were forced to live in the declining inner city environment primarily because of lack of income, but racism in the suburban housing and labor markets also played an important role.

After the masses of population moved to the outlying suburban areas, employment followed. Since the inner city residents relied on buses and trains that made up the majority of public transportation systems which did not service the outlying areas adequately, the inner city residents were stranded, isolated from the high employment growth areas in the suburbs.

Based on the premise that the unemployment that characterizes the inner city residents was partially due to the fact that they did not have effective means of transportation to the jobs in the suburbs, reverse commuting efforts emerged. Reverse commuting programs that specialized in the transportation of the inner city residents to the employment
areas in the suburbs have been developed in twenty-five metropolitan areas across the United States. The large number of programs across the nation indicates that the problems associated with reverse commuting are becoming more widespread.

In Detroit, various concepts regarding reverse commuting have been formed, including the privately-owned firms that specialize in transportation for inner city residents and extensions of bus routes that better serve the suburban employment areas. However, even with these attempts, unemployment still persists among the inner city residents which can be attributed to a number of reasons. Most stem from obstacles in employment and transportation. These have been termed "Barriers to Labor Mobility" and include the following:

• Lack of adequate public transportation

• Difficulty in coordinating work schedules of job seekers to allow for group transportation

• Employer reluctance to subsidize transportation costs

• Racism's impact in diminishing job opportunities and, in turn, transportation options

• Disincentives to work by some State and Federal job and welfare programs

• A weakened economy within Southeast Michigan which has reduced demand for employees

SEMCOG; 1991, p. i

This study claims that commuting costs could be lowered if the existing methods in commuting were modified. This study focuses on the costs associated with reverse commuting and sets forth a concept of a neighborhood-based vanpool with the objective of creating less
expensive, consistent quality transportation for its riders. Based on classic economic theory, if the costs of not working are increased enough, the residents will want to work. The costs of not working can be increased by increasing the amount that each employee would receive in income. One way to increase this amount is to decrease the amount of income that each individual spends on commuting.

The first chapter sets the stage for the study by addressing the problem with reverse commuting in Detroit. Questions for research and a brief description of the methodology that will be used are also a part of chapter one. Finally, the purpose for this study is clarified.

Once the basis for the research has been determined, the study sets forth the foundations of information on the causes of reverse commuting. Therefore, chapter two gives a background on the decentralization of the metropolitan areas and how transportation has evolved. Chapter two also provides a basis of information on the topic of non-transportation related barriers to employment for inner city residents.

Chapter three reviews various reverse commuting programs and analyzes the components of the programs. This chapter provides insight on how the proposed concept evolved. The proposed concept will be outlined at the end of the chapter.

The fourth chapter explains the methodology used for the study. It sets forth the basis for the assumptions and the strategies used. The analysis is performed throughout chapter four.

The fifth chapter presents the issues in a summary and gives recommendations based on the findings of the study.
Chapter One: *Statement of the Problem*

**Problem.**

The Detroit Metropolitan Area has many available, low-skilled jobs in its suburban areas. It also has a high unemployment rate. Apparently this is a contradiction. If there are available jobs in the Detroit Metropolitan area, then why is the unemployment rate so high? One reason for this occurrence is due to the type jobs that are available—low-paying, blue-collar. The blue-collar jobs occur in an area where the labor supply is predominantly white-collar status.

A second reason hinges on the fact that the majority of the unemployment in the Detroit Metropolitan Area occurs in the central city. This phenomenon has been attributed to a number of reasons. This study assumes that one reason explaining why the residents cannot accept the suburban, blue-collar jobs is that commuting costs are too high.

One strategy for lowering commuting costs for the residents is employer subsidization. However, it has been determined that employers do not want to subsidize employee transportation costs because the costs are too high (SEMCOG, 1991, p. 26). Another option is to lower the commuting costs in general. Strategies like cutting the overhead costs and running a transportation service at nearly full capacity are methods that might work.

One way this has been done is through vanpools. A vanpool is a group of people who ride together, usually to work, for the purpose of saving money and helping cut down on traffic congestion and auto emissions. Vanpools have traditionally been set up by large companies but since the majority of available, blue-collar jobs in Detroit are in the service industry and consequently are with smaller-sized businesses, it is hard to initiate vanpools through them.

Therefore, instead of relying on the smaller-sized businesses to help initiate a vanpool, why not put the inner city residents in the driver's seat and have them take charge? Granted, there would have to be some type of supervisors to keep files and possibly drive
the vehicles. A logical way to break down the inner city of Detroit would be into neighborhoods, since the neighborhood service centers could be the focal point for the vanpools, people would be in close proximity to each other and the service center, and neighborhood revitalization could stem from the vanpool program by building from the service center.

Before a big leap of faith is made on the reliability of a project like this, the first step is to determine if a neighborhood-based vanpool would actually result in lower commuting costs for its riders. Therefore, this thesis project is in effect, a feasibility study to determine whether or not:

"A neighborhood-based vanpool will provide quality service at a lower cost to its riders."

Questions.

This study seeks to answer two essential questions: "What are the costs of the available modes of transportation for reverse commuting?" Once these costs are determined, the study compares the costs of reverse commuting using the existing modes with the costs of the proposed concept that is delineated in chapter three of this proposal. Therefore, the second question that the study revolves around is: "Does the proposed concept offer reverse commuting services at lower costs than the existing modes, while still providing consistent quality of service?"

Methodology.

Instead of attempting to analyze reverse commuting costs for metropolitan areas across the United States, the study looks solely at reverse commuting costs within one specific metropolitan area. There are three logical, geographic areas that will be involved with the neighborhood-based vanpool feasibility study: 1) A metropolitan study area, 2) A neighborhood, and 3) A suburb. It will use Detroit, Michigan for the metropolitan study
area. Mack "Subcommunity" in Detroit will be the neighborhood. Troy, Michigan will be used as the study's suburb.

The methodology consists of an inventory, a spatial analysis, and a feasibility analysis. The inventory will establish the available modes that the residents can utilize for commuting. The spatial analysis determines which combinations of modes will produce the best route to and from work. The feasibility analysis attaches the costs involved with each specific route and compares the results.

**Purpose.**

The purpose of this study is to determine if the proposed concept will result in lower transportation costs to the neighborhood residents. Lower user costs are considered an indicator of a more beneficial system to both the inner city residents and the employers in the suburbs. If the inner city residents do not have to pay as much for transportation, then they will receive more disposable income. Similarly, if the costs of transportation are lowered, employers should feel more inclined to subsidize a percentage of employee transportation costs. For example, assume an employer had to subsidize fifty percent of $10 for transportation costs before the vanpool was available. If, by operating the vanpool, the employee's transportation costs were only $6, then the employer might be more inclined to subsidize the fifty percent.

This study concerns the residents, businessmen, city officials, and planners. If the vanpool concept leads to lower costs of commuting, the residents will have greater opportunity in finding employment. Similarly, the businesses that are currently operating without the needed help will find accessible labor supply within the inner city. City officials and planners should benefit from this study visualizing what the programs could do for unemployment and neighborhood revitalization.
Chapter Two: *Background*

Introduction.

Before the crux of this study is presented, it is pertinent to establish a background for the question: "Why does reverse commuting exist today?" This chapter gives an overview of two inferred components of this question: 1) the effects of the decentralization of American's metropolitan areas on transportation and employment, and 2) the resulting barriers to employment for central city residents because of this decentralization.

**Metropolitan growth and decentralization.**

**Patterns and waves.**

Without defining the terms growth and decentralization, one cannot understand the dynamic trends that shaped the metropolitan areas in America. The outward shift in population and business occurred in terms of these two processes. Growth of the metropolitan areas can be defined in terms of *concentration and deconcentration, which are simply the ratios of metropolitan population to the total U.S. population*. Decentralization and its counterpart, centralization allude to the ratio of people in the central city to the people living in the surrounding suburban ring (Heilburn, 1987, p. 29).

The patterns of growth and dispersion were inherent during three waves of metropolitan development. These waves can be chronologically broken down into three different time periods: 1) pre-1920, which experienced increases in concentration and centralization, 2) 1920-1970, which exemplified increases in concentration and decreases in centralization, and 3) post-1970, which was dominated by decentralization (Heilburn, 1987, p. 31). Since the three waves strongly correspond with new developments in transportation, the modes and policies that were prominent during each wave will be examined.
Pre-1920.

During the pre-1920 time period, metropolitan areas were characterized as being mononucleic\(^1\). This meant that people, businesses, and activity during this first wave centralized around the central business district\(^2\). Therefore, monocentric city pattern resulted in high competition for land in the center and consequently very dense development patterns (Heilburn, 1987, p. 32). The central business district is depicted by the dark circle in the diagram above.

The effects of the single activity area within the city which was surrounded by residential areas (the lighter shaded circle in the diagram) allowed people to live fairly close to their place of work. With regards to the journey to work, or commute, during the first half of the nineteenth century in the monocentric city most people walked or used horse drawn carriages (Vuchic, 1981, p. 12). The commute pattern can be thought of as the central city-to-CBD trip and it was probably the first type of commuting.

