ASSESSING PARKING AND TRANSPORTATION NEEDS IN DOWNTOWN WORCESTER

An Interactive Qualifying Project Report
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by

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Abstract

This study, sponsored by the City Manager's Executive Office of Economic Development, analyzed parking and transportation issues in downtown Worcester. The goal was to evaluate the attitudes of people towards parking and transportation in downtown Worcester and to develop recommendations for possible solutions. A survey was used to gather data on current behaviors and attitudes of residents and business people of downtown Worcester. It was determined that supply of parking spaces is sufficient, but problems exist such as cost, distance to desired location and convenience. Upon completion recommendations were made for the City Manager's Executive Office of Economic Development.

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1.0 Executive Summary

The Executive Office of Economic Development of the City of Worcester asked the Interdisciplinary Global Studies Department (IGSD) of Worcester Polytechnic Institute (WPI) for a student team to conduct a study to analyze transportation and parking issues in downtown Worcester. A previous study in 1999 had been conducted with the conclusion that there was enough parking in downtown Worcester. Since that study the demand had increased and thus a further analysis was necessary to evaluate the current situation in downtown Worcester. The goal of this study was to evaluate the attitudes of people towards parking and transportation in downtown Worcester.

We first looked at different approaches that deal with various parking problems such as increasing supply, reducing demand, raising efficiency, and preventing spillover. This served to familiarize us with the concerns of parking problems and how they have been dealt with so that we could apply these solutions to the parking problems of downtown Worcester.

We then proceeded to examine the problems in downtown Worcester. A survey was used to gather data on the current behavior of the residents and business people of downtown Worcester. We wanted to find out the current transportation patterns of the people in downtown Worcester. The survey also served to collect the opinions of the people towards parking and various forms of transportation in downtown Worcester. The findings were displayed in graph form and analyzed.

An inventory of the parking spaces and facilities was made within the area of study. Amount charged, number of spaces, and rate of occupancy was noted and examined. Our findings were put into tables and maps for analysis.

Upon analysis we concluded that downtown Worcester had a surplus of parking spaces but these spaces cost too much, were too far away from the user's destination, and were generally inconvenient. Most of the garages were utilized by neighboring businesses and operated at approximately 80% capacity during the day. At night however, the garages remain for the most part empty since they are all too far away from residential buildings to be convenient and the residents feel that the prices are too high. The garages also discourage overnight parkers by closing the facility down overnight, making access to transportation cumbersome. This leaves the residents at a parking disadvantage for they have no legal place to park their cars overnight. For this case we recommended a garage be built close to the residential building. Possible location for a garage would be the lot behind the Telegram & Gazette, which is now a parking lot for the Telegram & Gazette. This garage could cater to the residential needs as well as the commercial needs of the area by being open 24 hours a day and having the rent of the nearby residential buildings include parking.

It was also concluded that presently the automobile is the most prevalent mode of transportation for both the businesses and residents of downtown Worcester, with the businesses favoring it more than the residents. This is backed up by the data that a significant amount of the businesses provide free parking for the employees. Thus, downtown Worcester has enough parking spaces for its working people, and even a small surplus, but the demand for parking might soon exceed the supply. In case of such an event, we provided recommendations for the employers to provide more incentives for carpooling and mass transit. It was also suggested to enhance the awareness of public transportation in Worcester.

Through our recommendations, downtown Worcester will provide a more competitive residential market, increasing the value of residential buildings, and rise further in its current revitalization efforts. We hope that through this study the residents and business people of downtown Worcester had a chance to voice their opinions in a way that will positively affect their neighborhood.

2.0 Introduction

A study conducted by The Worcester Department of Public Works (DPW) three years ago found that the demand for parking exceeded the supply of parking spaces in the downtown area of Worcester by 22%. This translates into a deficit of nearly 3,500 parking spaces (Department of Public Works, 1999). Increased downtown development and the planning of future projects have increased the demand for parking in downtown Worcester. Several proposed development projects throughout the city have been terminated in the past due to lack of parking spaces per order of the zoning board (Department of Public Works, 1999).

Many cities have faced or are currently facing similar issues, stemming from the increased number of automobiles on the roads. Between 1960 and 1990, the number of automobiles on the road has risen from 47,190,300 to 156,346,000 (Hanson, 1995). This increase has overwhelmed many cities with transportation problems. This trend of automobile use is likely to continue and must be taken into account by current studies.

The City Manager's Executive Office of Economic Development of the City of Worcester asked The Interdisciplinary Global Studies Department (IGSD) of Worcester Polytechnic Institute (WPI) for a student team to conduct a study to analyze transportation and parking issues in downtown Worcester. The subsequent study determined the current supply and demand of parking spaces and possible alternatives to parking in downtown Worcester. The study utilized surveys to find out the attitudes and behaviors of residents and business employees to formulate possible solutions to the problem.

The following chapters include the background research that was necessary for a full understanding of the issues at hand, the methodology that was used to gather the needed data, a description of the data analysis, and the conclusions that were drawn from the analysis.

- **Chapter 3** includes a background of parking and transportation, the issues that have been born from them in other cities, and how the problems have been solved.
- **Chapter 4** contains a complete and detailed description of the methods that were used to collect the desired data.
- **Chapter 5** is a complete analysis of all acquired data. Maps are used to illustrate the current parking facilities in downtown Worcester. Tables and graphs are utilized to represent trends in the data regarding the views of residents and businesses toward parking and transportation.
- **Chapter 6** consists of the conclusions that were drawn from the data analysis.
- **Chapter 7** formulates recommendations of possible solutions to the parking and transportation issues based upon the analysis.

3.0 Literature Review

The following chapter is comprised of all the background research necessary for a full understanding of parking, transportation, and problems that arise there from. The chapter contains the following sections: historical background, parking, parking in Worcester, and summary.

3.1 Historical Background

The automobile was once considered a solution to problems of horse-powered transportation. In the days before cars, the horse was the main mode of locomotion, being the driving force behind such vehicles as wagons, buggies, coaches, and carriages. This congested city streets much the same way that cars do today with the addition of dirt and smell emanating from the horses. The introduction of cars was a welcome change from the smell and grime that was associated with horses. The car provided a private means to access almost any place in a short time for a relatively low cost. Yet instead of being a panacea, the automobile, like the horse, had its own unique problems.

Automobiles clogged the streets of cities much the same way that horses did. They also emitted their own noxious fumes, dirt and grime (Jacobs, 1961). One only needs to look at the signs rendered unrecognizable from filth and soot above the artery tunnel of the Mass. Turnpike in Boston (Figure 3.1). Traffic is not a new development, but an old problem that has over the years been masked, hidden, and made-over, yet underneath

Figure 3.1
Mass. Turnpike Sign

still remains the same. The automobile is only the newest form of an old problem (Jacobs, 1961).

The problem of parking is related to traffic because the number of cars that are on the road is directly proportional to the number of cars that need to park. Hence, an increase in the number of cars in urban areas is the main factor in parking problems.

Increasing population, dual income households, suburbanization and the declining cost have all increased the number of cars on the roads (Hanson, 1995). The population of the United States has grown from 179,323,175 in 1960 to 281,421,906 in 2000 (U.S. Bureau of the Census, 1960, 2000). In 1960 there was only one car for every 3.8 people, while by 1990 that number has decreased to one car for every 1.8 people (Hanson, 1995). The effect of population and decrease of car per person can be seen in the following table (Table 3.1).

Year	Car per person	Population
1960	3.8	179 million
1990	1.8	281 million

Table 3.1
Comparison of Population with People per Car over a 30-Year Span

The time period between 1960 and 1990 also saw an increase in dual-income households. In 1960, 36% of women age 16 to 64 were in the paid labor force, compared to 57% by 1990 (Hanson, 1995). This increase has added to the average number of cars per family. Now, it is not only the father who owns a car, but the mother as well.

Lastly, suburbanization has led to people living further away from their workplace, as well as commercial and entertainment centers. All these factors have led to the tremendous increase in the number and use of automobiles, which contributed to the congestion of cities and highways (Figure 3.2), air, water and noise pollution, energy consumption, urban sprawl and traffic accidents.

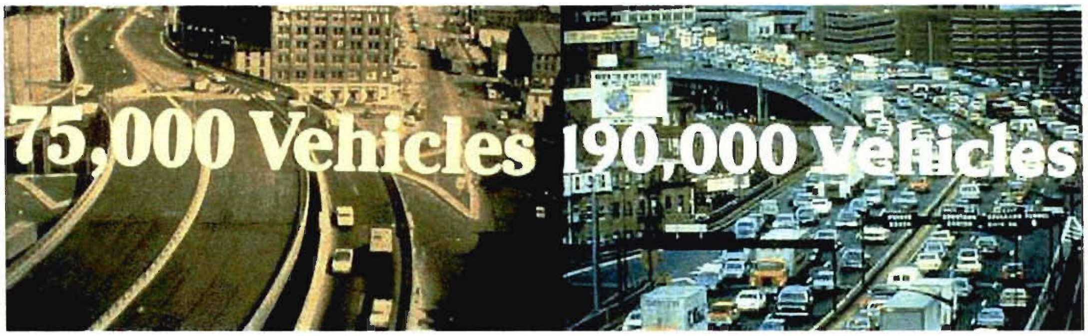


Figure 3.2
Comparison of Boston Daily Traffic (1959 & 1990)

3.2 Parking

As the automobile continues to grow more popular, parking is becoming an important part of the modern urban environment, to the point where it "affects the vitality of our communities and the locations of our activities" (Levinson, 1982). The transition from public to personal transportation resulted in the need for parking planning. As Revell (2001) remarks:

> Parking planning can play a direct role in the success of a city's traffic management, the health of its business and the level of satisfaction experienced by residents and visitors. Poor parking planning can have disastrous results: Traffic can become gridlocked, urban businesses may have trouble competing with suburban companies, in-town residents can get fed up with searching for parking spaces every time they return home, and, in the worst cases, municipal credit rating can suffer. Conversely, cities that can provide sufficient parking spaces will create satisfied residents and businesses.

Parking downtown or in the central business district (CBD) can present many problems. Extremely high demand, lack of available land, environmental problems, and financing hinder the possibility of providing convenient free parking. Finding a solution can be accomplished by looking at what factors contribute to parking problems. These factors include lack of supply, high demand, inefficiency, and spillover[1] (Victoria Transport Policy Institute 2001).

Another factor for defining parking issues is the categories of people that present the greatest demand for parking in a particular area (Victoria Transport Policy Institute, 2001). These people can be divided into commuter, customer, and resident. Commuters desire long-term parking during regular business hours. Price is relatively important and commuters will walk extra distance for a better price. Customers for a business or commercial property tend to have different needs. The proximity of parking to the desired location is the most important factor. Customers are more willing to pay a higher price and tend to stay for a shorter period of time than commuters or residents. Residents need long-term parking, but require overnight accommodations, as they take the car to work during the business day. Price is most important, followed by distance (Victoria Transport Policy Institute, 2001).

3.2.1 Lack of Supply

Parking problems can be attributed to lack of supply of parking spaces. Possible solutions include increasing the number of parking spaces—through on-street, off-street or remote parking—and redesigning existing facilities.

Increasing on-street parking is accomplished by designing streets with parking lanes or by converting traffic lanes to available parking spaces. On-street parking is relatively inexpensive compared to building a garage and is much more convenient, placing people closer to there desired location. However, the numbers of spaces that can

[1] Spillover occurs when inadequate parking at one location leads to a strain on parking in another. For example, sporting events with a large number of patrons can lead to parking issues for area businesses. The parking for the event spills over into surrounding lots. Thus nearby parking facilities can become inadequate for their regular customers, who then must find parking elsewhere.

be created are often limited and may lead to future congestion on the road. Diagonal parking, as opposed to parallel parking, is an additional way to increase the supply of on-street parking (Victoria Transport Policy Institute, 2001).

As on-street parking possibilities have long been exhausted, parking garages are frequently built in CBDs. Garages are advantageous because less land per parking space is required compared with on-street parking and supply is increased without decreasing the number of traffic lanes, which is favorable for drawing more people to the area for both residential and commercial purposes. This may be especially attractive for many downtown revitalization projects. High building cost is the main disadvantage of parking garages.

Another way to increase parking space supply is to build more parking spaces, but not directly in the CBD. This is called satellite or remote parking and has the advantage of being much cheaper, as relatively inexpensive land can be purchased on the outskirts of the city. Suburban land and construction costs for one surface space are typically lower then those in a CBD parking garage, as can be seen in Table 3.2 (Victoria Transport Policy Institute, 2001).

	Average Land Cost ($)	Average Construction Cost ($)
Suburban	455.00	1,500.00
CBD	1,900.00	10,000.00

Table 3.2
Average building costs for one parking space

To encourage the use of remote parking, parking fees are usually reduced and a shuttle service is provided. Remote parking is particularly effective when applied to commuters, as seen with park-and-ride facilities. This type of multimodal approach is usually sought by urban planners but is hard to achieve, as people prefer to use automobiles and are reluctant to use it if parking available in the CBD itself. Convenience and the need to provide information to the parking user about location of the facility are other disadvantages of remote parking.

Facility redesign is the last method for increasing supply, and is accomplished by utilizing all potential areas and converting some spaces to fit compact cars or motorcycles. This approach is inexpensive but limited in how many spaces can be created and goes against current trends of increasing car size (Victoria Transport Policy Institute, 2001).

These solutions attempt to alleviate parking problems by increasing the supply of parking spaces. They tend to be popular with the car users. The disadvantages of these solutions include encouraged car use, increased costs for businesses and the government that are transferred to consumers, and unfairness to the people who drive less often.

3.2.2 Reducing Demand

Reducing demand provides its own set of solutions. This approach is more realistic in the CBD because it would be difficult as well as expensive to provide enough parking without transforming the landscape. Possible solutions include discouraging automobile use, increasing use of mass transit and other forms of transportation, and pricing parking.

3.2.2.1 Discourage Automobile Use

As a means of transportation, the car offers privacy and flexibility, but is very inefficient and space consuming. In 1990, the average vehicle occupancy was 1.6

persons (Hanson, 1995). This shows that most people drive alone or with one passenger, increasing the number of cars on the roads. Coupled with the fact that the automobile accounts approximately 90% of total miles traveled leads to very inefficient use of space (Center for Urban Transportation Research, University of South Florida, 1996).

Obstacles to reducing automobile use are significant because during the last fifty years the car has been favored as the main means of transportation. The federal government regularly funds highway construction projects, with only a very small percentage coming from state or local funds (Vuchic, 1999). These subsidies make traveling by car cheaper in terms of direct out of pocket costs. Gasoline and vehicle maintenance are the main costs associated with driving. Parking and tolls are others but they are not as common in most places. Other factors such as road construction do not enter into consideration because those who drive do not directly pay for them.

Other forms of transportation have never had this advantage. Even with some government subsidies, mass transit must charge a fare to cover operating and other costs. When a person makes a decision to travel only the direct out of pocket costs are evaluated. The automobile is favored because the government pays most of the cost of travel (Vuchic, 1999). The estimated cost of travel by auto per person per mile traveled is between 38 cents and 52 cents, with between 33.5 cents and 42.4 cents being paid for by society (Hanson, 1995).

The government and employers also favor the car through other policies. Many companies subsidize parking by providing their employees with free parking or parking at lower than market rates. Tax breaks are given to companies that subsidize employee parking. Studies of employers with and without employer paid parking suggest employer paid parking increases the number of cars driven to work by an average of 19 cars per 100 employees, and increases solo driving about 25 percent (Shoup, 1992).

Removing the subsidy altogether is one option. However, employees who are used to this luxury are likely to resist this measure. A "cash out" program is an alternative, and consists of giving employees the option of taking the subsidy or its cash value equivalent. They may then rely on other means of transportation such as mass transit or carpooling, or can still use a car but seek parking elsewhere. California is on the leading edge of this idea, as it passed a law that requires cash out programs for companies with 50 or more employees who lease parking in regions of California that do not meet federal clean air standards (Wormser, 1997). Disadvantages of the cash out programs include reduced effectiveness compared with removing the parking subsidy altogether, and increased spillover (U.S. Department Of Transportation, 1994).

Several other techniques are similar to parking cash outs. Travel allowances are given to employees to cover commuting costs instead of free parking. Commuters can use this money to pay for a parking space or for another travel mode. The difference from cash out is that all employees are eligible, not just those that were given subsidized parking. Transit and rideshare benefits are free or discounted transit fares provided for employees. They are very convenient and valued by commuters (Victoria Transport Policy Institute, 2001). There are also commuter checks that are sponsored by companies and the government. Under this program, employees have a set amount of money taken out of their paychecks each month before taxes that then is given back in the form of a check. The check can only be used for public transportation, such as monthly passes, etc.

Residential areas can decrease the use of cars by unbundling parking from rent. For example, an apartment might rent for $1,000 per month, which includes two parking spaces. Unbundling could mean that the apartment alone rents for $800, plus $100 for each parking space. This typically reduces parking demand by 10-30% (Victoria Transport Policy Institute, 2001).

3.2.2.2 Encouraging Other Modes of Transportation

Encouraging people to use alternative forms of transportation could relieve many traffic and parking problems. Mass transit, ridesharing, bicycling and walking are some of the available options.

3.2.2.2.1 Mass Transit

Mass transit systems, such as buses, light rail, and subways, are the main alternative forms of transportation. Increased capacity to transport people compared with the car is the main advantage of mass transit. Despite this, drawbacks of this mode of transportation exist. Mass transit requires large metropolitan areas with high population density to be efficient. This goes against the current trend of suburbanization and urban sprawl. It offers limited accessibility to different locations in a city, as opposed to the automobile, and usually has to be combined with other transportation modes. Mass transit is usually designed to serve the radial journey to the CDB, but cross-town and suburban trips have limited accessibility (Hanson, 1995). Also, one must realize that mass transit is not likely to replace the car as the main means of transportation. Even in metropolitan areas with population over 1 million and heavy rail systems, the automobile still accounts for 53.6 percent of all trips (Hanson, 1995).

Transit can be separated based on three types of rights-of-way (ROW). The first category consists of mass transit using regular roads (Category C). Buses, trolleybuses, trolleys, and para-transit vehicles are good examples. In this category, cars are actually faster and more reliable, as transit vehicles have to deal with traffic as well as stop to pick up passengers. The advantages of category C transit include low investment and flexibility to change routes (Vuchic, 1999).

The second category of ROW consists of partially separated roads or lanes (Category B). Transit tracks or lanes usually run along medians and are separated everywhere except for intersections where regular traffic is crossed. Typically called semi-rapid transit, this category includes light rail transit and bus transit systems. Semi-rapid transit offers significant improvements in speed, reliability, and carrying capacity, but requires greater investment and fixed routes. Bus transit systems that run on bus lanes offer an advantage over light rail by not requiring separate construction costs. Bus lanes exclude private or commercial vehicles during peak traffic times, and can be unidirectional, going to the city in the morning and back to the suburbs in the afternoon. The Shirley Corridor in Washington, DC serves as a good example, with similar lanes existing in Seattle and Houston (Vuchic, 1999).

Fully separated ROW makes up (Category A) transit. Typically called rapid transit, it is always guided, usually through rail. Trains and subways are the characteristic examples. Rapid transit systems offer superior capacity, reliability and safety, attracting more passengers than street transit and competing very well with cars. Unlike street transit and cars, which come to a virtual stop if capacity of the road or highway is surpassed, rapid transit continues to operate efficiently even if its capacity is exceeded; however, the cost of rapid transit systems is extremely high, especially with elevated or underground structures. Therefore, size of the (Category A) transit networks is limited to areas that can attract large number of passengers (Vuchic, 1999).

Tokyo is a good example of a city utilizing rapid transit systems. Subways account for 24 percent of traffic, carrying 5,377,000 people per day. "The most notable feature of Tokyo's mass transit system is the Yamanote line" (Sudjic, 1992). This line consists of a 21-mile loop that intersects all the subway lines of the capital. The system is very reliable and provides a pleasant riding experience with the availability of noodles to eat and magazines to read (Sudjic, 1992).

Transit lines can also be divided into regular and commuter systems. Regular transit offers access to many parts of the city and surrounding areas, operating from early morning to late evening. Transferring is relatively easy as there are many stops along the routes. Commuter transit, on the other hand, is aimed primarily at the bringing people to the CBD and back. There are relatively few stops along routes and no convenient a transfer between radial lines, but speed is improved (Vuchic, 1999).

3.2.2.2.2 Ridesharing

One way to decrease the total number of vehicles on the roads is through ridesharing, which involves the shared use of a vehicle to commute to and from work. Ridesharing programs include the use of private cars or publicly owned vans or buses.

Carpools are the most common form of ridesharing, where people who work and live close together share transportation. They can result from informal arrangements or ride matching services provided by an employer. Vanpools are another type of ridesharing. They usually have six or more people sharing a vehicle, and tend to be more organized. Many companies have vanpool programs, where the actual vehicles are either owned or leased by the company. State and local governments also help to encourage ridesharing by providing funding or tax breaks for vehicle purchases and program planning. One example is the State of Connecticut Vanpool Program, which enables commuters to purchase vans at low interest, tax-free and near-wholesale prices (Center for Urban Transportation Research, University of South Florida, 1996). Bus-pool programs are the last type of ridesharing and have the greatest capacity, carrying sixteen or more passengers. They tend to either provided by the employer or private carriers, and are used for park and ride shuttles.

One good way to promote ridesharing programs is through a guaranteed ride home program, which offers passengers an alternative way to get home if they miss their regular ride or have an emergency. The usual transportation options include taxi service, short-term car rental, company car, and shuttle or public transit. The city of Denver established such a program in 1991, which reimburses employees for up to 100 miles of a taxi ride in case they miss their commute (Center for Urban Transportation Research, University of South Florida, 1996).

Local government and the private sector can provide incentives for rideshare programs. Governments can require employees to have a certain amount of parking spaces designated for rideshare vehicles, provide financial support, decrease parking, and increase parking rates. Companies can encourage these programs by providing matching services, substituting travel allowances or parking cash out for parking subsidies, and providing preferential parking for those that use ridesharing programs.

High occupancy vehicles (HOV) lanes (Figure 3.3) can encourage ridesharing programs. They are usually reserved to vehicles with two or more passengers and provide a faster commute to those who rideshare. However, good enforcement is needed for HOV lanes to be effective and cost can be high if the lanes are built separately from existing roads (Center for Urban Transportation Research, University of South Florida, 1996). Boston has recently set up a car-pool lane on its major highway. This lane can only be used by vehicles containing more than two passengers, and operates during peak times only.

Figure 3.3
HOV lanes in use

3.2.2.2.3 Bicycling and Walking

Encouraging non-motorized transportation, such as bicycling and walking, is a great way to reduce demand for parking spaces. These modes of transportation are efficient for short trips and offer a variety of benefits. Walking is free and bicycling is very inexpensive. Problems associated with motorized transportation, such as pollution, noise, and traffic, are avoided. Walking and bicycling are also excellent ways to exercise. In busy urban areas bicycling or walking is often faster than any other mode of transportation. However, climate, geography and distance affect bicycling and walking much more than other forms of transportation (Vuchic, 1999).

Planning the urban landscape can encourage bicycling and walking. Physical connections between areas can be critical, as properly designed crossings, overpasses, and underpasses are needed. Sidewalks and plazas with unobstructed line of sight encourage walking. Linking walking and bicycling facilities with mass transit provides an excellent way to increase the range of non-motorized transportation. Two good examples include Groningen, Netherlands, which provides bicycle-parking facilities at train stations, and Phoenix, which started a program in 1991 that equipped buses with bicycle racks (Center for Urban Transportation Research, University of South Florida, 1996).

Toronto is another example of a city that actively promotes bicycling. By the mid-1990s, Toronto was spending some $1 million annually on bike improvements, and had installed 5,000 post rings (Figure 3.4) on sidewalks for parking and 52 kilometers of on-street lanes, with 44 more kilometers planned. The bike lane on the Prince Edward Viaduct carries 3,100 riders a day. Up to twenty percent of adult residents in old Toronto use bicycles. There is also an extensive bike trail on the Don River that is helping to restore

Figure 3.4
Bike Post Ring

nt. However, there are still problems. Local officials are reluctant to increase the number of bike lanes. Motorists often take advantage of these lanes for parking, as police enforcement is minimal. Even with all the positive improvements safety is still an issue in Toronto. Bicyclists have been injured or killed due to aggressive and negligent motorists or their own carelessness (Bielski, 1998).

One of the biggest issues with bicycling and walking, as seen in the Toronto example, is safety. People will not walk or ride their bikes if they feel threatened by crime or other vehicles in a certain area. Safety can be improved by providing exclusive bike lanes, while blocking off streets during peak times in a busy downtown area accomplishes the same for walking.

Employers can encourage bicycling and walking by providing cash incentives, changing rooms and showering facilities, and bicycle parking facilities. Bicycling and pedestrian trails are another good way to promote non-motorized transportation, as many people who ride their bikes for travel discovered its potential through recreational use (Center for Urban Transportation Research, University of South Florida, 1996).

3.2.2.3 Pricing Parking

Reducing demand can be accomplished by pricing parking. Cost of parking is a very critical factor, as our society has gotten used to having free parking. Richard Rich, a parking consultant for Rich and Associates, says that people expect "a guaranteed parking spot in front of the house" because they perceive it as their property (Andrews, 2000). When in comes to downtown areas, most people will therefore avoid paying parking fees. This occurs despite the fact that the fees present only a small percentage of what parking actually costs, as businesses and government cover a large percentage. The people's "natural assumption is that the locality is gleefully taking advantage of them to raise money" (Revell, 2000).

In reality, the opposite is true, as most people never consider the full cost of parking. The total cost is made up of land, construction, operation, maintenance, and transaction costs. One parking space located in the CBD can cost annually around $1,162 for a surface spot, $1,425 for a garage, and $2,288 for an underground space (Victoria Transport Policy Institute, 2001). Someone must pay for this parking and the three main sources are parkers, local business, and the government, which uses taxpayer money.

Variable pricing is one way that cost can be used to solve the parking problems. This policy favors either short-term or long-term customers based on location. On-street parking should favor short-term parking, used mainly by customers, by making each progressive hour cost more. Another way to favor short-term over long-term parkers is to use on street parking that has a certain limit, such as 30 minutes or an hour. Short-term users would not be affected, while long-term parkers would not be able to park there because it is illegal to refill the meter. This would have to be coupled with good enforcement measures, such as frequent meter maids, who would make sure that no one stayed past the limit and was not feeding the meter.

Off-street facilities should favor long-term parking, mainly used by commuters, by having monthly discounts. Variable pricing could also target specific times of day, such as during peak hours when prices would be increased. Many cities have applied pricing techniques to manage parking with positive results. Most large cities in Germany have recently begun using these techniques, and a decline in solo drivers has generally been observed (Topp, 1995).

Raising the price of parking is a way to make people more aware of the cost of parking, by transferring the burden from the government and businesses to those people that actually use the parking facilities. Since price increases would raise direct out of pocket costs, people would be quick to change their transportation habits (Victoria Transport Policy Institute, 2001). However, solution could prove very unpopular politically.

If this solution is applied to only on-street parking, then a benefit results from the fact that the more convenient on-street parking would become more expensive than parking in garages, which would lead more people to use existing garages. The government can also indirectly control pricing of private parking by reducing supply and increasing price of public parking, decreasing minimum parking requirements in zoning, and eliminating tax breaks for free parking.

3.2.3 Inefficiency

Parking problems can result from inefficiency, as parking facilities are rarely full and many times they are operating way below their capacity. Christian Luz, the national director of parking services for HNTB Corporation, believes that many parking management problems result from underused facilities as opposed to a shortage of space (Andrews, 2000). The solutions that aim to solve parking problems by increasing efficiency include improving customer information, using shared parking, planning properly and using minimum and maximum parking requirements. The main advantage of these solutions is low cost.

The simplest way to increase efficiency is to provide better information to the parking user. Location, prices and availability could be more effectively displayed and marketed. The main benefit would be the reduction of frustration in finding a parking spot. Although this appears simple, it can be hard to implement, especially providing real-time information on the location of available parking (Victoria Transport Policy Institute, 2001).

Shared parking is another way to increase efficiency, and involves either several individuals or buildings using the same parking facilities but at different times. A good example would be offices, which have high demand during the day on weekdays, coupled with restaurants and entertainment, which use the facilities mainly on nights and weekends. However, sometimes it is difficult to overcome the current belief in free and available parking. For example, Iowa City tried a shared parking program in commercial districts but found it did not work too well, as "the individual tenants want their own spaces with their names on them. That is their proof to customers that a store is convenient to shop in" (Wormser, 1997).

Proper planning when building parking facilities can reduce inefficiency. This is difficult as demand is hard to predict in the ever-changing urban world. However, local governments often rely on estimates from national sources such as Institute of Transportation Engineers' (ITE) Planning Handbook and Parking Generation Manual, as well as guides from Urban Land Institute, American Planning Association and the National Parking Association (Wormser, 1997). ITE conducts limited studies based on suburban areas with ample free parking and no transit. According to Shoup (1999), the results of these studies overestimate parking demand by ignoring transit and paid parking. "Half of the 101 reported parking generation rates are based on four or fewer surveys of parking occupancy, and 22 percent of the parking generation rates are based on a single survey."

The best way to judge demand is through surveys and studies done at the local level, something that even ITE admits (Institute of Transportation Engineers, 1992). However, local surveys are rarely done, as governments tend to rely on simple formulas. Willson, the chair of the Department of Urban and Regional Planning at California State Polytechnic University in Pomona, says that "administrative simplicity . . . appears to be a factor in the use of a single standard for a wide range of uses: jurisdiction wish to avoid complex parking regulations that are difficult to administer" (Wormser, 1997).

A good example of relying too much on national averages is provided by Spokane, Washington, and is contrasted by planning in Charlottesville, Virginia. Spokane used mostly ITE's data and ended up expanding parking by 75% at a cost of $31 million dollars. When the garage did not bring in the money, huge financial and political problems arose that in the end resulted in the downgrading of the city's bond rating, which will hurt the city in the future. On the other hand, Charlottesville used local data that led to the construction of a 624 car, mixed-use parking structure featuring retail and office space. The solution proved very successful, and the city is now looking to apply it in other areas (Revell, 2001).

Reevaluating or eliminating minimum parking requirements that exist in many zoning ordinances can improve efficiency. Minimum parking requirements specify how many parking spaces per square foot of area are required for a property based on how its used. Urban planners base these by looking at national data, such as ITE handbooks which may contain unreliable data, or by looking at other cities, who themselves probably looked at the ITE handbooks (Shoup 1999). This leads to local factors rarely being accounted for, causing huge amount of empty spaces and overuse of cars. Many mall parking lots serve as a good example because they were designed for the 20th busiest hour of the year, such as the yearly Christmas rush. Not wanting to turn back any customers for lack of parking space, the parking lots are designed to accommodate a peak-shopping day. Since not every day is a peak-shopping day, this process leaves at least half of the parking spaces empty a minimum 40 percent of the time (Wormser, 1997). Shoup, the director of the Institute of Transportation Studies at the University of

California, calls minimum parking requirements "a fertility drug for cars" (Wormser, 1997). He believes that:

> Minimum parking requirements bundle the cost of parking spaces into the cost of development, and thereby increase the cost of all the goods and services sold at the sites that offer free parking. These requirements "externalize" the cost of parking, so that you cannot reduce what you pay for parking by consuming less of it. Minimum parking requirements bypass the price system in the markets for both transportation and land (Shoup, 1999).

One current alternative based on this idea is to implement variable minimum parking requirements based on local areas. The New Jersey Hudson River waterfront provides a good example. Recently, the minimum parking requirements for all coastal development, oceanfront and riverfront alike, have been changed. Barry, chairman of the Applied Companies and co-Chairman of the Hudson River Property Owners and Conservators Association, said, "that the previous requirement for two parking spaces per residential unit was not only unnecessary, but also counter-productive insofar as it discouraged mass transit" (Real Estate Weekly, 2000). The new requirements distinguish between coastal and riverfront areas, and will encourage more development projects along the river. Another alternative is to use maximum parking requirements to discourage automobile use and prevent the building of too many spaces that go unused (Vuchic, 1999).

3.2.4 Spillover

Spillover is another major cause of parking problems. A busy area will tend to cause problems in other nearby locations, especially during peak times, special events, around schools, universities, and train stations, and on the fringes of the CBDs. Spillover can be effective dealt with using various regulations, pricing and good enforcement.

Residential communities are usually the hardest hit by this problem, as nearby businesses or schools tend to occupy all the on-street parking. One way to deal with this is to implement a residential parking permit program. This forces outsiders off the streets, but needs good enforcement to be effective. The program requires a small fee for administrative purposes, but this can lead to resistance as the residents feel that outsiders created the problem (Andrews, 2000).

Areas around university campuses are especially difficult to deal with. UCLA has an average daily campus population of 50,000 and campus parking is so scarce that 5,000 students are on a waiting list for parking permits. Surrounding neighborhoods are flooded, filling up residential on street parking as well as private parking lots for various businesses and restaurants. The businesses are seriously hurt by this, as there is no room for their customers to park (Belgum, 1999).

3.3 Parking and Worcester

Worcester has gone through changes in the past half-century that have affected its parking and transportation needs. To address this the city has performed two parking studies over the last two decades, one in 1980 and the other in 1999. Currently there are projects proposed that will further affect the parking and transportation situation in downtown Worcester.

3.3.1 History

Between 1960 and 1990, Worcester has gone through many changes that are typical of most cities. Suburbanization has led to a decrease in the percentage of the metropolitan population living in the city itself from 57.7 percent to 38.9 percent

(Hanson, 1995). This time period also marked an increase in the percentage of households with more than one vehicle from 15.2 percent to 52.4 percent (Hanson, 1995).

There have also been a number of new buildings built in the past 30 years that have changed the parking needs of downtown Worcester. These buildings include the Convention Center, the Worcester Centrum, the Crowne Plaza Hotel, the Registry of Motor Vehicles, the renovation of Mechanics Hall, as well as renovations of apartment buildings and old hotels now beings used as apartment buildings. Some of these buildings had a garage lot built along with them, such as the Crowne Plaza Hotel (Department of Traffic Engineering, 1980).

3.3.2 Past Studies

The Department of Public Works in Worcester has conducted parking studies in 1980 and 1999. Appendix D contains the 1999 study. The most recent study focused on the types of parking, private and public, and on and off-street parking, which exist in the Worcester Central Business District (CBD). On-street parking is categorized by metered spaces, restricted parking zones and unrestricted zones. Parking lots are categorized into private and public. Those two categories can then be broken down into restricted, unrestricted, and charged parking lots. Since there are no free parking garages in the city there is only one category that classifies parking garages (see Table 3.3). There are six major parking garages located in the Worcester CBD (Department of Public Works, 1999).

Parking Lots					
Private			Public		
Restricted parking	Unrestricted parking	Charged parking	Restricted parking	Unrestricted parking	Charged parking

On-street		
Metered spaces	Restricted parking zones	Unrestricted parking zones

Garage
Charged parking

Table 3.3
Classification of Parking Facilities

Employee absenteeism affects the CBD demand for parking. The absenteeism of Worcester is about 9% according to the Personnel Office of the City of Worcester. Since everyday is not a peak-shopping day in Worcester, the retail demand is discounted by 25%. Places of assembly are assumed to be operating at full capacity. These percentages are used to represent a typical day in the CBD of Worcester.