As city centers grew and they became more and more dense, the need for urban mass transportation emerged. The existing rail lines primarily moved goods over long distances between cities. Rail lines were not used extensively in the intra-urban transportation network until the development of electric streetcars, subways, and elevated trains (Heilburn, 1987, p. 33; Vuchic, 1981, p. 1-58; Howson, 1971, p. 25). These three inventions provided more efficient mobility and consequently allowed people to live further away from the center. Streetcars, subways, and elevated trains allowed the central city-to-

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1. Thomas Schurch has likened the mononucleic city to a "fried egg" where all of the activity is in the yoke and the egg-white which goes out in many different directions represents the residential areas.
2. Central business district is defined as the part of the city where there is a high concentration of commercial and office uses, and service business. In the case of the early cities, manufacturing was also located there. Most of the time the central business district will be characterized by the tallest buildings since people are often competing for maximum floor area.
3. It should be noted that horse drawn rail cars were used in cities from the 1830s. Later, they were replaced by electric streetcars.
CBD commute to be longer, but not as long as commutes are today.

About the same time as intraurban rail became available for mobility within the city, the interurban lines developed. The interurban lines were essentially high speed rail lines that connected cities with one another. The first two interurban lines in the United States were built in 1893 and were located in Oregon and Ohio (Vuchic, 1981, p. 45). Each system connected a larger city with a smaller community. Decentralization had its origins from the development of urban rail.

Interurban rail systems made the first city-to-city commuting options available. They ran along existing rights-of-way and helped transport people longer distances in shorter times than the other modes of travel. Prompted by various measures which prevented downtown operation and by the invention of the automobile, the interurban lines slowly faded away (Vuchic, 1981, p. 46).

The end of this first period of growth and development led to higher concentration within the central city because employment and social activities were located there. However, the rail lines did much to form a basis for a radial city layout and thus preempted decentralization. The extent that people actually moved out of the central city was minimal compared to what lay ahead.

By the end of this period, most metropolitan areas had a layout similar to the diagram above. The CBD, shown in the darker shade, had grown somewhat due to the increases in economic and population growth. Residential areas, depicted by the light shade, had spread out away from the center since the inventions of the urban rail systems

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4. Dr. Francis Parker commented on this decentralization involving the interurban lines. "Strictly speaking, the interurban lines which began in 1893 were electric — but the steam railroads had already established a basis for upper class suburban commuting, (for example, Riverside, Illinois, in 1869)."
which are indicated by the radial formation of lines. The form of the city was still essentially composed of a CBD and a residential ring.

1920-1970

The second wave of growth and development began in the 1920s with the mass production of the automobile. The automobile greatly impacted urban form and the transportation industry. Before the dynamics of urban form during this second wave can be explained, a background on the makeup of urban transportation during this time should be examined.

The automobile allowed for the emergence of more flexible, demand responsive transportation within the transit industry which have come to be known as paratransit. Today, paratransit is considered a viable solution to the urban transportation problems (Kirby et al, 1974, p. 6; Heilburn, 1987, p. 235; Cervero, 1986, p. 112). Forms of paratransit today include taxis, dial-a-ride buses, carpools, and vanpools. During this second wave of metropolitan transformation however, the major forms of paratransit available were only taxis and jitneys.

With the automobile more prominent than ever, the taxi industry went through drastic changes. In contrast to small-scale taxi operations, large-scale taxi cab fleets started to form since the operators felt the automobile was going to increase their opportunity to serve the public. At one time there were only a few operators, but with the emergence of many different makes and models of automobiles (potential taxi-cabs), the taxi industry became very competitive (Gilbert and Samuels, 1982, p. 50). The taxi industry began to grow, it looked very prosperous to operators, and it held a positive image in the eyes of the public.

However, during the Depression, as the industry became more competitive, it went under many regulations which altered its positive image. Some of the first regulations such as mandatory fareboxes and minimum and maximum fares changed the industry to a more
consistent operation. The regulations led competing companies and drivers to resort to tactics such as fare wars to capture the greatest share of the market. Since most drivers could not break even because of the extremely lowered fares, they demanded outrageous tips for their services (Gilbert & Samuels, 1982, p. 72; Kirby, 1974, p. 65). After these and other regulations were established, the positive image of a growing industry was gone.

Jitneys were privately owned vehicles which were similar to taxis since they operated in a demand responsive environment. They usually held more people than taxis and operated along major development corridors (Hartshorn, 1980, p. 423; Vuchic, 1981, p. 606). However, they originated around the time of World War I and actually started to phase out during the 1920s because regulatory agencies felt jitneys were undermining the existing public transportation system. Undoubtedly they were observed as a threat to public transportation (Kirby et al, 1974, p. 166; Vuchic, 1981, p. 608).

Since the jitneys transported more people per vehicle and worked fairly well, they prompted the increased development of buses for public transit (Vuchic, 1981, p. 33). The buses evolved from the light rail streetcars that were a major part of the public transportation market in the previous wave of metropolitan growth. These new buses were not solely fixed to the railways so start-up costs were lower and they did not have the exclusive right-of-way like subways so the service area was broadened. These characteristics led them to become the more popular form of transportation.

The public transportation bus systems had to run along major development corridors to maintain the highest amount of ridership. In a word, they were "fixed" to an assigned route, but routes could change given a change in the travel demand.

The fixed routes were based on the economics of public transportation and the survival of the system. However, public transportation also had to cater to the public's

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5. Traditionally, very few transit operations have ever been able to break even. For more information on the matter of operating incomes of transit operations see, *Transit Service Contracting: Cream-Skimming or Deficit Skimming?*, by Robert Cervero, 1988, page ii.
needs. Transit operations within a city have had to maximize ridership while providing service for the entire city, regardless of profitability (Vuchic, 1981, p. 608).

Since the layout of the central city and the CBD had higher population densities than the suburbs, fixed route bus systems focused their main operating environments in the downtown areas. At its beginning, mass transit bus operations did not have much trouble in transporting the numbers of people because of the dense layout, but as the population shifted its general location to the outlying suburbs, densities decreased and public transportation experienced higher operating deficits. Federal subsidies to urban public transit increased from $132 million in 1970 to an astonishing $3.2 billion in 1982, a 2,400 percent increase (Cervero, 1988, p. 1).

A spin-off from the regular-sized motorbuses was the minibus. The minibus is essentially a scaled down version of the fixed route bus. Spanning a length ranging anywhere from sixteen to twenty-three feet, the mini-bus fits into the traffic network better than regular buses. Passenger capacity ranges from fifteen to twenty-five people and the minibus can travel up to 60 miles per hour (Vuchic, 1981, p. 204).

One type of service that has developed which has used minibuses for its operation has been the dial-a-ride service. In this type of operation, the riders call up the service and ask to be transported to a certain location. Usually the riders share similar interests in trips so the minibus produces a relatively convenient route to the destinations. Since this mode acts as a personal chauffeur, the fares for privately owned dial-a-ride services are usually higher than public bus systems. This has allowed the privately owned operations to be self-supportive. In contrast, publicly owned dial-ride services that kept their fares low have needed much public funding (Kirby et al, 1974, p 164).

Rail transportation experienced relatively the same fate as the urban bus systems. Studies have shown that any timed scheduled transit operation needs to have residential densities anywhere from 3,000 to 6,000 people per square mile to operate. Since the suburban densities are usually less than 3,000 people per square mile, the majority of transit
operations have not operated in the suburbs (Cervero, 1986, p. 109)\textsuperscript{6}. Besides, most of the people living in suburban areas are not as dependent on public transportation as the inner city people because the majority of suburban residents are wealthier and can afford automobiles. Since the suburban population densities were too low and most people owned automobiles, ridership on the rail transit diminished.

The common thread that was associated with the changes in the public transportation industry was the automobile. It is arguably the most significant attribute to urban form and commuting patterns in history (Levy, 1988, p. 189; So, 1988, p. 141; Hartshorn, 1980, p. 210; Heilburn, 1987, p. 34; Meyer et al, 1965, p. 12). Its convenience and efficiency allowed people to live at greater distances from the center and commute to work in the CBD.

In its primordial stages, the automobile was too expensive for most people to purchase. Also, the impacts of the Great Depression throughout the 1930s did much to keep people from purchasing automobiles. These reasons provide an argument as to why the urban form did not change that much during the twenties and thirties. However, metropolitan areas were experiencing increasing concentrations of population (Heilburn, 1987, p. 31). The increase in concentration set the stage for the post-World War II years, when personal income rose, financing for home ownership changed, the Federal Aid Highway Act of 1956 was adopted, and the rush to the suburbs began.

During the decade of the 1950s, real median family income rose by 38\%. It showed an increase of 33\% in the following decade as well (Sternlieb, 1988, p. 88). This rise in income put power in the hands of many Americans. It gave many Americans the power to buy goods such as new automobiles and with that, the ability to live farther from work.

Automobile ownership from the end of World War II to 1970 increased by more

\textsuperscript{6} Check Cervero's reference note 35 on timed transfer operations.
than 250% (Levy, 1988, p. 17). The increased automobile ownership correlates with the trend in decentralization. Because of the increased overall concentrations of people living in metropolitan areas during this second wave and the relative rise in income, the people who were able to move outward did. The increased automobile use and the resulting outward movement of the population have been labeled as the "automobile affect" and the "overflow affect," respectively (Heilburn, 1987, p. 37). They both contributed to the formation of the suburbs and the term, "suburbanization."

Besides the public's increased ease in transportation due to the automobile, the Federal Aid Highway Act of 1956 planned for 40,000 miles of interstate freeway which eased the friction of space between the CBD and the suburbs. The new freeway system increased the mobility of inter-city and local traffic and therefore led to more suburban sprawl (Levy, 1988, p. 194). It also helped the freight industry by creating a less congested highway system which provided faster delivery and increased profits. On average, trip times were reduced due to the interstate highway system (Meyer et al, 1965, p. 76). The increased income, the automobile, and the interstate highway system were major contributors to the causes of decentralization and led to a new type of commuting trip—suburb-to-CBD.

By the end of the second wave most metropolitan areas had an urban form similar to Figure 3. The CBD was still the central location for jobs and business activity and it is depicted by the darkest shade. The ring that directly surrounds the CBD was called the central city, or inner city and is illustrated by the next darkest shade. The people who could not afford to move to the outlying suburban areas resided here. The ring farthest from the CBD

Figure 3: The Post-War City
defines the suburban areas and is depicted by the lightest shade. For most of this period these suburbs consisted of mainly residential land. It was not until the third wave of metropolitan development that increased business activity within the suburban ring became prominent.

1970 to present.

The third wave of suburbanization consisted of increased decentralization and fairly even concentration. The formation of actual cities within the suburban ring has characterized this wave as the wave of "multi-nucleation." Figure 4 illustrates the new pattern of development for the metropolitan areas. It is essentially the same as the metropolitan areas of the second wave. However, the smaller cities in the suburban ring which are depicted by the black dots had concentrations that equaled or exceeded the central city in employment and business activity.

Notice now that the outlying cities are also connected by a "beltway" road network and a radial road network that emanates from the CBD.

With the new shape of the city having many different centers of population and business, many new trends started taking shape. Regarding transportation, two new types of commuting patterns resulted from the new urban form: suburb-to-suburb and central city-to-suburb commutes. Traveling from suburb to suburb was essentially a peripheral commute since beltways tied everything together. The central city-to-suburb commute came to be known as reverse commuting since it was opposite to the common direction that had characterized commuting.

Since the suburban ring had increasing numbers of people and businesses located within its boundaries, the economic activity increased as well. The increased economic and
employment activity within the suburban communities aggravated the unemployment problems in the inner city via transportation: 1) the majority of the people living there did not own automobiles, and 2) public transportation did not service the outlying suburbs due to the low population densities.

Besides aggravating the unemployment problem, the increased activity in the suburbs also led to more dependence on the automobile. Traffic congestion and air pollution followed. Since these two problems started to occur right around the time of the 1972 oil embargo and the consequent push for energy conservation, efforts went into ridesharing tactics for taxis, autos, and vans.

Taxis used a shared ride system where more than one party could use the cab. The fares remained relatively the same for each passenger, therefore the taxi's profits increased. However, the driver needed permission from the first passenger in order to pick up additional passengers. As the gas prices went back down and energy conservation faded away, shared ride taxis faded away as well (Gilbert & Samuels 1982).

The seventies also encouraged a couple of modes that implanted themselves into the urban transportation fabric as a result of the push for energy conservation. These two modes were carpools and vanpools. Carpools with three and four people per car who were traveling to work or to shop alleviated some congestion and pollution from the city. Vanpools had the same results, only to a greater extent than carpools because they could carry more passengers. Although these two different modes were helping the environmental concerns, the percentage of people using carpools and vanpools was so small compared to the percentage of those people who were not, that the benefits did not have much impact (Lowe, 1990, p. 14).

Both carpools and vanpools have operated in a flexible route format. This allowed people to wait in the comfort of their home while the car or van was picking up the riders. Once the rider was picked up, the vehicle would go straight to the place of work. This is sometimes referred to as a "door-to-door" service since no transfers or extra stops have to be
The most common type of trip taken by these two modes has been the journey to work. The ridesharing programs that encompassed carpooling and vanpooling were usually established by the workers or the employers and have traditionally been set up by certain individuals based on where they live and work (Kirby et al., 1974; Vuchic, 1981; UMTA, 1979; USDOT, 1980). One or two people were responsible for the organization and formation of the commuting trip. The people took turns driving the vehicle or paid fees to the driver.

Carpools are not and never were mandatory which has led to high turnover among the carpooling passengers. As well, they have only been prominent when the people using them were going to the same destination, usually work. It follows then, that they have competed with public transportation during the peak hours in the mornings and evenings.

Some of the user benefits that carpooling can yield are easier parking due to the decrease in the number of vehicles at work, cheaper parking fees per person, and social interaction between colleagues in a non-work environment. Transportation and environmental benefits such as less traffic congestion and improved air quality can also result from the use of carpools and vanpools.

In contrast to carpools which were organized by workers, vanpools were set up by the employers in a more formal manner. The employer bought vans in the company's name and grouped between eight and fifteen employees per van. One of the employees was chosen to be the driver and was responsible for the collection and distribution of the other employees that were assigned to that van.

The vanpools were similar to carpools in that they involved lower costs per person and fewer environmental impacts than the traditional mode of one person per automobile. They were also considered HOVs7 and also cut down on parking requirements. However, the extensive organization and monitoring of the vanpool programs were the major drawbacks.

7. HOVs are High Occupancy Vehicles such as carpools, vanpools, and buses. Definitions vary from two to three persons per vehicle as a minimum to be considered a HOV.
Whereas carpools have been used in many different sized companies, the majority of vanpool programs have been used with large sized companies that had 1,000 or more employees (Vuchic, 1981, p. 598). This characteristic has been attributed to the high start-up costs of starting a vanpool between employers and the employees.

By the third wave of metropolitan growth and development, the cities had gone through many different trends in transportation. Urban rail transportation for the most part had come and gone; jitneys were basically illegal; public bus transportation was losing patronage and increasing its Federal subsidization; paratransit modes like shared ride taxis, carpools, and vanpools were used by very few; and the automobile was the dominant mode of transportation in the United States. These trends in transportation affected the shape of the cities and the lives of its residents.

Besides trends in transportation, the trends that seriously impacted the central city residents hinged on the decentralization of jobs. For the most part, the manufacturing industry by this time had already established itself in the outlying areas (Heilburn, 1987, p.41). The service industry was rapidly increasing and becoming the dominant industry (Blakely, 1988, p. 20; Cervero, 1986, p. 8; Sternlieb, 1988, p. 103). However, as more and more people moved outward, more and more jobs moved with them. This left the inner city residents behind in the declining economic environment of the central city.

This presented another problem for the inner city residents. Besides having the majority of employment opportunities shift to the outlying suburban communities, the inner city residents who used the mass transportation systems to get around were stuck in the central city with no way to get to the jobs in the growing suburbs. The reverse commuting pattern that these inner city residents had to take to the low-density, suburban communities was not adequately serviced by the public transportation systems. This transportation barrier was only one of the many barriers that central city residents have been faced with in

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8. This was based on a 1976 survey a vanpool commuting programs which used over thirty different programs around the country. This figure is probably different today.
their quest for employment in the suburbs. The next section looks at the many different non-
transportation barriers to employment for the central city residents.

**Barriers to central city employment.**

**Introduction.**

When the new, sprawled city took shape in the post-World War II years, the inner-
city residents were not only bound by the inadequacy of public transportation, but they
were also hindered by other barriers to employment. This section examines barriers such as
racial segregation in the housing and labor markets, disincentives to work created by
welfare programs, and the female headed household structure of the central city residents.

**Racism as a barrier.**

Racial segregation has occurred in both the labor and the housing markets for ages.
In a segregation study that Taeuber and Taeuber\(^9\) developed, Detroit was comparatively
lower than other Midwestern cities on their segregation scale. The scale was based on the
spatial distributions of blacks and whites within the city limits. If a census tract contained a
high percentage of blacks and other tracts contain high percentages of whites, they con-
cluded that the city had racial segregation. Table 1 illustrates the segregation indices. An
index of 100 would indicate complete segregation while an index of zero would indicate
complete integration.

**Table 1. Segregation indexes for the Midwest.**

<table>
<thead>
<tr>
<th></th>
<th>1960</th>
<th>1970</th>
<th>1980</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago</td>
<td>93</td>
<td>93</td>
<td>92</td>
</tr>
<tr>
<td>Detroit</td>
<td>85</td>
<td>82</td>
<td>73</td>
</tr>
<tr>
<td>Indianapolis</td>
<td>92</td>
<td>90</td>
<td>83</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>88</td>
<td>88</td>
<td>80</td>
</tr>
</tbody>
</table>

*Source: Heilburn, 1987, p. 252*

9. The Tauber and Tauber study was footnoted in Heilburn on page 252.
This study contradicts a regional projection that was made by SEMCOG in 1991. They believe that "housing patterns in Southeast Michigan will continue to be among the most racially segregated in the United States" (SEMCOG, 1991a, p. 49). The current spatial pattern for the Detroit Metropolitan Area is made up of rich, white suburban communities which surround the poor, black inner-city communities. SEMCOG maintains that although some African-Americans have moved out to the suburbs, the majority will not because of suburban resistance to "housing integration." Comparing this projection with the Taubers' findings reveals that although the central city has not been as racially segregated as other central cities, when it is combined with its surrounding metropolitan area, the region probably ranks as one of the most segregated in the nation.

Racial segregation is not a recent problem in the Detroit area. During the sixties John F. Kain tested three different hypotheses dealing with racial segregation. He suggested that "racial segregation in the housing markets (1) affects the distribution of Negro employment and (2) reduces Negro job opportunities, and that (3) postwar suburbanization of employment [had] seriously aggravated the problem". He argued that segregation in the housing markets of the suburbs hindered the central city residents from being able to establish themselves closer to the suburban places of employment. Since the residents incur greater travel costs by commuting from the central city to the suburbs, they will not take suburban jobs. Kain's study showed that housing market segregation in Detroit accounted for 4,000 to 9,000 jobs lost (Kain, 1968, p. 176).10

Kain's study alludes to the high costs of reverse commuting and their impacts on employment. Kain, however, highlighted housing market segregation as one of the roots of inner city unemployment. This study, on the other hand, recognizes that racial segregation exists in the suburban housing market but contends that the existing reverse commuting

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options available to the residents are inadequate and thereby result in high commuting costs.