The supply and demand for parking in the CBD changes drastically any given day. Areas of the city that have hundreds of available spaces during the day may be completely filled up during the evening. Buildings such as the Palladium, Mechanics Hall, or the Worcester Centrum Center, have an extremely high demand for evening parking but take up few spaces during the business day.

The major plan for future development in the CBD during the 1999 parking study was the construction of the Fallon St. Vincent Medical City Complex. The complex that was completed in the fall of 1999 added two more parking garages in the CBD. One 1500-space garage was constructed for the medical center itself and another was built to supply approximately 1000 additional public parking spaces. All new developments in the city are required to supply sufficient parking for its own demands as well as replace all the parking spaces that had to be removed during the development. This requirement will hopefully cut back on parking problems in the future.

The study shows that there is an overwhelming supply of spaces in the CBD. The major problem is the location of the surplus spaces. The areas where there is a high demand of spaces may be quite a distance from available parking. The factors that may add to the parking problem in Worcester are the prices of spaces and their location. There is a major opportunity for the city to implement a system of people moving as to take advantage of the available spaces (Department of Public Works, 1999).

3.3.3 Current

Since the study that was conducted in 1999, there have been several developments that have changed the transportation and parking situation in downtown Worcester. These include the establishment of the Massachusetts College of Pharmacy, renovation of several buildings including the old Bancroft Hotel (Figure 3.5), and the razing of a two-story parking lot behind the Telegram and Gazette building, see Appendix A (Personal communication with Paul Morano, The City Manager's Executive Office of Economic Development, January 28, 2001).

Figure 3.5
Bancroft Hotel circa 1945

The Massachusetts College of Pharmacy was established in 2000. The main academic building is located on the corner of Norwich and Foster Streets, in the heart of downtown. With the college came a need for downtown housing with parking facilities to accommodate the new students (Personal communication with Paul Morano, The City Manager's Executive Office of Economic Development, January 28, 2001).

The renovation of several residential buildings, highlighted by the Bancroft Building, added much needed residential space. However, parking for the students has not been addressed yet. There are also plans to renovate other buildings in the area for residential purposes, but they are currently on hold due to lack of parking. An increase in residents in this area will add to transportation and parking problems (Personal communication with Paul Morano, The City Manager's Executive Office of Economic Development, January 28, 2001).

The demolition of a two-story parking lot behind the Telegram and Gazette building has decreased the available supply of parking in the area. It was razed due to its deteriorating condition, as parts of the structure were falling on parked cars. This site, on the corner of Portland and Federal Streets, was turned into a surface lot. However, this could be a possible location for a future parking garage.

3.4 Summary

The literature review provided a background of the concepts of transportation and parking. Transportation issues have evolved over time and have been affected by the introduction of the automobile. The automobile's rise to popularity has changed the landscape of modern cities, as parking has become a major issue that cities have to deal with.

Several parking issues were looked at including lack of supply, ways of reducing demand, and inefficiency. From these issues, possible solutions were identified. Lack of supply could be handled by increasing the number of on-street and off-street parking spaces, using remote parking, or redesigning existing facilities. Reducing demand can be achieved by discourage automobile use, encouraging alternatives modes of transportation, and pricing parking. Providing better customer information, use of shared parking, and proper planning can eliminate inefficiency. From the background research, a methodology was developed that will help achieve the goals of this study.

4.0 Methodology

The following chapter contains a description of the following aspects of the study; the goals, objectives, methods used, data collection, and representation of data.

4.1 Goals

The goals of this study are to evaluate the attitudes of people towards parking and transportation in downtown Worcester and develop recommendations for possible solutions to address Worcester's parking issues.

4.2 Objectives

This study examined the attitudes of the residents and business people of downtown Worcester. Visitors to the city were beyond the scope of the study due to the large number of businesses and residents in the area and the limited time and resources that were available. Focus was placed on the section of the city bordered by Main, Myrtle, Salem and Front Streets as shown to the right (Figure 4.1). A more detailed map is available in Appendix A.

In the first part of the study, the current parking situation was ascertained by locating current parking facilities in the area and determining the number of spaces, cost, and hours of availability.

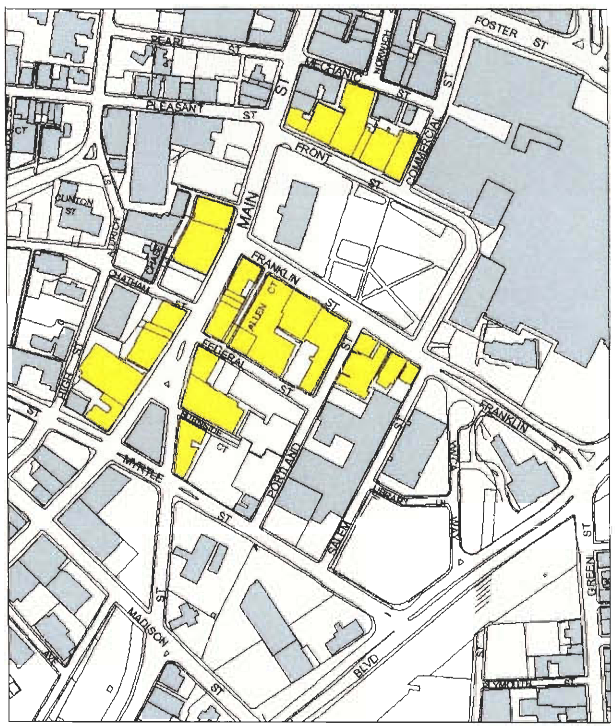


Figure 4.1
Map of Project Area

Next, current behaviors of people in downtown Worcester were analyzed. This included what modes of transportation people use in downtown Worcester and their place of origin. Factors such as where people park, rates they pay, and how far they walk to their destination were studied.

The last part of the study focused on attitudes of people towards parking and transportation, such as the availability of parking downtown, public transportation, and other ways of getting downtown, including, but not limited to, remote parking, carpooling, bicycling, and walking. The study also determined how much people would be willing to pay to park in the future and how far they would be willing to walk to their destination.

From the information that was gathered, preferred modes of transportation were identified and recommendations for possible solutions for current and future parking issues in downtown Worcester were developed. Lastly, the study evaluated the influence of demographics on parking needs.

4.3 Methods

The study used existing data, observations, and interviews to determine the characteristics of current parking facilities in the area. Surveys were used to study the attitudes and views of the residents and businesses of downtown Worcester. The variables can be seen below (Table 4.1).

Existing data and observation:
- Number of spaces
- Rates
- Availability

Survey:
- People: residents, business owners and workers
- Modes of transportation: car, bus, bikes, foot, rail, and carpool
- Parking: rates and distance

Table 4.1
Variables of Study

4.3.1 Existing Data, Observations, and Interviews

To collect the data regarding current available parking in downtown Worcester, existing data from a downtown Worcester parking study that was conducted in 1999 was used (Department of Public Works, 1999). For this part of the research, the focus was on the specific area bordered by Main, Myrtle, Salem and Front Streets (see Appendix A). Because the study was done recently, the number and location of parking has changed very little in the past three years in the project area. The only significant change was the razing of a two-story parking lot behind the Telegram & Gazette building. The data from the 1999 study as seen in Appendix B, served as a good indication on the location and number of spaces in the area.

Every lot and garage in the area was visited to count the number of available spaces and note the rates and hours of availability. There were several large garages just outside the project area that were included in the inventory of parking spaces, because it is likely that people inside the project area use them. These included the Pearl-Elm Street, Pleasant Street, Federal Plaza, and Common Outlets garages. For the large garages, an informal interview with the managers was conducted to determine the number of parking spaces, hours of availability, hourly and monthly rates, and occupancy rate. Along with the garages, an inventory of on-street parking was performed, noting time limits and rates, which were not in included in the 1999 study. The gathered data on the location and number of parking spaces was compared with the 1999 study and was found to be in agreement.

4.3.2 Survey

Surveys were chosen as the most effective way to collect data on the people of downtown Worcester, allowing a large number of people to be studied given the limited time and resources that were available. Although surveys are time consuming to create, distribute, collect, and analyze, they are more efficient than other methods such as individual in-depth interviews or field research. A survey was appropriate because the study sought descriptive information about the attitudes and behaviors of residents and workers of Worcester, and the survey format was an efficient way to gather this type of data (Singleton, 1999). A copy of the survey used for the study can be found in Appendix C.

4.3.2.1 Research Design

The face-to-face survey was chosen because the rate of response is usually higher than that for telephone or mail-back surveys. Mail-back surveys usually have the lowest rate of response, while telephone response rates are between the other two types.

Cost is another factor that was examined. The face-to-face survey is a relatively inexpensive method, especially because traveling costs were avoided. Telephone surveys would also be inexpensive, but as mentioned earlier the response rates are lower. Mail-back survey would be the most expensive method, and this, along with the low response rate, were the main reasons it was not chosen.

A cross-sectional design was used in the research, where the data was gathered in a short period of time. This was appropriate because the study examined current attitudes and behaviors and was not concerned with causal relationships or processes of change.

The cross-sectional method was also more economical and less time consuming compared to other research designs (Singleton, 1999).

A structured survey with closed-ended questions was used to standardize what each person was asked to enhance the reliability of the data by eliminating errors that occur when respondents are asked questions that are worded differently. Closed-ended questions made the survey easier on the respondent and eliminated some sources of error by providing the same set of possible responses for each respondent. The respondent picked from provided answers; thus, all possible answers had to be included and the questions had to be written clearly. Due to the closed-ended questions, data analysis was simplified by making coding easier, minimizing interpretation errors (Singleton, 1999).

4.3.2.2 Identification of Respondents

This section explains how and why the population was chosen.

4.3.2.2.1 Residential and Business

To generalize the results to the population of downtown Worcester, purposive nonprobability sampling was used to study all the business workers and residents of downtown Worcester. A section of downtown Worcester bordered by Main, Myrtle, Salem and Front Streets was surveyed, see Appendix A. Due to the relatively small area of the project, a census of the population was taken. This area was chosen because it represented the main interests of the sponsor of this study, The City Manager's Executive Office of Economic Development of Worcester.

4.3.2.2.2 Nonrespondents

Nonresponse bias was a factor that could skew the results of the study. Residents and business people who declined to do the survey or failed to respond to some questions lead to missing data. The missing data may have been influential in the analysis because a critical part of the population may have been omitted.

Nonresponse bias could introduce errors: a census of the target population might not be achieved, as only a fraction of the population would be willing to respond. This could introduce significant errors, especially if the nonrespondents are different from those who responded in some characteristic way (age, gender, race) (Pertruccelli, 1990). As an extreme, if people who do not own cars decline to participate in the survey because they are not interested in parking, the results would show that everyone owns a car.

4.4 Data Collection

This section includes the ways data was collected for the residential and business sectors of the project area.

4.4.1 Residential

Face-to-face surveys were conducted to obtain the data from the residents of the project area. First, contact with the landlords of the building was established to inform them of the intentions of the study and to obtain permission to conduct the survey. A sign was posted on the entrance to the buildings for several days informing the tenants about the study. Access to the buildings was established through the landlord.

The survey was conducted door to door to get a higher amount of returns as opposed to mail surveys (Singleton, 1999). To get a higher rate of returns, each location was visited twice, at different times of the day, to get those people that were not available initially. If the person still could not be contacted, a survey was left at the door with instructions to drop it off at the rental office of the person's apartment building. This provided an extra opportunity to get the surveys back, resulting in a higher rate of returns.

4.4.2 Business

The survey of small businesses in the project area was conducted door to door, with the respondents given the option of filling out the survey right away or over a couple of days after which the survey was picked up. For large businesses, contact was initially made with the manager of the business over the phone to inform them of the study. The manager assisted us by adding an incentive for the employees to respond and by collecting the survey from the employees. After one week, the completed surveys were collected, which allowed adequate time to complete the survey. A span of one week also ensured the inclusion of workers who work on weekends or any other day for that matter.

4.5 Presentation of Data

The results from research of current parking facilities were presented using different maps. These maps were created using ArcView software to incorporate the Geographical Information System (GIS) data of the project area. This allowed the addition of different information to a map of the research area. One map showed the number of parking spaces and the rates that are being charged. Numbers on top of appropriate buildings designate the number of parking spaces, and different colors were used to represent time limits of parking. The survey results were analyzed using statistical methods. Trends in the data were examined from individual questions by performing counts and finding out distributions and measures of central tendency (Dillman, 1994). To analyze the data from multiple questions, cross-tabulations were used to see if relationships existed between data sets (Dillman, 1994).

The results of the analysis were represented with charts, graphs, tables, and maps. Maps created in ArcView software were used to show where people tend to park downtown, the location of parking facilities, and other variables that affect transportation and parking. Frequency graphs were used to show how much people pay for parking, what modes of transportation are used, and the attitudes of people toward parking and transportation.

5.0 Data Analysis

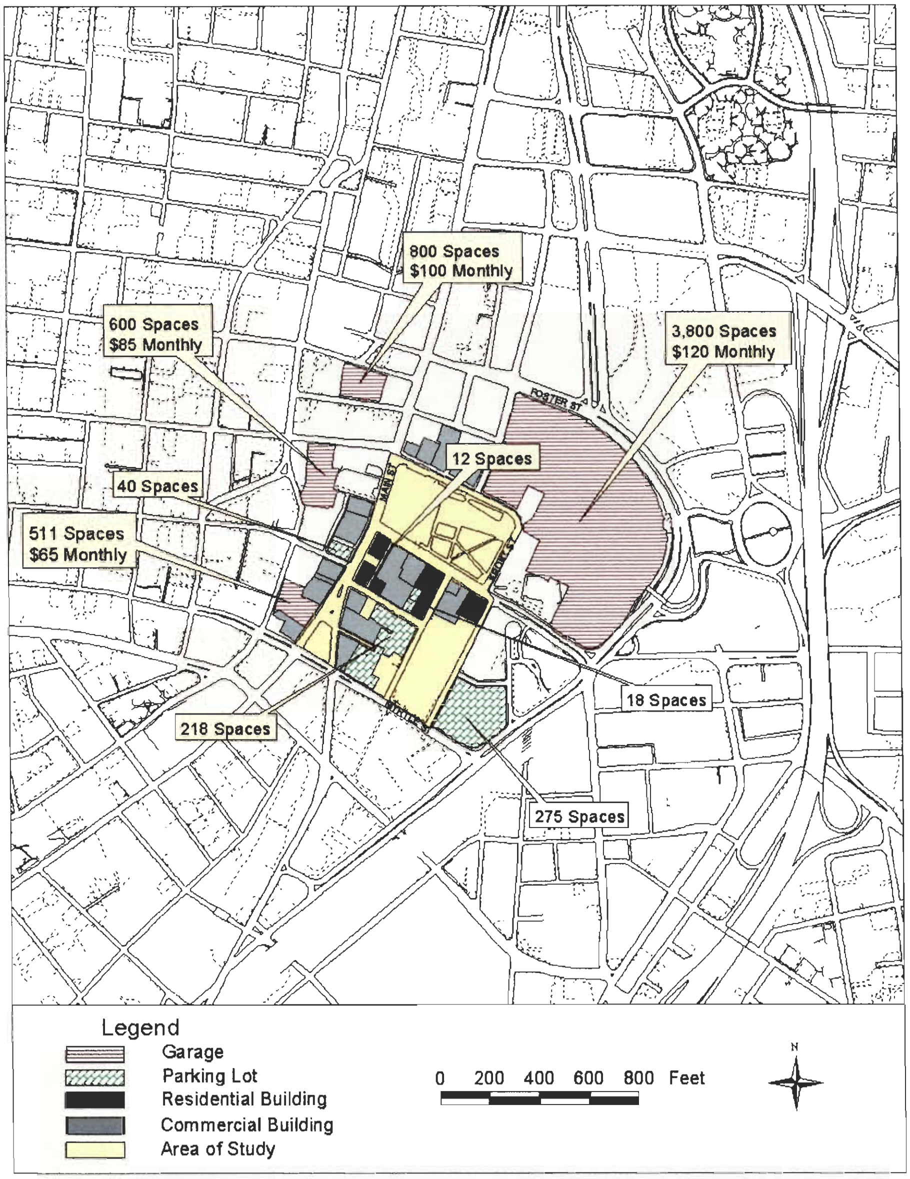
The following chapter examines the collected data and presents the results obtained.

5.1 Inventory of Parking Spaces

An inventory of parking facilities in the project area was performed to determine the number of parking spaces, location, and price. The parking data from the inventory can be found in Appendix B. Three types of parking facilities were found in the project area: parking garages, on-street parking spaces, and surface lots. On-street parking was further subdivided into metered and non-metered spaces. Surface lots were categorized as public, private, or municipal. There were no public lots in the project area, and only one municipal lot, which subsequently will be referred to as a public lot.

5.1.1 Off-Street Parking

There were four parking garages in the area of study, as shown in Map 5.1. (See Appendix A for a larger map) Their capacity varied from 511 spaces to 3,800 spaces. The prices ranged from $65 per month to $120 per month. The library lot was the only public surface lot, as the rest were private. Also, the parking spaces in the library lot are metered. Overall, there were 6,274 off-street parking spaces in the area of study. For the purpose of clarity, only buildings that part of the study are shown in the map. See Appendix B for complete garage information.



Map 5.1 Map of Garages, Parking Lots, and Area of Study

Most of the garages operated close to their capacity during the day. The Pearl-Elm garage was usually full, and the Federal Plaza and Worcester Plaza each had about 100 empty spaces on average. The Common Outlet garage, which has Yellow and Blue subsections, had on average 400 empty spaces, with the Yellow garage usually completely filled, according to the management.