Besides having to deal with racism in the suburban housing market, central city residents have to deal with racism in the suburban labor market as well. Detroit City Councilman Mel Ravitz said that "the majority of low- and no-skilled jobs that these people qualify for are in the suburbs" (Mitchell, 1991, p. B-2). In another article he also said that "as long as this deeply ingrained racism persists [in the suburbs], unemployment among the central city residents will remain" (Goodin, 1991, p. 3). This labor market racism can also be traced back to negative attitudes towards blacks living and residing in the "vanilla suburbs" 11. Essentially, the people of the suburbs are wary about any presence of blacks in their communities.

Racism in the housing and labor markets aggravates the problem of unemployment for the inner city residents. Cervero believes that the root causes for inner city unemployment are a lack of affordable suburban housing and lack of inner-city business investment and that reverse commuting programs are only "short-term, Band Aid" solutions (Lemov, 1993, p. 33). Essentially, the goal of the neighborhood-based vanpool concept is to provide short-term solutions (5 to 10 years) for the residents in certain neighborhoods. By allowing them a chance to perform in the labor force, a chance to interact with others in their neighborhood, and a chance to possibly increase their income, the concept strives to promote the neighborhood through its labor supply. By establishing a positive image of the neighborhood through this promotion, a long-term goal (10 to 20 years) is neighborhood and neighborhood business revitalization.

Problems with welfare.

Probably the most criticized social policy in the last two decades has been the public aid programs, more commonly known as "welfare" (Heilburn, 1987, p. 276; Rosen, 1987).
1992, p. 180). Qualified welfare recipients receive benefits such as food stamps, Medicaid, Aid to Families with Dependent Children (AFDC), Social Security Income, and housing assistance. Qualified participants are normally below the "poverty line" which is a cut off point established by the Federal Government based on an absolute figure that is considered sufficient to purchase necessities (Heilburn, 1987, p. 239; Macarov, 1980, p. 71). However, the formulas for determining the poverty line and welfare recipients are totally different, which points out that a person might be classified as "poor" but he or she might not be able to qualify for welfare payments (Macarov, 1980, p. 73).

One of the biggest criticisms as it relates to the topic of reverse commuting is the work versus welfare debate. Some of the "working poor" as Macarov describes as the "nub and crux of the poverty problem," might be qualified for payments that are designed to push them out of poverty thus contradicting their poverty-defined salaries (p. 75). The payments would therefore decrease incentives to work and as it has been argued, create a larger underclass subculture (Blakely, 1988, p. 45).

If the unemployed people want to stay unemployed because of these benefits from the public assistance programs, what would it take to push them to work? In monetary terms it would have to be an income greater than what they could receive on welfare payments. According to the Michigan Social Service Agency, in Wayne County (where Mack Neighborhood is located) a family of three people can receive $459 per month on welfare (AFDC) payments and $260 per month on Food Stamps12. Since the average family size in Mack Neighborhood is 3.7 people, the combined income of welfare and food stamps is reasonably close to what the majority of the unemployed, neighborhood residents on welfare will make. This income amounts to a total of $719 per month which does not include Medicaid or any housing assistance payments.

In the suburban areas of Detroit, most jobs pay around six dollars per hour. The table below shows the relationship between three different types of work weeks:

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12. This came from telephone interview that I had with the State Office in Lansing, Michigan.
Table 2: Income Comparisons for Welfare Recipients.

<table>
<thead>
<tr>
<th></th>
<th>40hr/wk</th>
<th>30hr/wk</th>
<th>20hr/wk</th>
</tr>
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<tbody>
<tr>
<td>Monthly Gross Income</td>
<td>$960</td>
<td>$520</td>
<td>$480</td>
</tr>
<tr>
<td>Monthly Welfare Income</td>
<td>$719</td>
<td>$719</td>
<td>$719</td>
</tr>
<tr>
<td>Net Gain</td>
<td>$241</td>
<td>($199)</td>
<td>($239)</td>
</tr>
</tbody>
</table>

Firstly, the thirty- and twenty-hour work weeks yield net losses to the worker and therefore are not even considered as being preferred to welfare. Secondly, most jobs that would be available to the residents probably do not entail forty-hour work weeks. However, for the sake of argument, assuming a forty-hour week at six dollars per hour, a worker receives $960 per month—presumably, a net gain of two hundred forty dollars. Remember, however, if the person goes off welfare, he or she will have to pay transportation costs to work, child care outlays while at work, health care payments since Medicaid could not be utilized, and/or full rent payments since housing assistance would no longer be available. Given the current welfare system and employment opportunities, it is no wonder why the jobs in the suburbs are going unfilled.

However, recent proposals for modifying the current welfare system as well as the "free" health care that Medicaid recipients receive are underway. Regarding the health care issue, currently, if a person qualifies for Medicaid assistance and needs health care, he or she can get that service "free. 13 Provided that the hospital or doctor’s office accepts Medicaid payments as valid, Medicaid will pay the health bill at a certain percentage of the actual bill. The problem that has arisen is that few hospitals will accept Medicaid health insurance. Attributed to the "below market" price that Medicaid pays, health care services for welfare recipients are becoming more scarce 14. Because of the scarce health care services associated with Medicaid and the future possibility of employers providing health care insurance for their employees, the incentives for welfare recipients to work are assumed.

13. "There is no such thing as a free lunch." Free in this sense means that the Medicaid recipients do not have to pay for their health care. However, since the doctors and hospitals are taking a cut in profits by accepting these people, prices for health care for those who pay will go up. Essentially, the taxpayers subsidize the Medicaid program.

14. Judy Gray, with Ball State's Social Work Department says that this trend has been happening in most of Indiana.
The changing household structure.

Regarding the welfare income of current recipients, recent legislation that essentially mandates that the unemployed work in certain "workfare" jobs has been put in place. Richard Nathan sums up a recently passed welfare law in New Jersey:

"The law, like many others in the field, combines carrots and sticks to try to change the behavior of welfare family heads, predominantly single women with children, so they can ultimately stop receiving welfare and become self-sufficient" (Nathan, 1993, p. 3).

The basic provision stated that if a woman became pregnant while she was receiving welfare, she would not get extra welfare benefits for that child.

Statistical studies have shown that the percentage of "female headed households with children" has nearly doubled in the last twenty years for both blacks and whites (Reischauer, 1989, p. 16). Correspondingly, the percentage of total unwedded births has more than doubled. These two statistics imply that although female headed households are increasing, so are the percentages of births from unmarried mothers. Although many reasons can be attributed to this trend, one reason for this occurrence might stem from the current welfare benefits that unwed mothers may receive. Provided that new types of legislation will emerge in the rest of the states, incentives for welfare mothers not to produce more children may occur. The future trend could be reversed.

Today, however, most welfare recipients who are unemployed are female heads of household. Typically, the mother will have to stay home and watch her children rather than go out and work because of the increasing cost of child care. Since welfare currently can provide the mother with the "necessities" to survive, she will choose not to work. Therefore, being a female head of household with no husband present has been considered a barrier to employment in this study.

Even though the current scenario results in grim opportunities for women in the
work force, it is assumed that the recent New Jersey law and others of its kind will be the prototypes for new welfare legislation. Similarly, it is also assumed that new health care legislation will provide greater incentives to work rather than creating the "free health care system" for Medicaid eligibles. Combined, the two assumptions provide reasoning for assuming that working will provide greater economic incentive for the inner city residents than welfare.
Chapter Three: *Review of related literature on reverse commuting programs*

**Introduction.**

For purposes of this paper, reverse commuting programs are defined as services that attempt to provide transportation to and from suburban places of work for central city residents. Six different reverse commuting programs were examined; each was based in a major metropolitan area of the United States. The metropolitan areas are located all over the nation rather than in one concentrated area, and the programs were initiated at different points in time. The metropolitan areas that were examined are the following: Chicago, Philadelphia, LA-South Central, Baltimore, Minneapolis, and Detroit\(^1\).

**Chicago.**

Two reverse commuting programs in the Chicago area were started as a result of a 1989 study done by the DuPage County planners and the Chicago Area Transportation Study which predicted that the need for central city Chicago residents as suburban employees will increase by the year 2010. The two programs that came about were Association House and Accel Transportation.

Association House, a not-for-profit service that assisted in social programs for residents, operated a vanpool for fifteen people who needed transportation to one workplace. The service leased one van for $6,780 per year and paid insurance of $4,000 per year\(^2\). Through negotiations and careful planning, subsidies were able to be received from the employer which allowed the riders to pay a flat fee of $2.00 for round trip rides. Even though the service provided transportation and felt that it was needed in the area, they were somewhat hesitant about being involved in the transportation business.

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1. The information on the case study programs in Chicago, Philadelphia, Baltimore, and Detroit came from the 1991 report, *Transportation Options for Job-Seekers*, written by the Southeast Michigan Council of Governments (SEMCOG). The other two metropolitan area studies are noted within the chapter.
2. These figures are in 1989 dollars.
A second reverse commuting program in the Chicago area, called Accel Transportation, has catered a commuting route to meet the needs of eighteen employees and their changing work schedules in the suburban areas. The key components that made this program successful in the eyes of the citizens as well as the employers were the amount of funding through the FTA and local sources, not to mention the marketing strategies that were initiated by the Chicago Institute for Economic Development, a division in conjunction with the Mayor's Office of Employment and Training.

Philadelphia.

Two reverse commuting programs in the Philadelphia area have been established that accounted for 700 passengers per day on average. These two operations were different in their approaches. One program, which was an extension of existing public transportation routes, was set up by the local public transit agency. The other program was based in the private sector and operated at a smaller scale.

The Southeast Pennsylvania Transportation Authority's Series 200 Routes accounted for 625 passenger trips to work per day. The operation was designed as a feeder bus system at the end of a commuter rail line. The busses ran at the peak hours of 8:00-9:00AM and 5:00-6:00 PM and hooked up with the major industrial parks outside the city limits of Philadelphia. The fares were taken care of by a joint venture between the employers and SEPTA, where the riders paid the regular fare and the employers would subsidize the remaining cost of the extension. The joint public/private effort has encouraged the organizations to work together and develop more solutions to the problem.

In contrast to the above operation where a local transit provider expanded its service, another program that was developed in Philadelphia based on private sector initiatives came out of the Regional Employment Plan. The plan identified three main issues that

3. FTA stands for the Federal Transit Authority which is synonymous with what used to be called UMTA, Urban Mass Transportation Administration. The name changed in 1993.
4. The Regional Employment Plan was the entire project done by public officials. The reverse commuting program came out of the REP as a pilot project.
needed attention: job awareness, job training, and transportation. The goal was to achieve employment for 100 unemployed residents and this was to be accomplished within nine months.

A major component of the program was the extensive employment programs such as job referral and job training. These were established by several different agencies, all of which revolved around one central referral service. The employment programs were complemented by transportation services set up by a private provider. Round trip costs were $10.00 per person which was subsidized in part (60%) by the employers, thus making the fare for the users $4.00 which was deducted through their paychecks.

The REP reached its goal while it was in progress. As soon as the program ended, however, the employees did not remain at the jobs. This was mainly attributed to a tax credit that the employers received when they participated in the project. When the project terminated, so did the tax credit. The employers felt that the only way their transportation subsidies could be covered was through the tax credit they received. Therefore, when the program finished, most of the employed residents returned to being unemployed.

Los Angeles.

Back in the mid-1960s, when the violence and riots were springing up in the city, officials were attempting to confirm that one of the main causes for these events was the lack of low-skilled jobs in the city. The Governor's Commission felt that "lack of adequate transportation," hindered the low-skilled, "in seeking and holding jobs, attending schools, shopping and in fulfilling other needs" (CBTA, 1970, p. vi). Since the two main areas that were representative of low-skilled labor were South Central Los Angeles and East Los Angeles, a project was conducted there.

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5. This indicates that employers used the employees for work based on economic considerations rather than any remorse they might have had for the poor people. It also suggests that a strategy of subsidizing transportation costs to get people "started" in the workforce is only as good as the subsidies. When the subsidies run out, if the wage rates are too low to support the full cost of unsubsidized transportation, the jobs will run out too.
The study called for transportation / employment programs⁶ to be set up in the ghetto areas and determine what the impacts to the local community were with regards to employment, shopping, education, and other opportunities. It took several years and tremendous amounts of money to complete the project. Two key findings of the project as they relate to the proposed concept of this thesis dealt with the proximity of service centers and the use of local transit.

The study found that certain portions of the study area that had the bus operations running out of the State Service Centers had a higher number of employed residents than those areas that did not have the centers (CBTA, 1970, p. 69). This indicated that the service centers were more effective when they were closer to the residents who need them for job training, education, day care, or other service. Theoretically, that phenomenon was also explained in a study which illustrated that multi-use centers⁷ within neighborhoods increased the number of trips made to the center (Kwantes, 1972, p. 521). In the case of Los Angeles, since more trips were made by the residents who lived closer to the service centers, those residents benefitted more, which provided evidence that localized transit / service centers will help the residents get jobs.

The study also found that "the more remote people are from a problem, the less they are aware of its existence and the less they are inclined to do something about it" (CBTA, 1970, p. 65). This finding was based on various meetings with community representatives who were part of the community but not in close proximity to the problem at hand. Similarly, a study done in Rochester, New York argued that local operators should have a comparative advantage over those based out-of-town because local providers would be more familiar with the area as well as the potential users (Newman, 1981, p. 29).

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⁶ Transportation / employment programs are services that assist in two different areas: 1) finding the jobs for the people qualified for those jobs, and 2) transporting the qualified residents to and from the certain place of employment.

⁷ Kwantes describes multi-use centers as "a concentration of complementing land uses that are physically integrated by means of internal pedestrian systems" (p. 517). They can be viewed as somewhat analogous to "one-stop shopping centers" that have a variety of different departments.
These two examples led to the belief that localizing a transit center in a neighborhood would allow the service to be catered to the residents more than if outside services were contracted.

**Baltimore.**

Baltimore's reverse commuting programs were started by a request from the Baltimore Regional Planning Council and a private transportation provider. Both entities found a basic need going unmet with labor mobility and aimed their attention at filling the gaps in the employment-transportation linkage. The main concern with this project revolved around the incredible amounts of project start-up costs.

Since it started from scratch, the project called for much capital through various grants from the FTA and state agencies. The officials in charge felt that if the money was spread around to numerous providers who were interested in participating, more benefits would result⁸. The overall funding from the federal and state grants accounted for $549,999. Most of this money was used to provide the mass amounts of capital that dealt with vehicle purchases.

In the transportation component of the project, providers were contacted through a Request for Proposal (RFP) process. The modes of transportation were determined by the transportation providers thus creating a laissez-faire system⁹. By allowing the providers maximum flexibility in creating programs to meet the needs of the market, the project was opening the door to a wider variety of solutions. Relating this back to the concept presented in this thesis illustrates that by allowing each neighborhood flexibility in designing a system to meet the needs of its residents more solutions will evolve and the possibilities for success will increase.

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⁸ I disagree with this philosophy since it resembles trickle-down economics. If funds were channeled to one or two different providers, each program would have a larger sum to work with from the start. "It takes money to make money."

⁹ Laissez-faire, or "hands-off" policy refers to the free market system. By allowing the market determine what and how the suppliers produce, maximum efficiency is hypothesized as the result.
Minneapolis.

The 3M Company plant that was constructed in the suburbs of Minneapolis was planned for 20,000 employees. The largest vanpool commuting project ever initiated by a single employer emerged from this firm. The location decision overlooked the fact that the suburb was not linked with any transit service. Since the traffic impacts from a company of such size would have caused congestion, the company needed to take fast action. In 1975, when it was operating at fifty percent of its employee capacity, the company had to operate 75 vans with 780 passengers per day with commuting distances ranging from 3 to 75 km from the site (Vuchic, 1981, p. 598-599).

A report done by the National Task Force on Ridesharing in 1980 stated that:

"The 3M Company estimates it has saved millions of dollars since it started a vanpool program to take the pressure off its St. Paul parking facilities that were feeling the effects of a large increase in the number of employees." (National Task Force on Ridesharing, 1980, p.8).

Detroit.

Detroit has also had some experience with reverse commuting. Numerous programs have been attempting to link the people with jobs and transportation. Two of the more well known and well established programs in the Detroit Area have different characteristics regarding the type of service they have been providing. The programs which were examined include: Jobs Employment Training Services (JETS) and VanPool Services Inc. (VPSI).

JETS was initiated in 1988 and has provided a comprehensive package of services that have included job brokering, job training, transportation, and job retention. The size of the business grew from two vans that carried around twenty employees to ten vans that carry about eighty-five employees while still operating on a door-to-door service. Since the staff of JETS has been negotiating with the employers about subsidizing transportation costs, the employees who have used the service have ridden free of charge (SEMCOG, 1990, p.
People have agreed that services that have dealt with improving the marketability of the labor force can be beneficial (Levy, 1981, p. 281; Blakely, 1989, p. 45-46; Wolman et al, 1991, p.151). Educational and training services have been thought of as integral components of any type of economic development efforts for Detroit (Engler, 1993, p. 2; Halling, 1990, p. 47; Thomas, 1990, p. 306). JETS has been a provider of these educational services as well as the transportation services. The combination of these services has resulted in favorable opinions of the program by several companies who have used JETS for labor supply. The companies have told JETS that ever since employees were being selected through the JETS program, employee turnover has decreased (Kleinknect, 1990, p. 1A).

In contrast to JETS, which administers a comprehensive package of services to employed and potentially employed residents, VPSI, a van leasing company, bases its target market on people who already have jobs and who do not want to travel individually because of financial or other reasons. The company has been in business since 1977 and is owned by Chrysler Corporation (Interview #1).

The average daily ridership that VPSI has been receiving ranges between 500 and 750 people per day. The people in the van usually work for the same employer and can lease vans for a flat fee of $700 per month which covers the use of the van and insurance. The vans have a capacity of twelve to fifteen people which averages out to about $60 per month per person for the use of the van, excluding maintenance costs such as gas and oil.

VPSI has taken a different approach to the reverse commuting problem. Instead of examining the areas where unemployment exists and attempting to reach these people, it has developed a program for those who are already employed. The effects of this program, therefore, tend to ease the transportation barrier for those who have jobs as well as alleviate traffic congestion on the transportation network. However, it offers no services like job finding or job training.
Summary.

The projects that have been examined share certain characteristics. Most operated with vans as the means for transporting the people. This was attributed to the relatively cheaper start-up costs of vans as opposed to buses, the lower operating expenses of vans, the greater comfort that vans provide, and the number of people needed to run them at capacity. Therefore, vans have been chosen as the vehicle for the proposed concept.