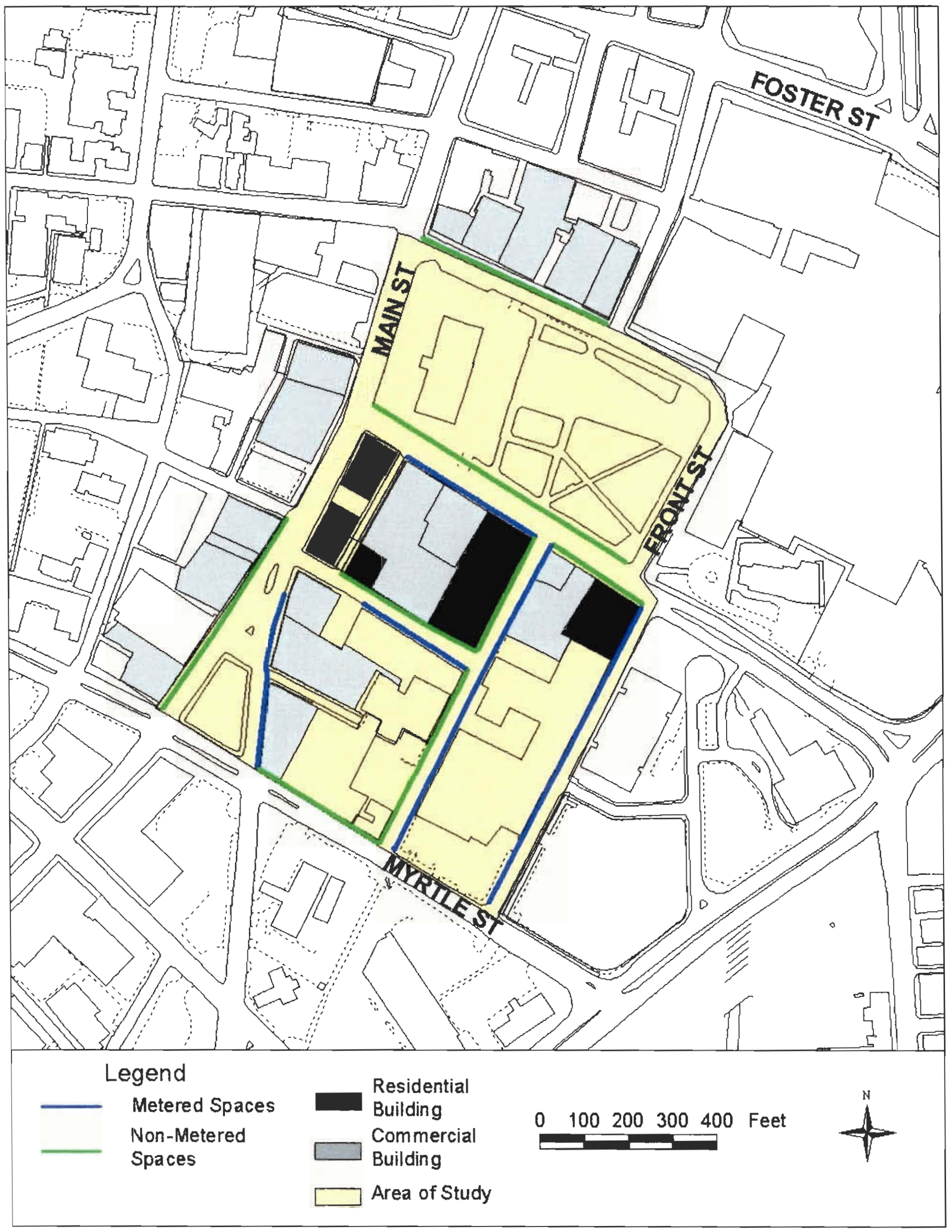
The garages in the area cater mostly to the commercial buildings, their customers being mostly from the area businesses. This can be seen by their pricing, after 5 p.m., the price for parking drops down to $1 per hour or for the whole night, depending on the garage. The Common Outlet garages charge $10 for an entire night of parking.

All the garages closed by 12:00 am. Overnight parking was allowed, but discouraged. If a car was left overnight, retrieval was not allowed until the next business day. Only the Common Outlet garage provided a telephone number that could be called in case a car needed to be retrieved

Overnight parking was minimal in all the garages. The Federal garage had approximately 30 – 40 people who paid monthly charges and park overnight. The Common Outlet garage had around 15 overnight parkers on average. The other two garages usually did not have overnight customers.

5.1.2 On-Street Parking

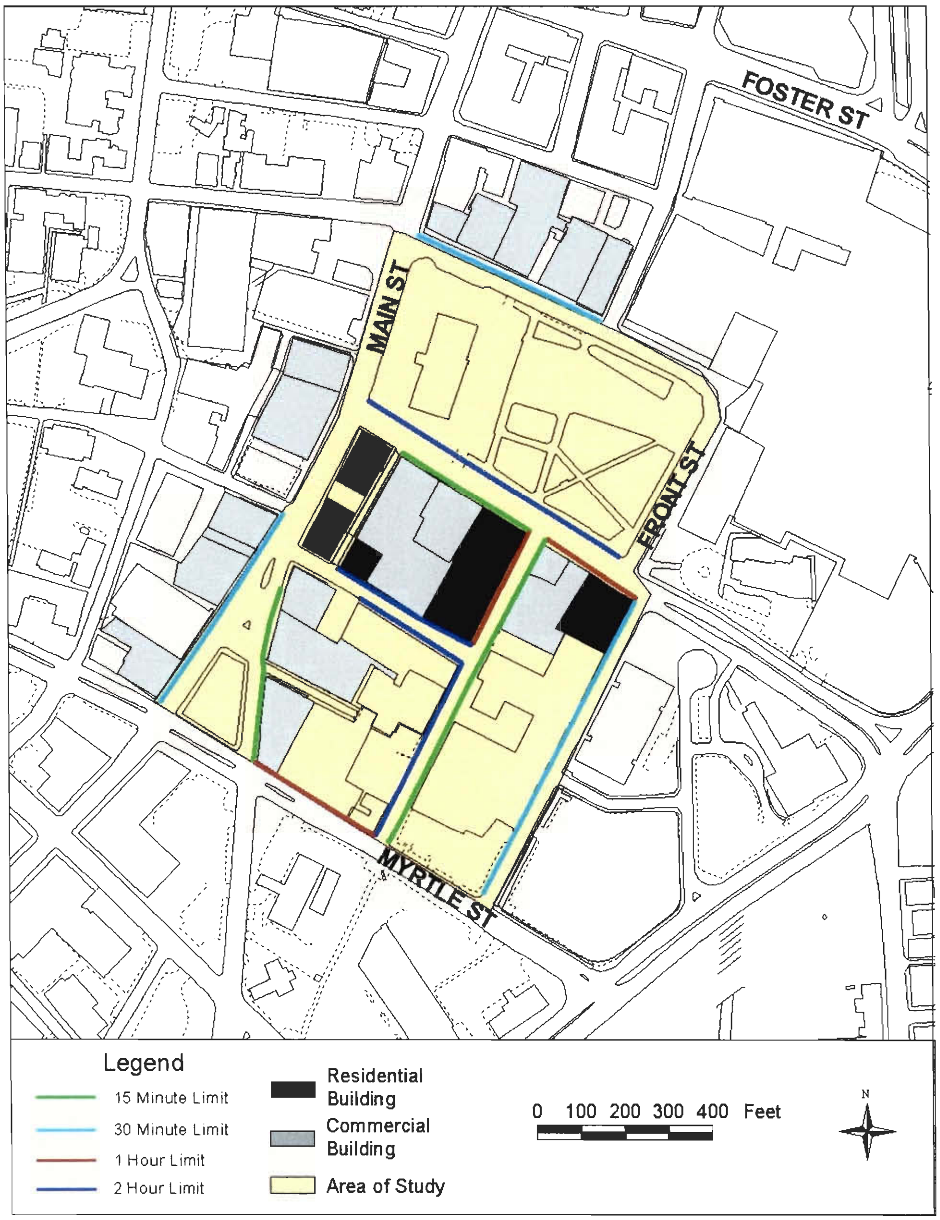
On-street parking was characterized as metered or non-metered, as shown in Map 5.2. Parking is not allowed where the map is not marked. The front of the Common Outlet Mall was designated as a passenger zone and had reserved spaces for police vehicles.



Map 5.2 On-Street Parking

Overall, there were 139 on-street parking spaces. See Appendix B for a complete list of the on-street parking. Note that the library lot contains meters, but was not included in this map.

Time limits for on-street parking varied from 15 minutes to 2 hours, as shown in Map 5.3. The library lot was not included in this map, although it had meters with 3 or 10-hour time limits.



Map 5.3 Hours of Availability and Time Limits

5.2 Survey Analysis and Results

Business people and Residents in the project area were surveyed. The actual survey can be found in Appendix C. Overall, 191 responses were received out of 660 surveys that were distributed. The Small Business Bureau was provided with 260 surveys, but due to miscommunication and time constraints, did not participate in the study. Thus, 400 surveys were passed out to willing participants. A number of participating businesses made their own copies, so the total number of their employees is not known. This includes the Bay State Savings Bank, which has approximately 50 employees, as well as several other businesses that had approximately 50 employees each. Thus, approximately 700-800 people were contacted, out of which 191 responded. This gives a total response rate of 24-27%, well above the 10% minimum that was expected.

The total number of residents in the buildings that were surveyed was 277. Of the 191 total respondents, 84 were residents, which gives a resident response rate of 21%. A couple of residential buildings in the project area were not surveyed because of the inability to establish contact with the landlords, which prevented survey conductors from gaining access into these buildings. The number of residents in these buildings was approximately 120.

	Contacted	Distributed	Responded	Response Rate
Residential	397	200	84	21%
Business	400-500	460	107	21 - 27%
Total	800-900	660	191	21 - 24%

Table 5.1 Survey Response Characteristics

5.2.1 Current Behaviors

Current trends and behavior patterns of the respondents regarding transportation, parking, and the difference in behavior between business employees and residents were examined.

5.2.1.1 Present Modes of Transportation

As shown in Fig. 5.1, the automobile was found to be the most widely used mode of transportation to get to and from downtown Worcester, with 79% of respondents driving a car, while 26% rode the bus and 25% walked. Daily use of the car accounted for 63%, as opposed to 12% and 8% for riding the bus and walking, respectively. A small percentage of people used a carpool, bicycle, rail or other means of transportation, such as taxi. This data was gathered using question 4[1], which allowed more than one response. Subsequent figures where percentages do not add up to 100% also represent questions that allowed more than one response.

[1] Question 4: How often do you use each form of transportation to get to and from downtown Worcester?

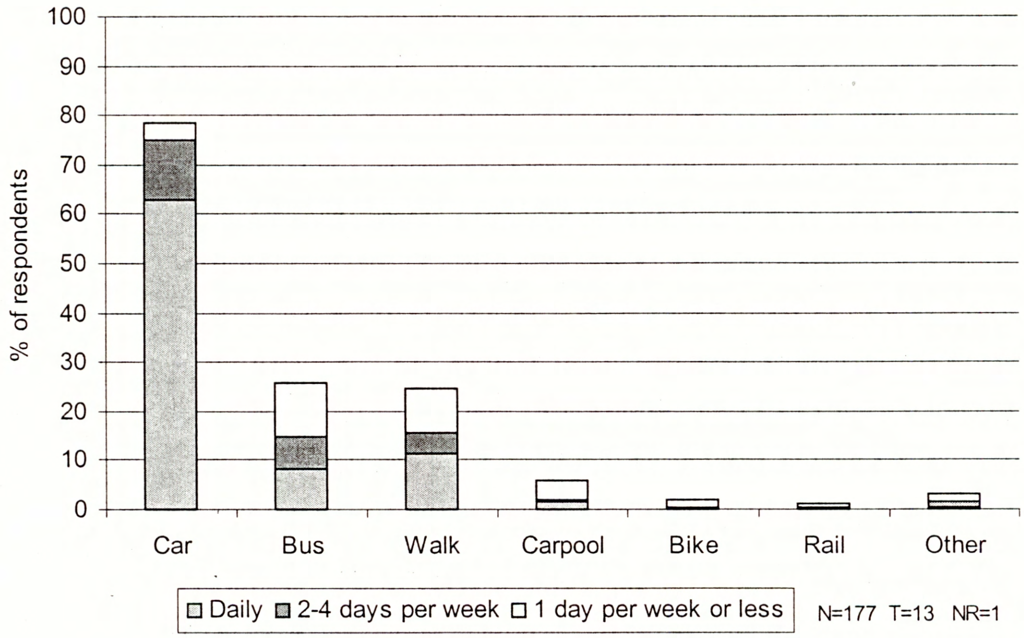


Figure 5.1 Current modes of transportation people use to get to and from downtown Worcester[2] (Question 4)

Comparing the current modes of transportation, differences can be observed between business people and residents, as shown in Fig. 5.2 and Fig. 5.3, respectively. This data was gathered by cross tabulating questions 4 and 23[3]. Business people tended to rely almost exclusively on the automobile, which accounted for 92%. All the other modes of transportation were below 15% each. The residents used more varied modes of transport; 62% of the residents drove a car, 44% walked, and 42% rode a bus. On a daily basis, the automobile dominated, accounting for 80% of the business people and 40% of the residents. Business people used a bus, walked, or carpooled less than 10% on a daily basis, and did not use the rail or a bike daily. The percentage of residents who walked and rode a bus on a daily basis was 23% and 12%, respectively.

[2] All figures in this chapter are based on only those people that responded to specific questions. On the right bottom of each figure there are three numbers. N is the number of people that responded to the specific question, T is the number of responses that were thrown away because they were filled in incorrectly, and NR is the number of people that did not respond to the specific question.
[3] Question 23: Your primary downtown needs are?

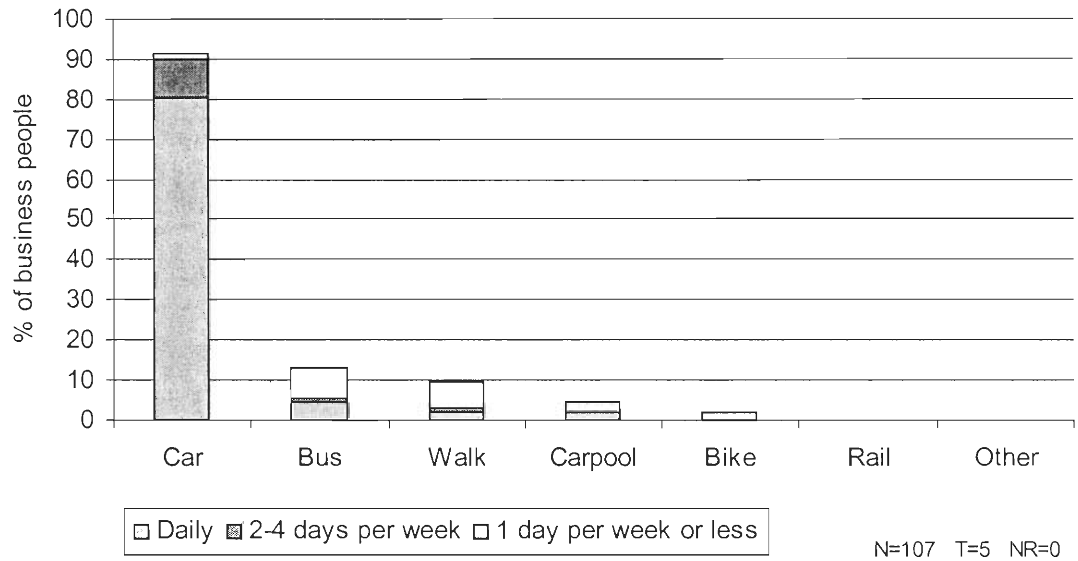


Figure 5.2 Current modes of transportation business people use to get to and from downtown Worcester (Question 4 cross tab Question 23)

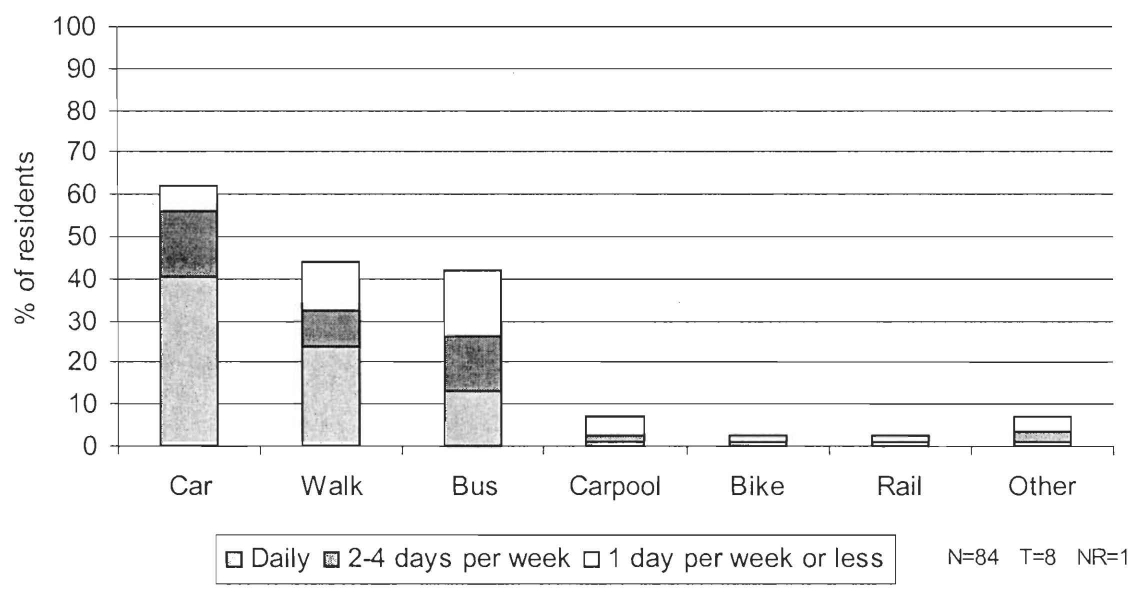


Figure 5.3 Current modes of transportation residents use to get to and from downtown Worcester (Question 4 cross tab Question 23)

The high percentage of automobile users in the area suggests that there is a demand for parking by people who travel to and from downtown Worcester, especially those working in the area. However, this does not necessarily mean that more parking spaces are needed, as current facilities could have enough spaces to satisfy the demand.

Factors that influence the choice of transportation varied widely, with 73% of respondents citing convenience as one of the primary factors, as shown in Fig. 5.4. Travel time, cost, and job requiring a car were the next main factors considered, each being selected by more than 20% of the respondents. Differences in opinions between residents and business people was not significant, except that more residents cited not owning a car, while more business people chose convenience and job requiring a car. Question 5[4] cross-tabulated with question 23 was used to gather this data.

Overall, the data suggests that people would be reluctant to switch from a car, which is much more convenient, to an alternative means of transportation unless some other factors were involved.

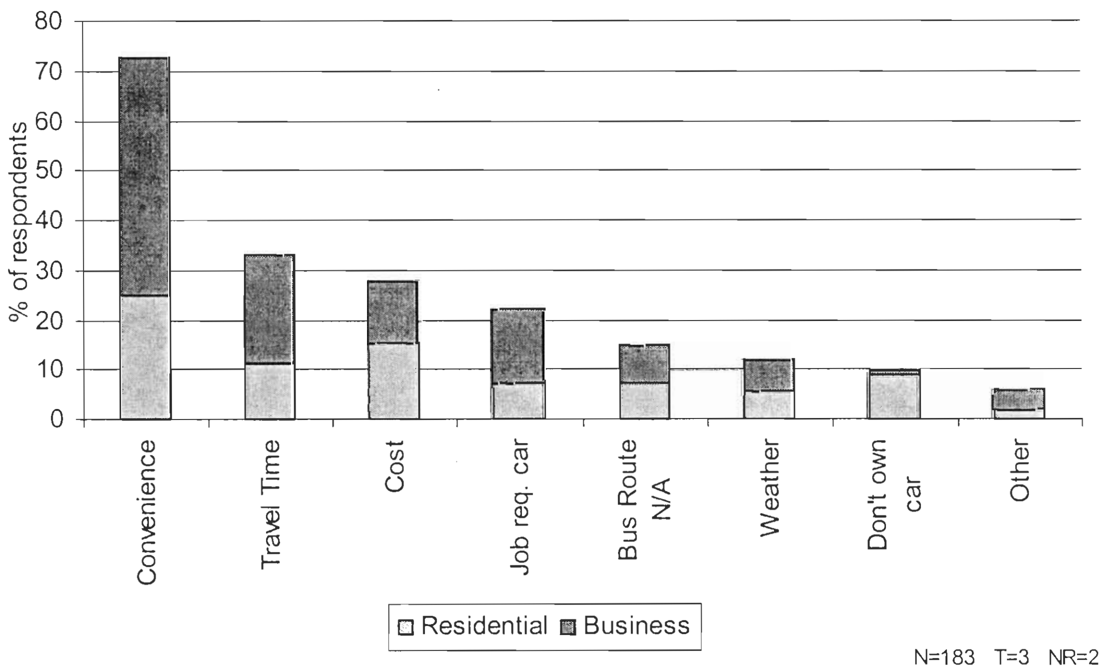


Figure 5.4 Factors that influence choice of transportation to and from downtown Worcester (Question 5 cross tab Question 23)

[4] Question 5: Which of the following factors most influences your decisions regarding transportation to and from downtown Worcester?

5.2.1.2 Parking

All percentages of the following chart are taken from the respondents that own an automobile (see Fig. 5.6). Private lots were the main locations for parking, representing 49% of respondents, followed by garages and metered on-street parking spaces, with 27% and 12%, respectively, as shown in Fig. 5.5. This data was gathered using question 14[5] cross-tabulated with question 23. The percentage of people using private lots was high because most of the larger businesses that were surveyed used them, such as Bay State Savings Bank and United Way.

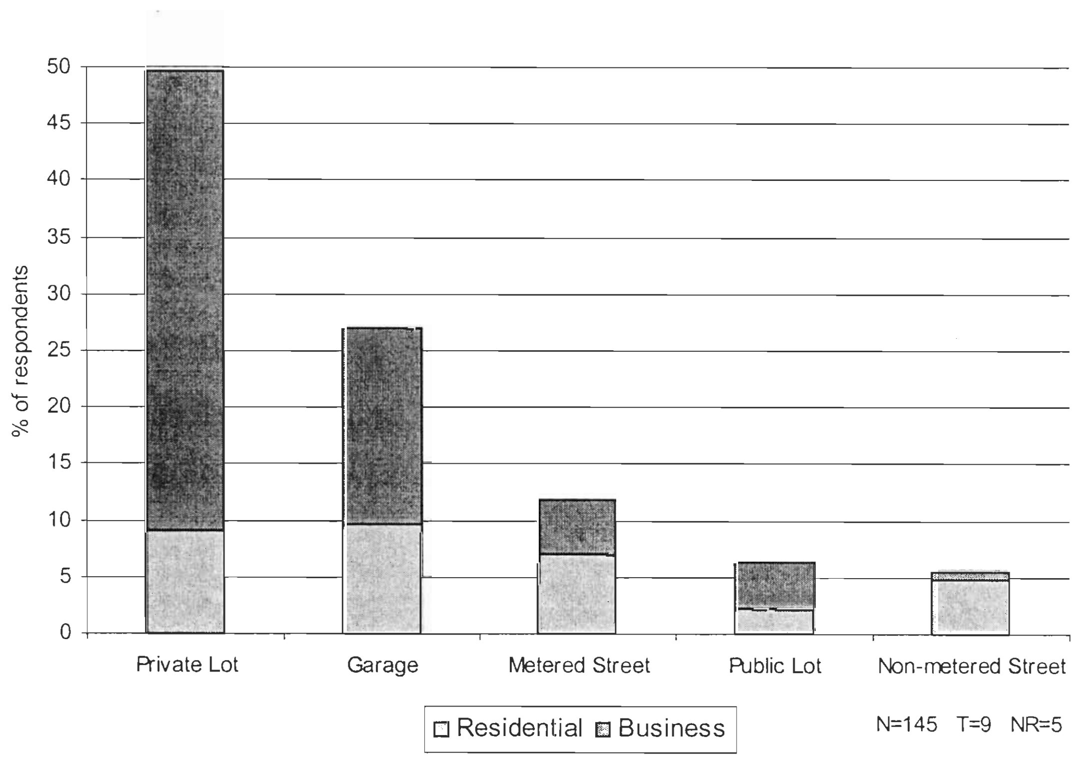


Figure 5.5 Locations where people usually park (Question 14 cross tab Question 23)

Comparing business people and residents, some differences can be noted. Business people tended to use off-street parking, representing 33% of respondents for private lots and 14 % for garages. On the other hand, residents used all possible categories of parking more equally, but claimed the majority of on-street parking. This is an especially appealing option for the residents because the meters do not require payment after 6 pm, at which point the metered parking spaces become free, providing residents with free space for overnight parking.

The percentage of people who do not have cars was another major difference between the business people and the residents, with 18% of the respondents not owning a car, 17% were residents (Figure 5.6). This fact also explains why residents tended to use other modes of transportations to get to and from downtown Worcester, as shown in Fig. 5.3

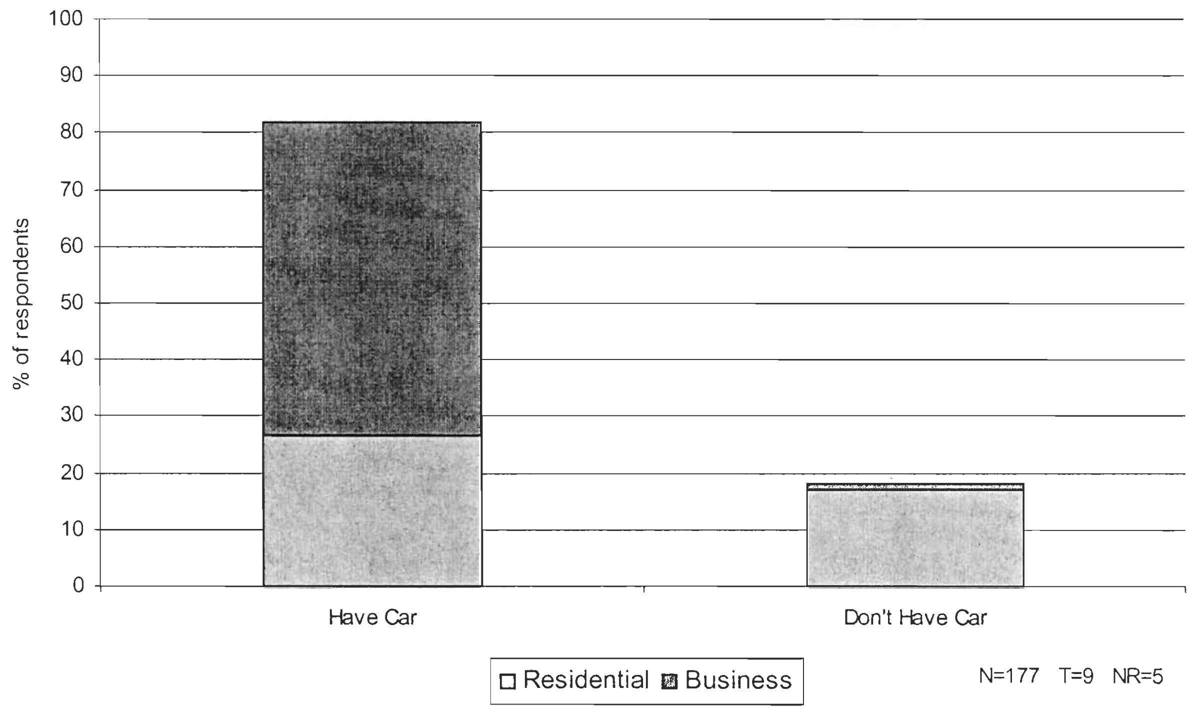


Figure 5.6 Percentages of Respondents that Own an Automobile

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[5] Question 14: Where do you usually park?

Most people, 90%, parked their cars for more than 5 hours, as seen in Fig. 5.7. Question 16[6] cross-tabulated with question 23 was used to gather this data. The high percentage of respondents that parked their cars for more than 5 hours is not surprising because visitors, such as shoppers, were not surveyed as explained in Section 4.2. A difference can also be noticed as 50% were business people who parked 5 to 9 hours, representing the standard eight-hour shift, while 22% were residents who parked for more than 9 hours, representing overnight parking.

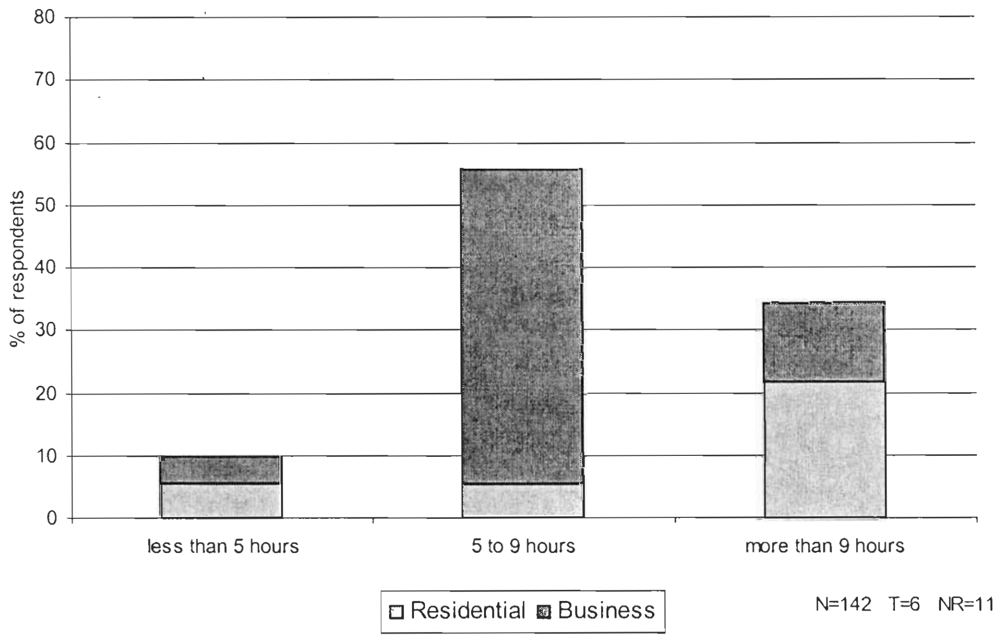

Figure 5.7 Length of time people parked their cars (Question 16 cross tab Question 23)

Of the surveyed individuals, 78% found parking within 2 blocks of their destination, and 98% within 5 blocks, as shown in Fig. 5.8. This data was gathered using questions 17[7] and 23. No significant differences between business people and residents were noted. This suggests that parking is available, although not always close to the desired location.

[6] Question 16: For how long do you usually park your car?
[7] Question 17: How far do you usually park your car from your desired location?

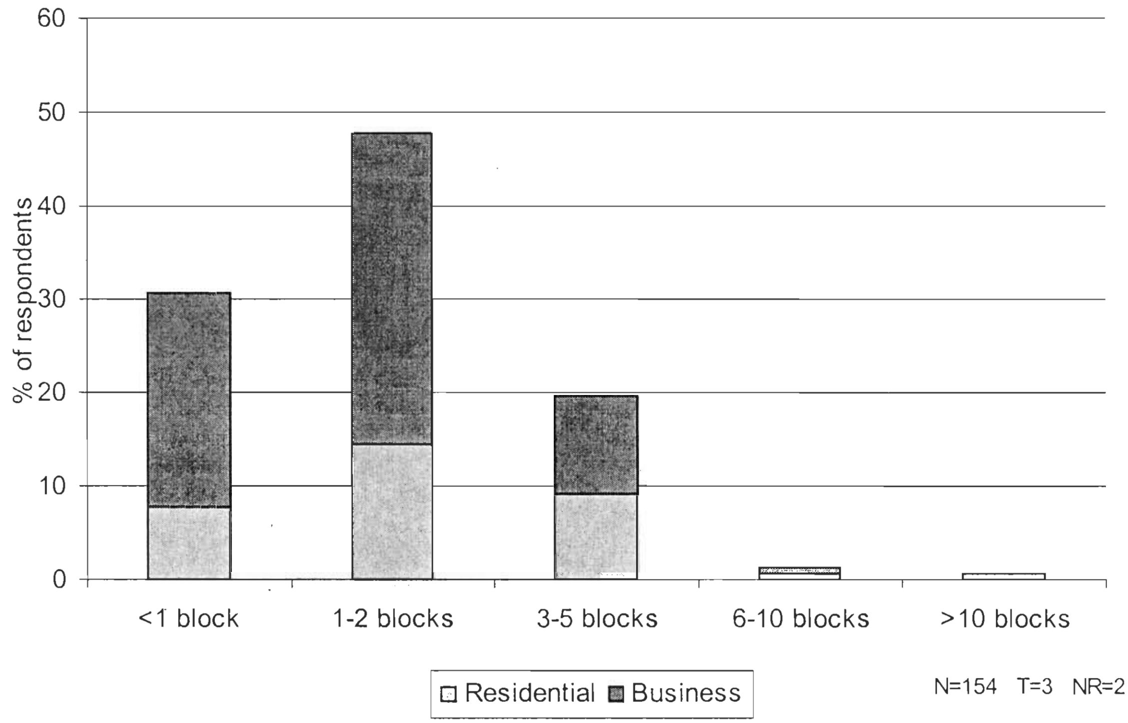

Figure 5.8 Average Parking Distance From Destination (Question 17 cross tab Question 23)

The average amount of money people pay to park per month is shown in Fig. 5.9. This data was gathered using questions 15[8] and 23. Responses that were given on a per hour basis were converted to monthly rates by multiplying the rate by 200 (8 hours per day for 25 day per month). Similarly daily rates were converted by multiplying the rate by 25 days. These conversations provide an approximation, as they tend to overestimate by assuming that people pay to park 8 hours a day and 25 days a month. Of the people surveyed, 37% do not pay for parking either by using nonmetered on street parking or by receiving free parking from their employers. Business people represent 31%, and residents make up the other 6% of the people that do not pay for parking. Of the

[8] Question 15: How much do you pay to park?

respondents that pay for parking, 46% pay between $40 and $80 a month. Those who pay $120 or more per month represent 13% of the people that pay for parking.

One issue with this data arises from the large number of nonrespondents, which probably occurred because question 15 was open-ended, as opposed to all the other questions that were closed-ended.