The programs that were more successful in linking the unemployed with job opportunities and transportation had a combination of services as in the cases of Accel Transportation in Chicago, the Regional Employment Plan in Philadelphia, and the South Central and East Los Angeles Transportation-Employment Project in Los Angeles. A combination of services was viewed as a positive component and was written into the concept. However, this takes into account additional costs that will have to be paid by someone. Also, employment brokers have said that their business does not have trouble finding jobs for the people of the city. In fact, waiting lines for available jobs act as indicators that the people want to work and have the opportunities out there (Henderson, 1993, p. 1A). The restraint holding them back is the transportation to and from work. Therefore, job related services other than employment might fit in better in the long-run after the transportation aspects are solved.

Success has also been a part of efforts when there was a single employer working with prospective employees as in the Association House program in Chicago, the SEPTA 200 Series routes in Philadelphia, and the 3M vanpooling program in Minneapolis. In Detroit, however, there are numerous employers who need employees for service related positions. There must be a common employment area or drop-off point for the neighborhood-based vanpool to access.

The proposed concept of centralizing transit centers within neighborhoods for the purpose of reverse commuting programs developed from the facts presented in chapters two and three. In effect, a neighborhood-based vanpool which could transport its
own residents to the suburbs, or act as a feeder into the existing bus lines would allow easier access to transportation for each of the neighborhood's residents. It would take less time for the vehicles to traverse the neighborhood area as opposed to the city bus routes that need to service certain routes within the metropolitan area. Since the vanpool could easily function like a "community taxi," it would also be catered more towards the residents' needs. Provisions for vehicle storage could be added onto the existing neighborhood centers.

The neighborhood center itself would function as the organizational and financial entity for the vanpooling program and it could incorporate provisions for job training programs as the project develops. By using the neighborhood as the market for the patronage, existing neighborhood centers can be utilized as the vanpool's "home base".

Other services that could emerge in the long-run could include day care, home repair, and possibly a small scale grocery. Day care might be needed since most of the female headed households with no husband present have children and the responsibilities of taking care of them. Without day care, the mothers would not be able to work even if they did have jobs and transportation to them.

Home repair programs are a good way to allow residents to fix up their houses as well as their neighborhood's physical appearance at lower costs than contractors. By having these programs based in the neighborhood center a "hands-on" training or construction service can be created for the residents. This can only benefit the residents by creating savings which can be re-invested for other uses within the neighborhood.

The grocery store in the neighborhood will be another aspect that can complete a comprehensive set of services to the neighborhood residents. Since this might be able to be located within the central area of the neighborhood, in close proximity to the people who are using the neighborhood transit operation, quick shopping on the way home from work is anticipated. By establishing a center of the neighborhood that was built for the purpose of reviving the neighborhood through transit, social services, and retail needs, numerous aspects of community have greater potential of developing. Granted, these ideas will not be
part of the study, but they should be set forth in order to establish long term project goals.

Who pays for this program? The users would be able to ride in the vehicle for a fee based on certain variables such as driver salaries, vehicle payments, insurance, and maintenance costs. This cost would be split among the people who would use the vehicle. For instance, if fifteen people fit into the vehicle, then those fifteen people would split the total costs of owning the vehicle and they would be able to use it for their transportation. Essentially, it would strive for neighborhood-based transportation that is self-sufficient.

Various funding mechanisms such as ISTEA, JPTA, or even a one of the "Big Three" could be used in initially obtaining the vans. These sources have been associated with establishing and promoting new forms of transportation in the past, and they could be used in this program as well. Their function would focus on the initial start-up costs only. Once the program is operating it is designed to cover its own costs.
The Study Area and Its Components.

Troy Employment Area

Mack Neighborhood
Chapter Four: *Methodology*

Introduction.

The methodology used for this study will combine three different types of strategies: inventory, spatial analysis, and feasibility analysis. The inventory will essentially establish the basis for the existing modes available for reverse commuting purposes.

The second strategy within this methodology includes a spatial analysis. It has three main objectives: 1) Locate and define the routes of each different mode, and 2) Establish different work trips\(^1\) using one or more of the available modes, 3) Attach costs to the work trips. Two distinct variables will emerge from this analysis: trip distance\(^2\) and trip time\(^3\). The trip distance, trip time, and other expenses such as bus and taxi fares will be attached to each work trip. The result will be a per day cost figure that will be used in the cost analysis. The spatial analysis is basically a screening process that will show which of Detroit's many different routes will be used in the cost comparison study.

The cost analysis will use the per day costs of each work trip. After all of the work trips have been converted into costs per month, comparisons will follow. This will produce alternatives that can be ranked on the basis of costs of the work trip. The lowest cost work trip will be considered the best.

Being a case study on reverse commuting, the first step in this study was determining the study area and its components: 1) a metropolitan area, 2) a suburb, and 3) an inner city neighborhood. The figure on the previous page shows the spatial relationship.

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1. Work trip is considered the round trip routes taken to work and back. Sometimes this is know as a "tour."
2. Trip distance will be the total round trip distance involved in the work trip.
3. Trip time will be the total amount of time on the work trip which will include both in-vehicle and waiting time.
Study area.
The metropolitan area.

The metropolitan study area involves Detroit, Michigan located in the southeastern part of the state along the Detroit River which connects Lake Erie and Lake St. Clair. The city itself occupies 139 square miles while the Detroit Metropolitan Area covers 614 square miles. Detroit had 1,027,974 residents in 1990, which was 175,395 fewer residents than in 1980 (U.S. Bureau of the Census 1980-90).

Detroit was chosen for this study based on its present need for some type of reverse commuting efforts. It has undergone decentralization like most metropolitan areas and its inner city has experienced high rates of unemployment since the decentralization. In 1990 unemployment exceeded 80,000 people which was close to twenty percent of its labor force (U.S. Bureau of the Census, 1990, p. 825). Clearly there is a problem of unemployment within the City of Detroit.

Coupling the high rate of unemployment with the fact that thirty percent of the households within the City of Detroit do not own an automobile, and an additional thirty-six percent only own one car, the employment-transportation linkage shows a correlation (U.S. Bureau of the Census, 1990, p. 1317). This correlation could be high due to the fact that three out of every four jobs in the tri-county area are created in the suburbs which are not serviced adequately by public transportation (SEMCOG, 1991b, p. 1). With these facts in mind, Detroit was chosen as the metropolitan area of study.

The economic perspective of the Detroit Metropolitan continues to resemble centrifugal, or outward movements of jobs. By 2010, an astonishing 92% of the jobs in the Detroit MSA are projected to be outside of the central city (SEMCOG, 1991a, p. 64). Of the 398,000 new jobs that are supposed to emerge in the region, most job growth is projected to be in the service sector. These numbers are already showing signs of truth in the job-rich suburbs like Troy.
The suburb.

The suburb of Troy, Michigan was selected as the area of employment since it was representative of a potential job market for the unemployed. Its 1990 population was 72,884 residents and its unemployment rate was 3.2% (US Bureau of the Census, 1990).

Troy is located just north of Detroit's city limits. It is in close proximity to Woodward Avenue and is intersected by Interstate 75. The former road is considered a primary arterial⁴ and the latter road is classified as a freeway⁵.

Troy is a typical suburban community on the rise. During the eighties Troy had the second highest amount of office space constructed in Southeast Michigan—8.1 million square feet. By 2010 the county that contains Troy, Oakland County is expected to have the largest percentage of total employment in the six-county region. If the current trend continues, the suburb of Troy will be the "powderkeg" of development and employment for the next several decades (SEMCOG, 1991a, p. 10).

For the sake of simplicity, the suburb will be broken down into an employment area that includes two major shopping malls that have ample opportunity for low-skilled, low-paying, blue-collar jobs in the service sector. Oakland Mall and Somerset Mall will be used as the employment areas also because they are both serviced by buslines and will therefore provide a common trip end for cost comparison.

The neighborhood.

The neighborhood study area comprises the Mack Neighborhood which is located on the southeast side of Detroit just north of Belle Isle Park. It is bounded by Interstate 94 on the north, Jefferson Avenue on the south, Chalmers Avenue on the east, and Conners Avenue on the west. These boundaries were determined by the United Community Ser-

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4. Primary arterial in this case has 3000+ average daily trips. The road itself has four lanes of moving traffic and turn lanes in spots with parking along the sides.
5. I-75 has six to eight lanes depending where you are on it.
vices of Metropolitan Detroit Research Division based on census tracts. Actually, the UCS does not define Mack Neighborhood as a neighborhood, but as a "subcommunity" which might include three or four neighborhoods. Since Mack had a 1990 population of 22,598 residents and probably comprised three to four neighborhoods, its population count was fairly consistent with the commonly used range of 3,000 to 7,000 residents per neighborhood (Von Eckhardt, 1976, p. 57; ). For the convenience and consistency of census data this study assumes the subcommunity of Mack as a neighborhood.

The neighborhood was chosen because it is representative of the type of neighborhood that could hypothetically use a reverse commuting program for its residents. Of its 7,649 functioning households, 4,137 do not own a vehicle and the overall average of vehicles per household within the neighborhood is only 0.7. Secondly, nearly 36% of the neighborhood's work force is unemployed and the median age of the residents is 24.7 years. These statistics imply that there are a number of residents within the neighborhood who are able to work based on age but do not have jobs. Looking at the low numbers of people within the neighborhood who work in the suburbs with the high number of unemployed and those without automobiles, the tendency to relate unemployment and lack of transportation is high.

Inventory of existing modes.

Introduction.