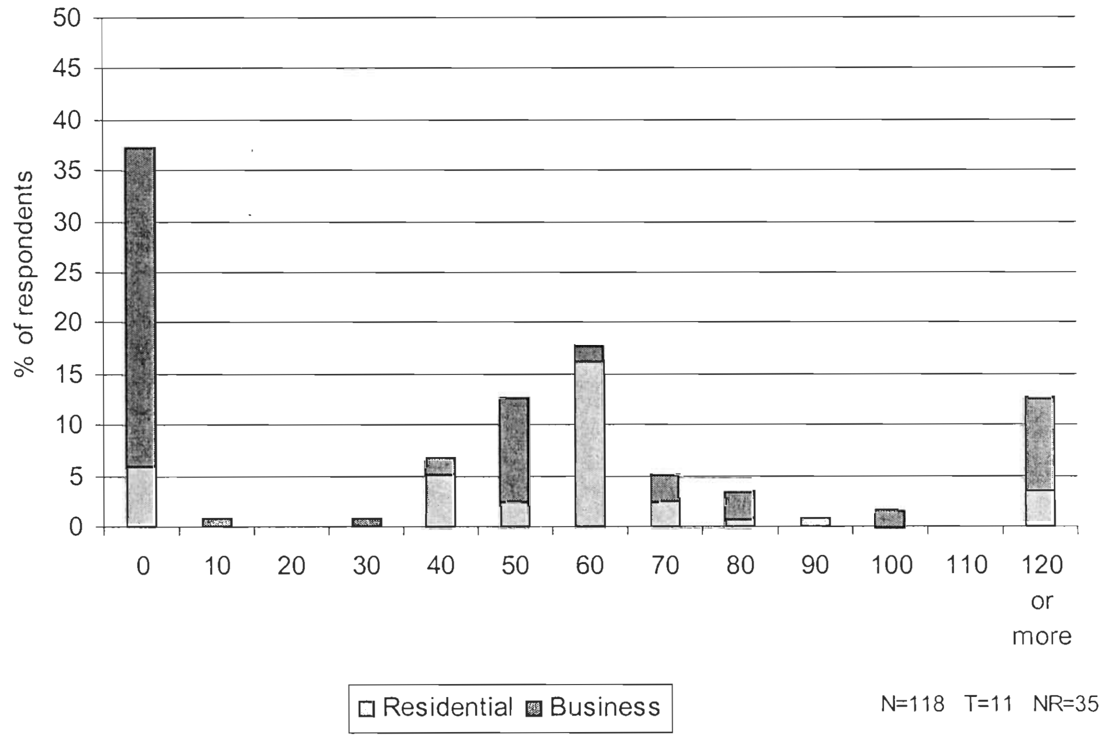

Figure 5.9 Average monthly parking costs (Question 15 cross tab Question 23)

From questions 22[9] and 23, data was gathered on the maximum amount that people would be willing to pay to park in a garage in the Worcester Commons area, as shown in Fig. 5.10. Of those who responded, 57% said that they would be willing to pay $40 per month. The high percentage of the "$40" response presented a problem because it was not known if this response was chosen because it was the lowest possible choice,

[9] Question 22: If a parking garage was built in the Worcester Common area, what is the maximum you would be willing to pay per month to park there?

and people picked it because they understood the question to mean, "What is the amount you prefer to pay" as opposed to "what is the maximum you would be willing to pay". This problem was anticipated before the survey was distributed, and the word "maximum" was inserted in hope to avoid confusion, but problems still arose with this question. Another issue with this data stems from the large percentage of nonrespondents.

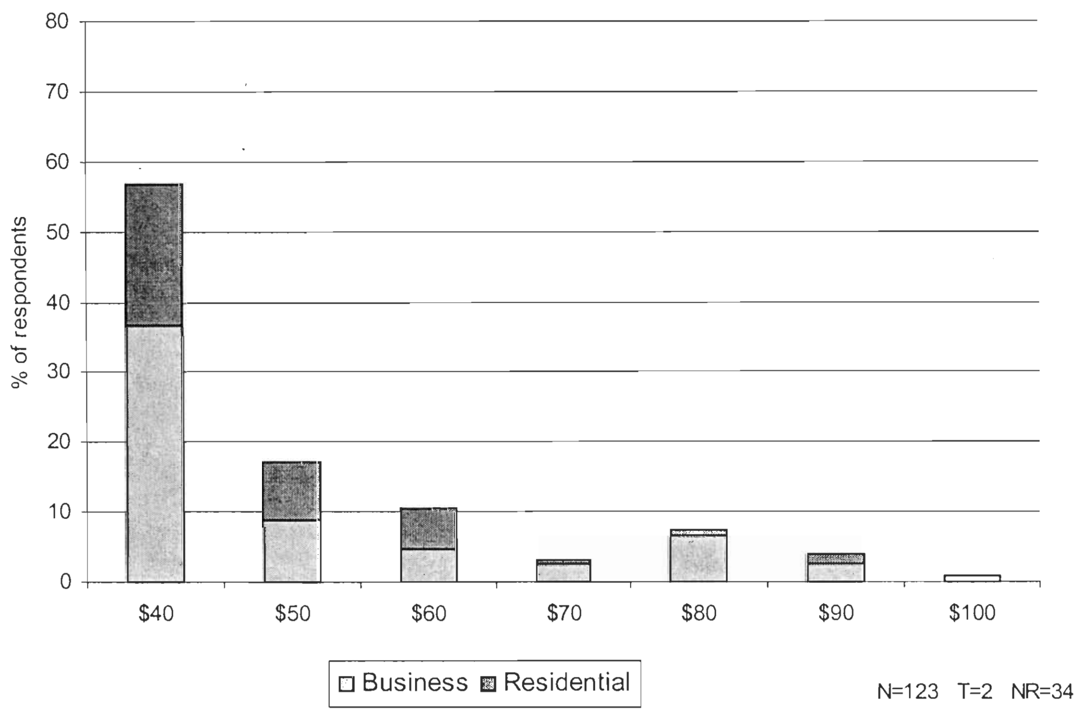

Figure 5.10 Maximum amount people are willing to pay per month to park in a garage in the Worcester Commons area (Question 22 cross tab Question 23)

Comparing data from questions 15 and 22, it can be seen those that chose the "$40" response probably did so because it was the lowest response. As shown in Fig. 5.11, only 12% pay $40 per month or less now. Most of those who chose the "$40" response, 59%, actually pay more than $40 per month to park now. Also, 29% represent people who do not pay to park now.

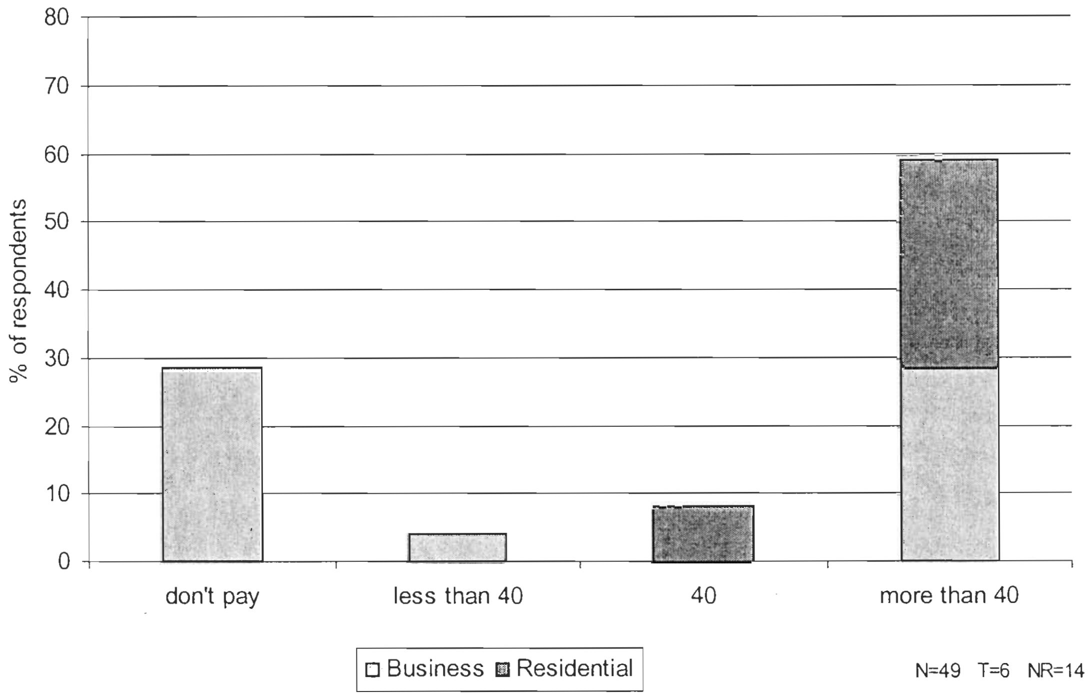

Figure 5.11 Amount people pay to park per month that responded "$40" (Question 15 cross tab with Question 22)

From the data presented in this section, it can be seen that the car is the most popular form of transportation, with 63% of the respondents using it daily. Overall, car use is at 79%, with 90% of car users seeking parking for more than 5 hours. The percentage that finds parking within 2 blocks is 78%. Riding the bus use and walking are the next major means of transportation, with 26 % and 25%, respectively, but the residents represent the majority.

5.2.1.3 Residential

Of residents surveyed, 68% say that availability of parking plays a significant role when choosing housing, as gathered from question 27[10] and shown in Fig. 5.12. Despite this none of the residential buildings in the area provide parking for the residents. The Bancroft and Park Plaza residents have an option of renting parking spaces from a lot across Main Street next to the Denholm building. Many residents expressed that the importance of parking was not apparent to them until after they moved in and came across the problems of finding parking for their car.

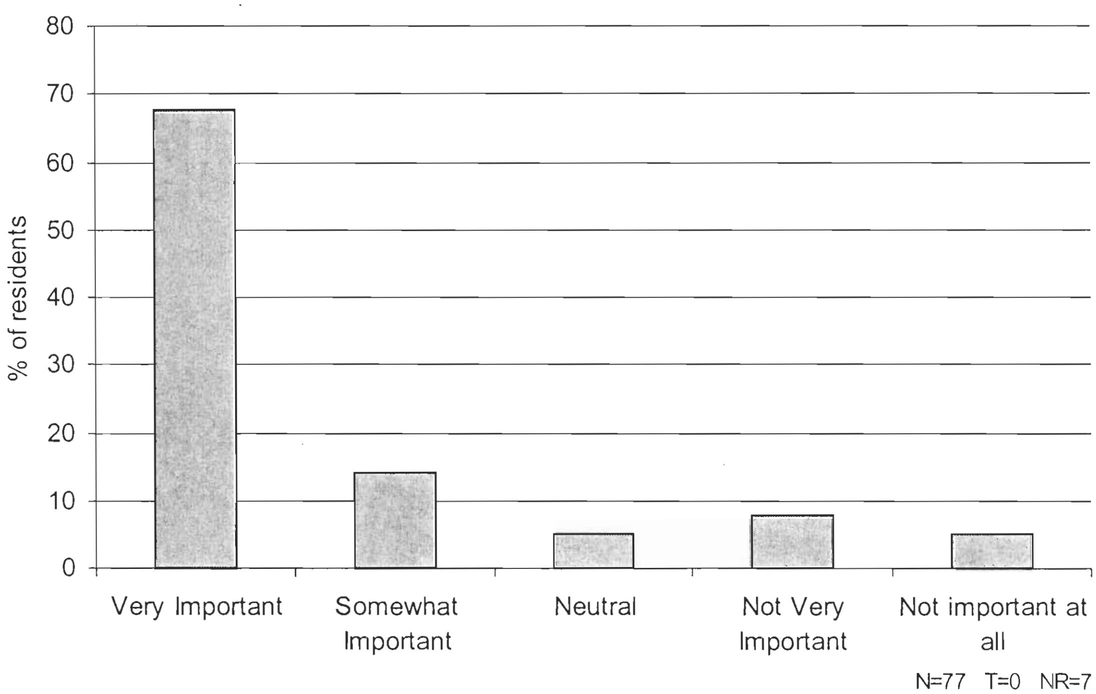

Figure 5.12 Importance of parking when choosing housing (Question 27)

[10] Question 27: How important is the availability of parking when choosing housing?

Of the people who live in the area, 37% do not have cars, as seen in Fig. 5.13, yet this group expressed concern for parking for their visitors. A majority of the residents, 67%, have at least one car and thus require parking. This data was gathered using question 24[11].

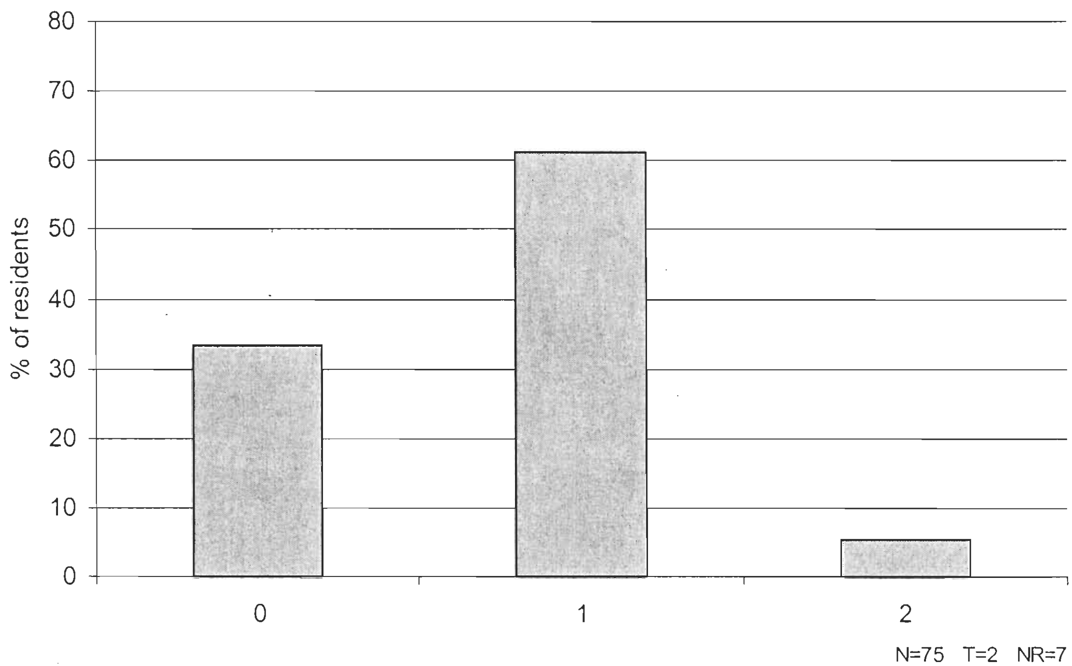

Figure 5.13 Number of Cars per Resident (Question 24)

[11] Question 24: How many vehicles do you have available for use?

As shown in Fig. 5.14, 33% of the residents reported that lack of parking discouraged them from owning a car or purchasing an additional vehicle. Of the respondents, 13% don not have a car and 19% have one already. Question 28[12] was used to gather this data. Anecdotal evidence from some respondents indicated that some people had moved out due to the lack of parking.

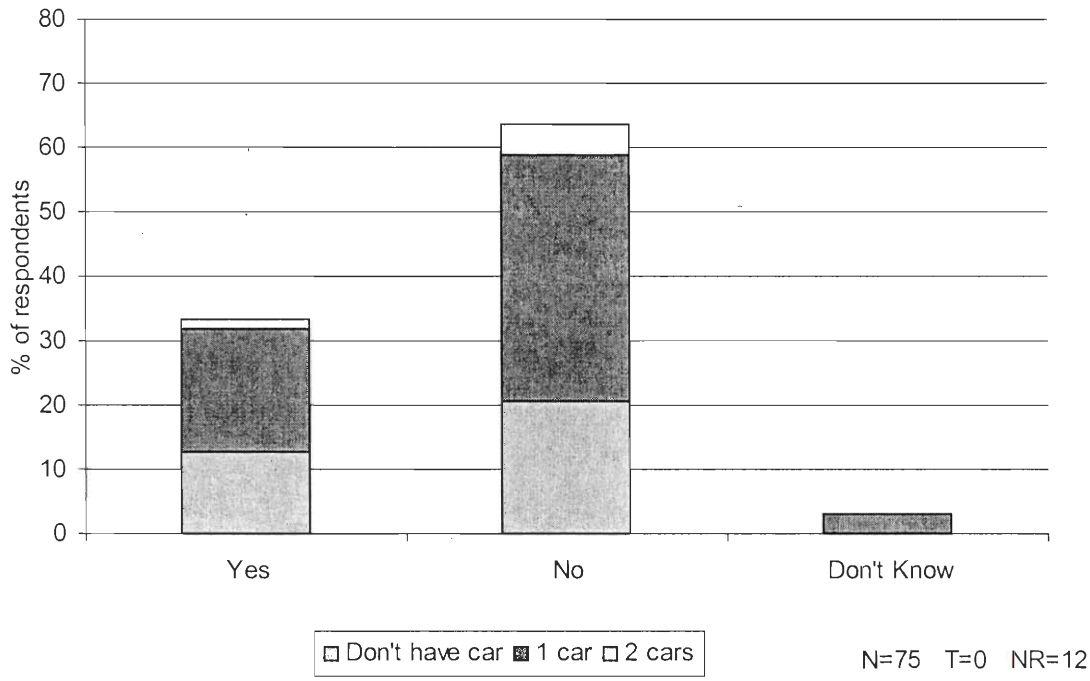

Figure 5.14 Lack of Parking Restricts car ownership (Question 28)

[12] Question 28: Is lack of parking restricting you from owning a car?

Of the residents who own at least one car, 68% use it daily and 84% use it 5 days per week or more, as gathered from question 25[13] and shown in Fig 5.15. This suggests that parking needs to be close to the residential buildings because people use their cars very frequently, and convenience is a primary factor when choosing transportation, as shown in Fig. 5.4.

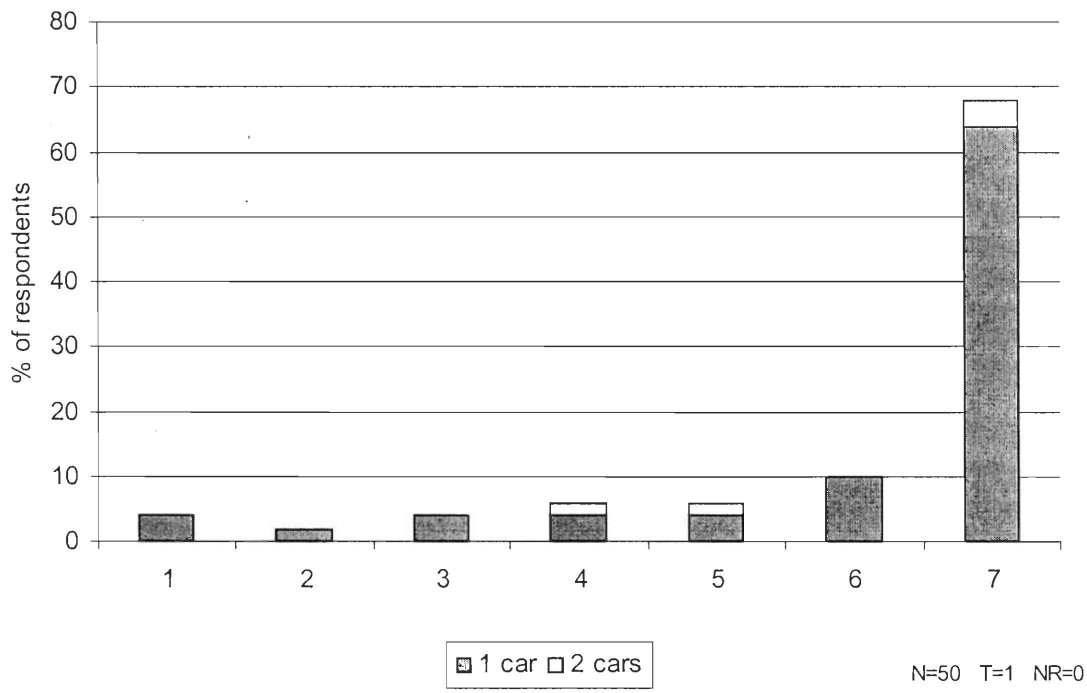

Figure 5.15 Number of Days for Car Use (Question 25)

Based on the data from the surveys, the residents of the downtown area either do not have cars or have found ways to park for free. Only 7% of the respondents are residents who park in the neighborhood garages.

[13] Question 25: How many days per week on average do you use your vehicle?

5.2.1.4 Business

As shown in Fig. 5.16 and gathered using question 30[14], 96% of the business people surveyed have regular weekday shifts. Some evening and night shift were also recorded. The value for weekend shifts may be skewed because day, evening, or night responses do not differentiate between weekday and weekend.

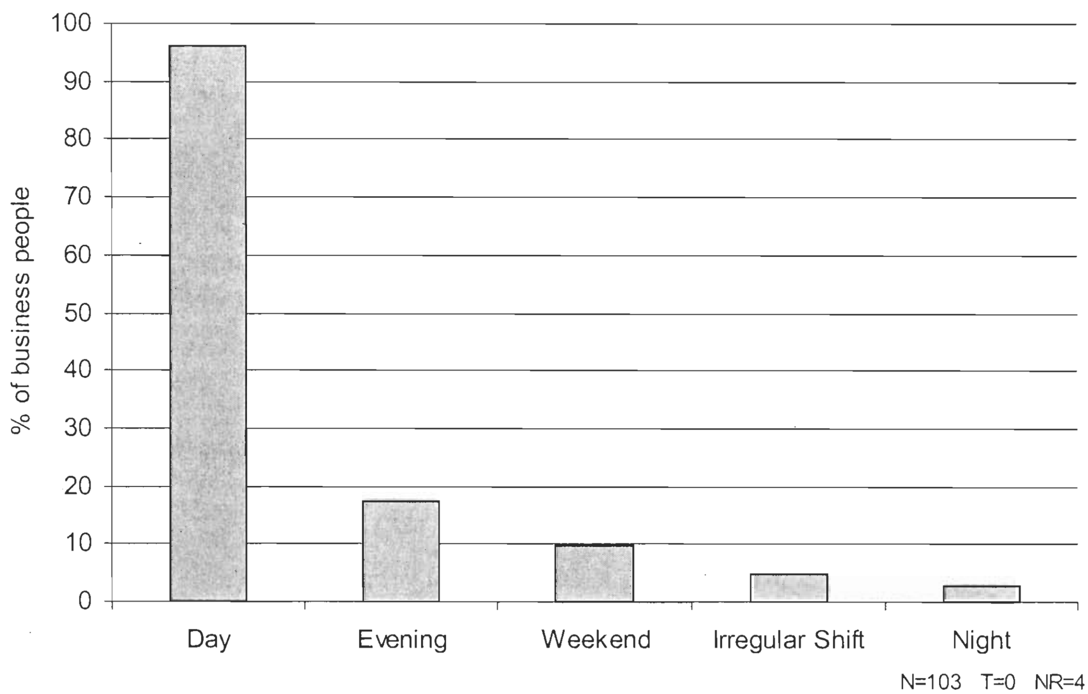

Figure 5.16 Work Schedule (Question 30)

[14] Question 30: Which most closely approximates your current work schedule?

Data on distance traveled to and from downtown Worcester was gathered using question 29[15] and shown in Fig. 5.17. Respondents were asked to provide the zip code in which they live. Distances were determined by using the zip code of the project area, 06108. Out of those surveyed, 50% live within 5 miles, with 27% living between 2 and 5 miles. The average travel distance was 9.6 miles. One possible issue with this data is the exclusion of residents who indicated that they worked downtown. Their data had could not be included because it was not known if they worked in the project area or not.

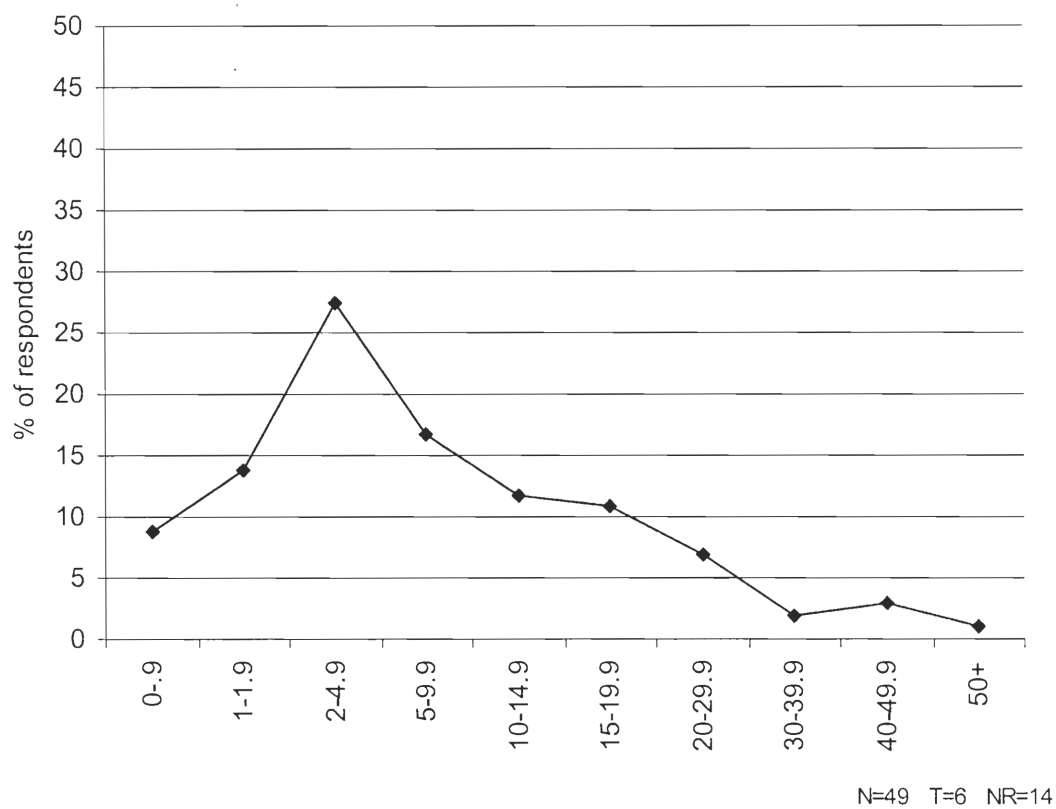

Figure 5.17 Distance in miles traveled to get to downtown Worcester (Question 29)

[15] Question 29: Please identify the zip code in which you live.

Fig. 5.18 shows that business people have an advantage over the residents, as 69% receive free parking and another 4% received partial subsidies towards parking fees. This data was gathered using question 33[16]. Most of the larger businesses that were surveyed, such as Bay State Savings Bank and United Way provide free parking for their employees

Figure 5.18 Business people who receive financial assistance toward parking (Question 33)

[16] Question 33: Does your employer provide financial assistance for parking?

The high percentage of business people who received free parking also helped to explain why business people tended to rely on the automobile, as shown in Figure 5.2. Other data supported this as well, as 33% of those who receive financial assistance for parking would be more likely to use alternative modes of transportation if the parking subsidy was removed, as shown in Fig. 5.19 and gathered from question 34[17].

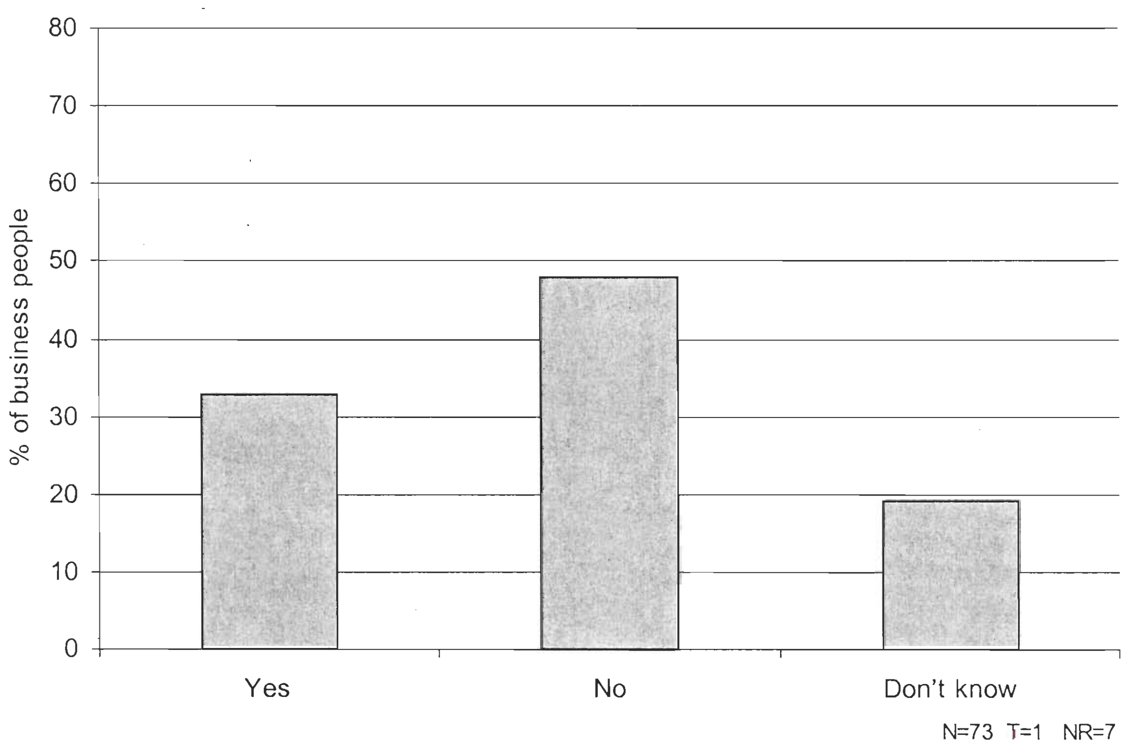

Figure 5.19 Business people who get financial assistance for parking and would be more likely to use alternative modes of transportation if financial assistance was not provided (Question 34)

[17] Question 34: If financial assistance for parking weren't provided, would you be more likely to use alternative forms of transportation?

As opposed to the high percentage that receive financial assistance towards parking, 71% of business people do not receive financial assistance for transit and 87% have employers who do not have programs to encouraged to carpooling, as shown in Figs. 5.20 and Fig. 5.21, respectively. Questions 35[18] and 36[19] were used to gather this data. Reversing these trends might be one way to reduce the percentage of business people who use cars. As shown in Fig 5.22, 19% of those business people who do not receive financial assistance for transit would be more willing to use it if such aid were provided. Of the respondents, 22% whose employers do not provide programs to encourage carpools would be more likely to use them if such programs were initiated.

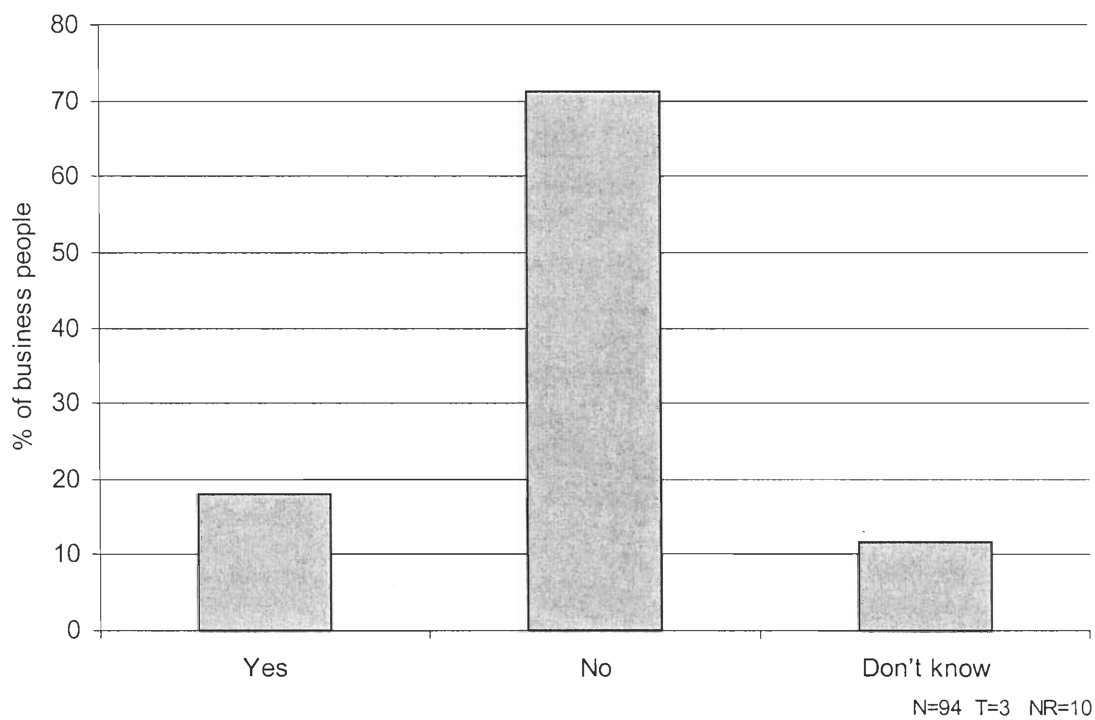

Figure 5.20 Business people who receive financial assistance toward transit (Question 35)

[18] Question 35: Does your employer provide financial assistance for transit?
[19] Question 36: Does your employer have any programs to encourage carpooling?

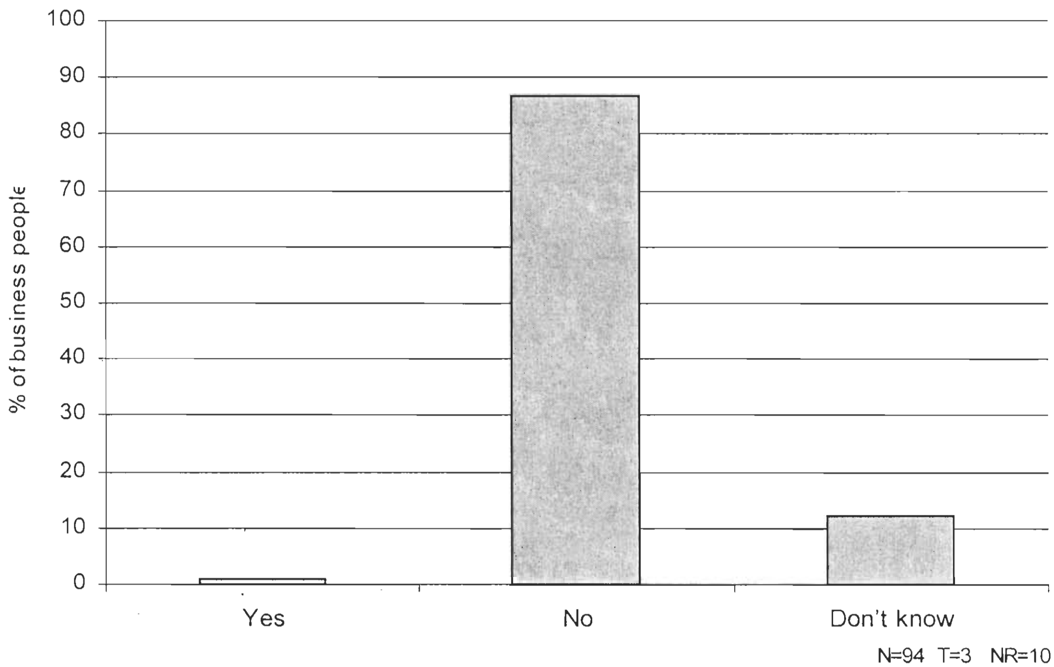

Figure 5.21 Business people whose employers have programs to encourage carpooling (Question 36)

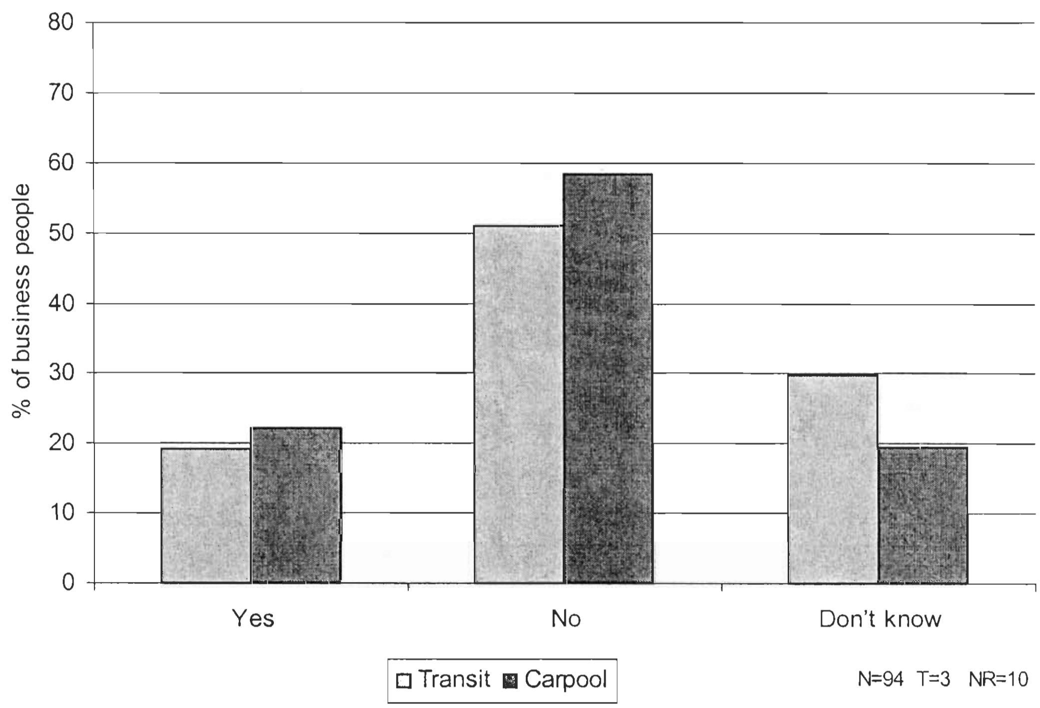

Figure 5.22 Business people who would be more likely to use other modes of transportation if financial assistance for transit or programs that encourage carpooling were provided (Questions 35 and 36)

5.2.2 Attitudes Toward Parking and Transportation

The survey data was analyzed to determine the attitudes of people in downtown Worcester towards parking and transportation.