In order to establish a common group of modes that can be utilized for reverse commuting purposes, an inventory must be taken. Although the Detroit Metropolitan area has some rail transportation such as Amtrak and the PeopleMover, rail transportation for reverse commuting purposes is basically obsolete. The modes that can be most easily utilized for reverse commuting purposes include the following: automobile, bus, taxi, and reverse commuting programs.

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6. UCS is a volunteer-driven agency which assists Detroit in planning and problem-solving data and solutions. It has been in service since 1917 and is supported by the United Way.
Automobile.

Instead of predicting what type of automobile will suit the needs of the people in Mack Neighborhood, the study will use operating costs per mile to determine the ultimate result for cost comparison. Therefore, the key in determining the costs of the automobile will be in the definition of the route it will travel. The route will be determined in the spatial analysis.

Bus.

The bus operations that are available include the D-DOT public transportation busline and the SMART busline. SMART runs as an extension service complementary to D-DOT and serves the suburban areas in the Detroit Metropolitan Area. D-DOT operates within the city limits of Detroit. The two buslines are compatible and allow transfers at certain points along the routes.

Taxi cabs.

Since the number of taxi companies in the Detroit area is great, the taxi companies which are closest to the neighborhood will be used as the available taxi service. The taxi operation for the study will be the Eastside Cab Company. It operates as demand responsive transit and will be used for the journey to and from the Renaissance Center. The method was chosen because 1) the cab ride from the neighborhood to the suburb is too long to be feasible (roughly $50 per day), and 2) since the buslines will access the place of employment directly, the need for a cab from the bus stop to work is not required.

Reverse Commuting Programs.

The reverse commuting programs are similar to "dial-a-ride" services except they specialize in transporting inner city residents to the suburbs for employment. There are many different programs in Detroit and assuming that they function as businesses, most
programs would transport the residents for a certain price based on supply and demand. Therefore, the study does not look at which firms would transport the residents based on the proximity to the neighborhood. Rather, it assumes that transportation is inevitable if a certain fee is paid by the riders.

The four modes will be examined more closely in the spatial analysis which will conclude by establishing a menu of work trips. The work trips will consist of various combinations of the modes and will be used later in the cost analysis.

Spatial analysis.

Introduction.

This spatial analysis will examine the alternative modes in the inventory. Essentially, its objectives are twofold: 1) Determine the applicable routes to use for the study, and 2) Establish work trips by using various combinations of these modes and routes. Since the spatial analysis will establish the available trip options and attach cost figures to them, it is a mandatory step in searching for the most cost-effective options in reverse commuting.

Time-of-Day Characteristics.

Before the routes can be determined, the work schedules must be clarified. Since the low-skilled, blue-collar jobs that the neighborhood residents would be most qualified for vary somewhat in work scheduling, it is hard to determine a regular schedule for the entire neighborhood. However, remembering that this neighborhood-based vanpool program works on an incremental basis means that if twelve jobs (the amount of people per van load) can be found in Troy that are scheduled fairly closely together, the van should run at nearly full capacity.

Instead of only dealing with one type of work schedule such as the forty-hour week, this analysis will outline three different types: forty-, thirty-, and twenty-hour work weeks. By providing alternative-hour work weeks, comparisons will be made in the cost analysis
which will show how the various costs associated with commuting relate to the different
types of work weeks. The intent of the various work schedules, therefore, is to show a
more comprehensive range of cost comparisons based on number of hours worked.

In talking with an employment agency that deals strictly with employment opportuni-
ties in the Troy area, available forty-hour per week jobs in the service sector are abundant
and run, on average, from 7:00am to 3:00pm. There are other jobs available that run
before or after this time range, and some of these are twenty- and thirty-hour per week
jobs.

The analysis assumes that for the forty-hour work week, employees need to be at
work before 8:30 AM and leave on the first available mode running after 5:00 PM. This
time schedule was chosen for various reasons: 1) Since the study uses two malls as the
major job generators, most of these jobs would start between 8:00 AM and 9:00 AM, 2) It
still allows a forty-hour per week job, and 3) It will allow the modes to be tested in morning
and evening rush-hour traffic. The last reason is critical for the vanpool since rush-hour
traffic would in-effect be the "worst case scenrio" in regards to time of day. Therefore
rush-hours can be used to determine the maximum time costs the residents will have to pay.

For the sake of simplicity, the twenty- and thirty-hour work weeks will also operate
during the 8:30 to 5:00pm range. The thirty-hour week will assume six-hour work days,
five days per week. Therefore, this work day assumes two extra hours that will not be used
working or eating lunch. The twenty-hour per week jobs will consist of five, four-hour per
day work days which will be scheduled from 8:30am to 12:30 pm and 12:30pm to 4:30pm.
By choosing these work shifts, the van will be able to transport the afternoon group of
people out to work by 12:30pm and pick up the people who are getting done with the
morning shift at 12:30pm.

7. This information came from a telephone interview that I had with an employee of NS Services, an
employment agency that has different branches for different parts of the Metropolitan Area.
8. Lunch is assumed as one-half hour and it is not viewed as a cost, since people need to eat. Although this
assumption could be disputed by those who value their time more than they value their nutrition, for this study lunch
is not a time cost.
Since the in-vehicle times of the bus routes are quite similar, the evening routes that the twenty-hour per week employees will use will be the same as the forty-hour per week employees. The proposed scheme indicates that they will be getting out of work at 4:30 pm. Instead of listing the 4:30 PM route for the twenty-hour employee and the 5:00 PM route for the forty-hour employee, the study will only use the route at five-o-clock in order for more simplistic analysis. The 5:00 PM route is assumed synonymously with the 4:30 PM route. The time spent traveling the 4:30 route equals the time spent traveling the 5:00 route.

Before arguments against the chosen work schedules develop, a few points should be reiterated. Regarding the forty-hour per week service sector jobs: the key aspect to remember is that there do not have to be multitudes of jobs that run during the classic "eight-hour-a-day job"--only increments of twelve. Since Troy is located in the high growth area of Oakland County which has been considered "the engine that drives Michigan's entire economy," it does not seem far-fetched to assume that twelve jobs with similar schedules can be obtained (Silarski, 1994, p. 2). Regarding the even distribution of work hours and days: by normalizing the amount of work across the five day work week allows a maximum amount of travel for the employees. Therefore, the maximum travel costs associated with each mode are able to be compared. By that same token, running the modes during the peak hours will tend to increase the time spent traveling and therefore increase time costs.

Taking these factors into account will yield an analysis that looks at the modes associated with the same work schedules which have pick-up and drop-off times during the peak hour traffic volumes.

**Trip Distance and Trip Time.**

The relationship between the neighborhood, the suburb, and the existing modes of transportation available to them are key in determining two distinct variables: trip distance and trip time. Trip distance is defined as the total distance that is spent traveling, and will be used in calculating the miles per month for maintenance purposes of the vanpool and the
automobile. Another key use for the distance variable which will be described later is determining costs of taxi services. The distance will be calculated after the overall routes are determined. It will be done by measuring the distance with respect to the given scale on the 1993 SMART Regional Route Map 9.

The other variable, trip time, is defined as the total amount of time that is spent per day during the journey to and from work. This will include in-vehicle time as well as waiting time for reasons such as bus transfers. The time will be measured on the bus routes by the given route time schedule, but for the modes like taxis, automobiles, and the neighborhood-vanpool, driving experiments measuring the travel time will have to be taken.

The basic assumptions for the spatial analysis have been laid out and include modal choices, time schedule constraints, and definitions of distance and time variables. With the assumptions in mind, the first part of the spatial analysis can be accomplished—defining the routes.

**Defining the routes.**

**Automobile.**

The automobile is the most flexible mode among the choices and does not require spatial analysis. In effect, the entire road network in the Metropolitan area can be accessed by the automobile, unlike fixed route bus lines. However, in order to establish comparisons of distances a normalized route will have to established. The automobile's route will be the same as the vanpool and the reverse commuting programs since these modes are essentially demand responsive, not fixed, and can provide direct transportation to the suburb for a fee that is not entirely out-of-the-question (as is the case for the taxi).

The routes used for the automobile and the other modes did not come from any

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9. SMART stands for Suburban Mobility Authority Regional Transportation. The map was obtained through a telephone order. SMART bus lines are described later.
type of transportation modeling and are not confirmed as minimum paths\(^{10}\). However, through intuition and examination of the maps of the area, the routes are intended to be minimum. Also, since all three modes generally fit into the transportation network well because of their size (unlike standard sized buses) and they will be using the same assignment, minimum paths to the employment area were not viewed as a high priority. The routes chosen for the study include Mack Avenue, Conners Avenue, Jefferson Avenue, I-94, and I-75. The distances were taken from the scale on the SMART Regional Map and included the following:

- Mack to Oakland Mall—18 miles
- Mack to Somerset Mall—21 miles
- Mack to Renaissance Center—6.5 miles

Since this study analyzes the costs of traveling certain routes on certain modes, common origin and destination points had to be assumed. Mack Neighborhood City Hall was considered the neighborhood's origin. It is located at 14143 Mack Avenue which is relatively the geographic center of the neighborhood. Since the other stops such as the Renaissance Center, Oakland Mall, Somerset Mall, and various bus stops were not as ambiguous as Mack Neighborhood was for an origin/destination point, they were already determined.

The times for the given distances were determined by driving experiments on the existing road network. These times were used in the cost effectiveness analysis. The experiment used a 1985 Ford Ranger for the vehicle and a stop watch for the timekeeping device. Since the experiment was limited to one day, and the driving time had to be within the peak hour range for morning trips and evening trips, certain route schedules had to be

\(^{10}\) Minimum paths are usually defined in transportation modeling programs based as the shortest distance between to points or traffic zones based on either distance or time. Impedances like speed limits, number of lanes, or number of stops are usually factored into the equation.
followed. The trip time from the Mack Neighborhood City Hall to Jefferson was measured first since it is on the route to the Renaissance Center. Logically, the trip time to the Renaissance Center was measured next.

After these were taken, the process started over in the center of the Mack Neighborhood and the times for the journey to Troy were measured. The times for the outbound journey from the neighborhood to the suburb were taken between 7:00 AM and 8:30AM which corresponded with the morning peak hour loads on the road network.

The stop watch was started at one origin point and stopped at the given destination point. For example, the process of establishing the trip times from the Mack Neighborhood City Hall to the Oakland Mall and the Somerset Mall used the lap function on the stop watch which allowed split times for each point. The same process was completed for the
trip times to Jefferson and the Renaissance Center. This process was also done for the evening trip and the results of the two trips indicated the following:

- Mack to Oakland Mall— 40 min
- Mack to Somerset Mall— 45 min
- Mack to Renaissance Center— 15 min

**Bus.**

The bus operations that are available include the D-DOT public transportation busline and the SMART busline. SMART runs as an extension service complementary to D-DOT and serves the suburban areas in the Detroit Metropolitan Area. The main terminal for the SMART buses is based out of the Renaissance Center area. Therefore, Mack residents have to go downtown before they can get to the suburb\(^{11}\). Since the fares of these bus lines are not based on distance traveled, as are the taxi services, the distance variable will be omitted for the bus route spatial analysis.

The city bus operation, D-DOT had only one route that adequately connected Mack Neighborhood with the Renaissance Center area—Route 31-Mack. The map below shows its path. The time schedule follows.

![Map of D-DOT Bus Route](image)

**Figure 6: D-DOT Bus Route**

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\(^{11}\) There is one exception to this. When the combination of Route 610 and 760 are used to get to Troy, the residents do not go downtown. This route will be shown in the SMART bus routes section.
Route 31—morning: Mack—6:08AM; Ren. Center—6:37AM
mid-morning: Mack—9:22AM; Ren. Center—9:50AM
afternoon: Ren. Center—1:39PM; Mack—2:08PM
alternate afternoon: Ren. Center—2:08PM; Mack—2:38PM
evening: Ren. Center—6:44PM; Mack—7:12PM
alternate evening: Ren. Center—7:20PM; Mack—7:48PM

The SMART bus lines run throughout the city of Detroit and service the periphery. The bus lines serve the tri-county area of Wayne, Macomb, and Oakland counties, but SMART has put certain restrictions on its service within the city of Detroit:

*Passengers may not board inbound SMART buses within the Detroit city limits except on portions of routes 185, 260, 265, 495, 530, 580, and 610.

*Passengers may not get off outbound SMART buses within the Detroit city limits except on the above routes.

*Local travel within the Detroit city limits is permitted on portions of John R. Warren, Harper, Moross, and Schoenherr. On these routes passengers may get off SMART buses at any designated stop (SMART Regional Route Map).

The process for determining the applicable SMART bus routes was essentially a destination-origin process. The process started by examining which bus routes serviced the Troy employment area, namely, the Somerset Mall and the Oakland Mall. From there, each route was traced back to its origin. In all, there were various routes that serviced the employment area. However, due to time conflicts or directional differences, some of these were eliminated.

The following were the SMART routes that serviced the employment area and were chosen for the study: Route 425—Northland-Oakland Mall, Route 760—Roseville-Troy,
Route 460—Woodward Avenue Local, and Route 495—John R. None of these routes service the Mack neighborhood residents directly. These routes will have to be used in connection with other modes such as the D-DOT bus lines and taxis. The map on the next page depicts where the routes operate and the time chart shows when the various stops occur with respect to the given work day.

Figure 7: SMARTBUS Routes

Route 425--
  morning: Woodward and 13 Mile--7:55AM; Oakland Mall--8:20AM
  afternoon: Oakland Mall--12:20PM; Woodward and 13 Mile--
  12:44PM
  evening: Oakland Mall--5:08PM; Woodward and 13 Mile--5:32PM

Route 760--
  morning: Macomb Mall--7:22AM; Oakland Mall--7:55AM;
  (eastbound) Somerset Mall--8:11AM
  mid-morning: Macomb Mall--11:01AM; Oakland Mall--11:34AM;
  afternoon: Somerset Mall 11:53AM
  Somerset Mall--12:00PM; Oakland Mall--12:25PM;
### Route Timetables

<table>
<thead>
<tr>
<th>Route</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>760</td>
<td><strong>Morning</strong></td>
</tr>
<tr>
<td>(westbound)</td>
<td>Woodward and Daines--7:02AM; Somerset Mall--7:12AM; Oakland Mall--7:37AM</td>
</tr>
<tr>
<td></td>
<td><strong>Afternoon</strong></td>
</tr>
<tr>
<td></td>
<td>Somerset Mall--5:12PM; Oakland Mall 5:41PM; Macomb Mall--6:16PM</td>
</tr>
<tr>
<td>460</td>
<td><strong>Morning</strong></td>
</tr>
<tr>
<td></td>
<td>Ren. Center--7:11AM; Somerset Mall--8:27AM</td>
</tr>
<tr>
<td></td>
<td><strong>Afternoon</strong></td>
</tr>
<tr>
<td></td>
<td>Ren. Center--10:15AM; Somerset Mall--11:27AM</td>
</tr>
<tr>
<td></td>
<td>Somerset--12:38PM; Ren. Center--1:52PM</td>
</tr>
<tr>
<td></td>
<td><strong>Alternate Afternoon</strong></td>
</tr>
<tr>
<td></td>
<td>Woodward and 13 Mile--12:54PM; Ren. Center--1:52PM</td>
</tr>
<tr>
<td></td>
<td><strong>Evening</strong></td>
</tr>
<tr>
<td></td>
<td>Somerset Mall--5:12PM; Woodward and 13 Mile--5:34PM; Ren. Center--6:34PM</td>
</tr>
<tr>
<td>495</td>
<td><strong>Morning</strong></td>
</tr>
<tr>
<td></td>
<td>Ren. Center--7:00AM; Oakland Mall--8:02AM</td>
</tr>
<tr>
<td></td>
<td><strong>Afternoon</strong></td>
</tr>
<tr>
<td></td>
<td>Oakland Mall--12:20PM; Ren. Center--1:19PM</td>
</tr>
<tr>
<td></td>
<td><strong>Evening</strong></td>
</tr>
<tr>
<td></td>
<td>Oakland Mall--5:12PM; Ren. Center--6:16PM</td>
</tr>
</tbody>
</table>

Route 450 will be treated as a transferable bus route for this study. It runs north and south along Woodward Avenue but does not service the employment area. However, it does run by the bus stops and transfer points which will allow it to act as a component of a work trip. It links with and feeds Route 425 which services the Oakland Mall as well as Route 760 which serves both the Oakland Mall and the Somerset Mall. Its time table is below.

(Route 425 link)  
<table>
<thead>
<tr>
<th>Route 450</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning</strong></td>
<td>Ren. Center--6:52AM; Woodward and 13 Mile--7:50AM</td>
</tr>
<tr>
<td><strong>Evening</strong></td>
<td>Woodward and 13 Mile--5:45PM; Ren. Center--6:45PM</td>
</tr>
</tbody>
</table>

(Route 760 link)  
<table>
<thead>
<tr>
<th>Route 450</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning</strong></td>
<td>Ren. Center--5:59AM; Woodward and Daines--7:00 AM</td>
</tr>
</tbody>
</table>
By examining the route options available for this trip, on its evening westbound run Route 425 arrives at Woodward and 13 Mile from the Oakland Mall at 5:32PM. If the rider chooses to take Route 450, he or she will wait about 15 minutes for the next bus since this route arrives at the same intersection around 5:45PM. However, if Route 460 is taken instead of Route 450, only two minutes of waiting time between buses will be used since Route 460 arrives here at 5:34PM. Both options will be examined in the cost-effectiveness analysis.

The Route 760 option only serves the malls in the morning coming from Woodward. In the evening westbound journeys, Route 760 does not go past the Somerset Mall and would not take the rider back to Woodward Avenue. The rider would have to find another route to get back to the neighborhood from work.

There is only one route that services the Mack Neighborhood; it is Route 610--Kercheval. This route was determined by examining the routes that passed by the neighborhood and had transit stops associated with them. This route runs along Jefferson Avenue, the southern boundary of the neighborhood. Its time schedule is below.

Route 610-- morning: Mack--6:20AM; Macomb Mall--7:02AM
Route 615 mid-morning: Mack--9:56AM; Macomb Mall--10:42AM
afternoon: Macomb Mall--1:04PM; Mack 1:56PM
evening: Macomb Mall--6:48PM; Mack--7:36PM

Route 610 links with Route 760 at the Macomb Mall. The 610/760 trip is the only SMART bus trip from the neighborhood to the employment area. As depicted in the table above, Route 610 runs by the southern boundary of the Mack neighborhood\textsuperscript{12} around 6:20AM and goes out to the Macomb Mall on the east side of Detroit (see map). The arrival time at the Macomb Mall is 7:02AM and there is a 20 minute headway until the

\textsuperscript{12} For simplicity, only one stop has been assumed. Actually, the map shows two stops on the southern boundary of Mack—one at Chalmers and Jefferson and one at Conner and Jefferson.