5.2.2.1 Safety

Perception of safety while walking in downtown Worcester varied widely between day and night, and between men and women, as shown by Figs. 5.23 and 5.24. Question 2[20] cross-tabulated with question 12[21] was used to gather this data. During the day, 61% of men but only 32% of the women felt very safe. Most of the women, 46%, felt somewhat safe, compared to 18% of men. Overall, the percentage of men and women who felt at least somewhat safe was similar, 79% and 78%, respectively. Similar relationship existed for percentage that responded "slightly unsafe" or worse, with 11% of the men and 13% of the women.

The perceived level of safety at night is lower for both men and women. The percentage of men who felt at least somewhat safe was 40%, compared with only 19% of the women. A majority of the women, 61%, felt slightly unsafe or worse, compared to 41% of the men.

Overall, most of the respondents found downtown Worcester to be a safe location to walk, though men felt safer than women. The percentages drop at night. Some people reported that increased police presence in the area had helped.

[20] Question 2: Gender?
[21] Question 12: Do you feel safe walking around downtown Worcester? (Day/Night)

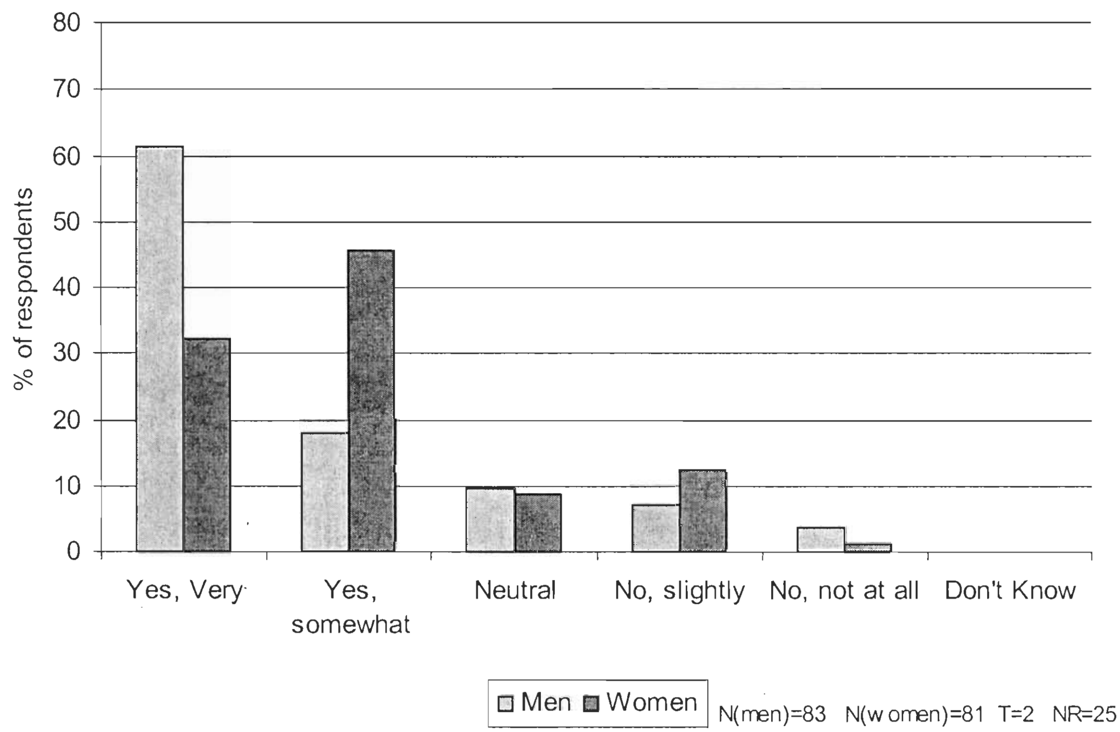

Figure 5.23 Safety perception about walking in downtown Worcester during the day (Question 2 cross tab Question 12)

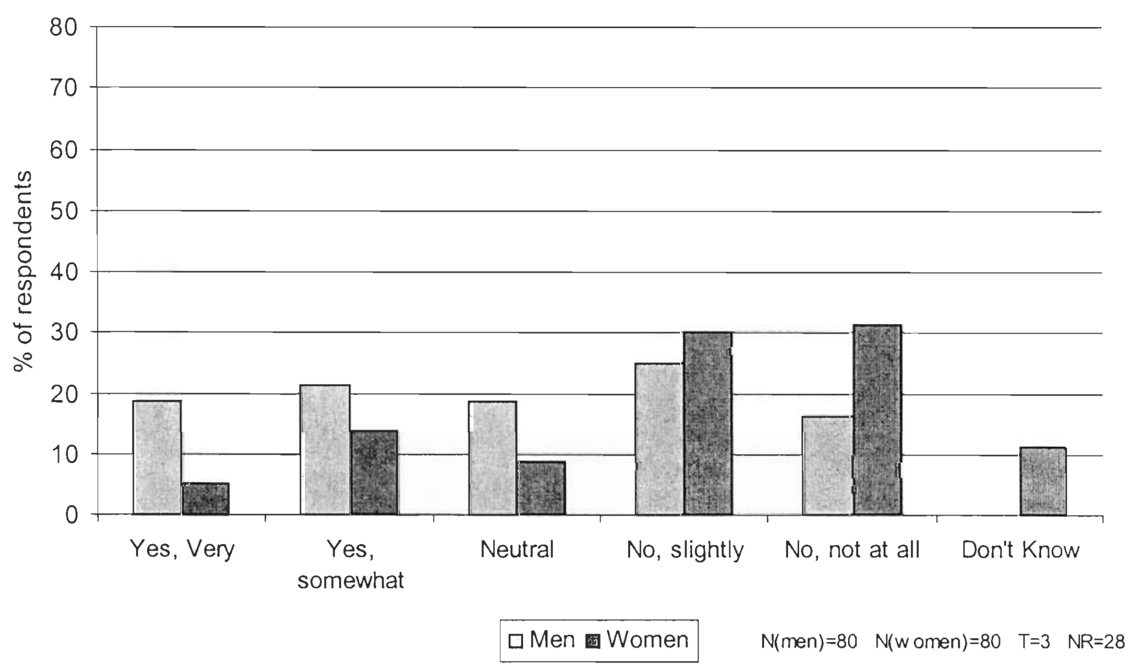

Figure 5.24 Safety perception about walking in downtown Worcester during the night (Question 2 cross tab Question 12)

5.2.2.2 Attitudes Toward Public Transportation

In general, the people of Worcester, especially those who rode the bus, felt that public transportation was satisfactory, as shown in Fig. 5.25. Question 11[22] cross-tabulated with question 4 was used to gather this data. A large majority of those who use the bus, 82%, rated it average or better, compared to the 68% approval rating by those who do not use the bus. Few of those respondents who regularly rode the bus rated public transportation poor, those who do not use the bus, 2% vs. 20%, respectively.

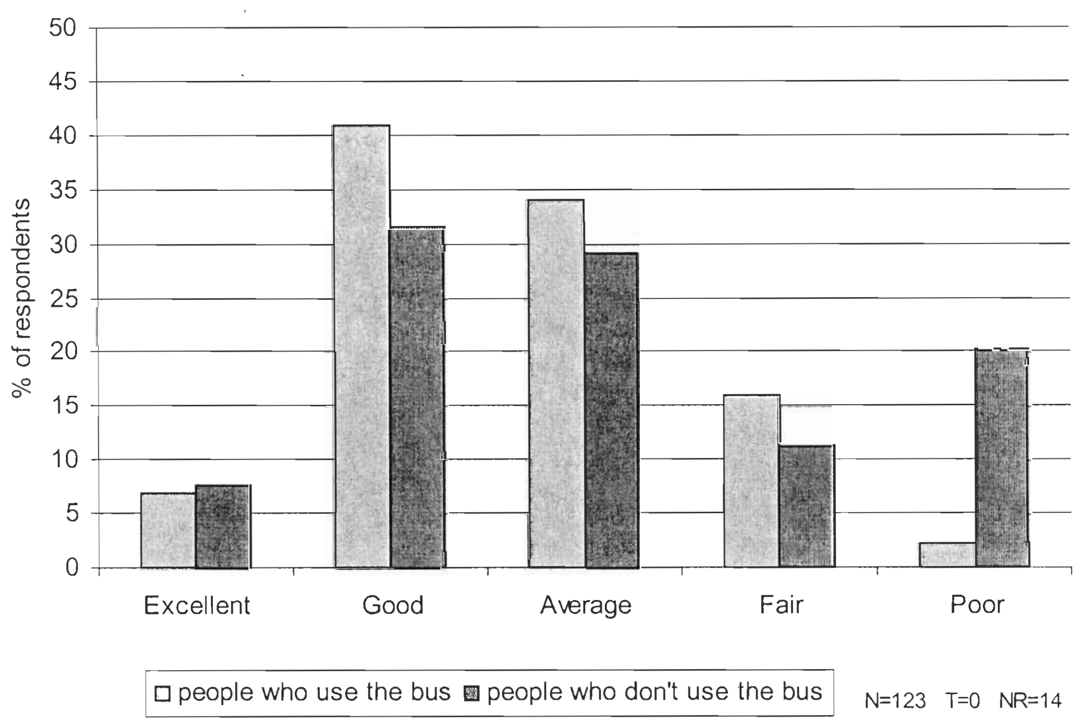

Figure 5.25 Public Transportation Ratings (Question 4 cross tab Question 11)

[22] Question 11: How would you rate public transportation in downtown Worcester?

Even though most people rated public transportation as being good, many indicated that it could be improved, as shown in Fig 5.26. More frequent scheduling was the highest complaint, accounting for 28% of respondents. Extending hours of service and increasing the availability of bus routes were the next desired improvements, with 25% and 23% of respondents, respectively. Bus pass subsidies accounted for 17% of the responses. This data was gathered using question 10[23] cross-tabulated with question 4.

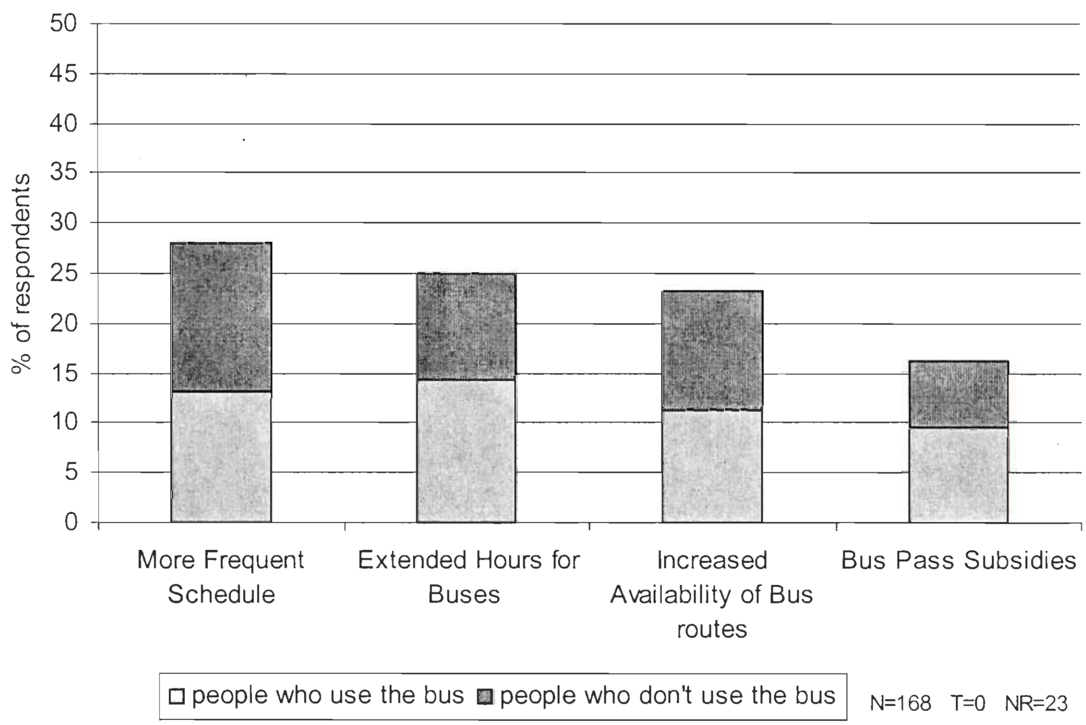

Figure 5.26 Improvements of public transportation (Question 4 cross tab Question 10)

[23] Question 10: Which of the following would encourage you to use one or more of the alternatives listed above?

5.2.2.3 Attitudes Toward Parking

Of the people surveyed, 70% were not satisfied with parking in downtown Worcester, as shown in Fig. 5.27 and gathered from questions 19[24] and 23.

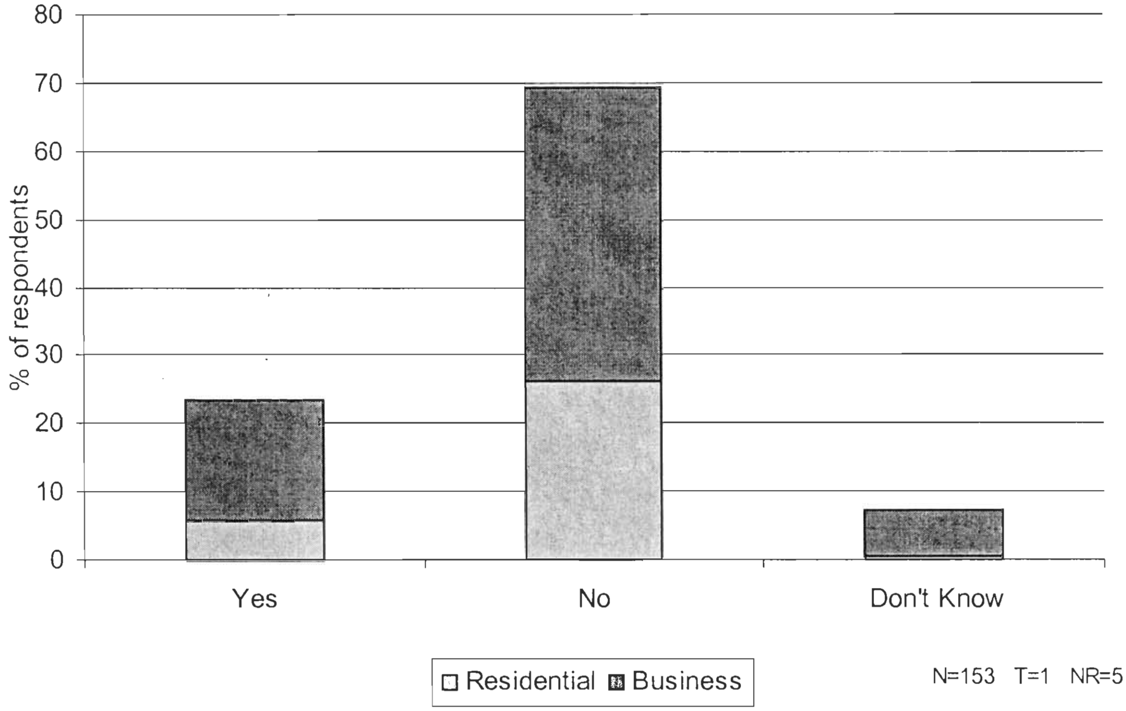

Figure 5.27 Parking Satisfaction (Question 19 cross tab Question 23)

[24] Question 19: Are you satisfied with parking in downtown Worcester?

People felt that there are many problems with parking, as shown in Fig. 5.28. Shortage of parking spaces was the highest response, accounting for 68% of the respondents. The next highest responses were cost and distance from destination, with 52% and 43%, respectively. Lastly, the potential for losing their parking space and unsafe parking facilities each came in with more than 30% of respondents. This data was gathered from question 20[25] cross-tabulated with question 23.

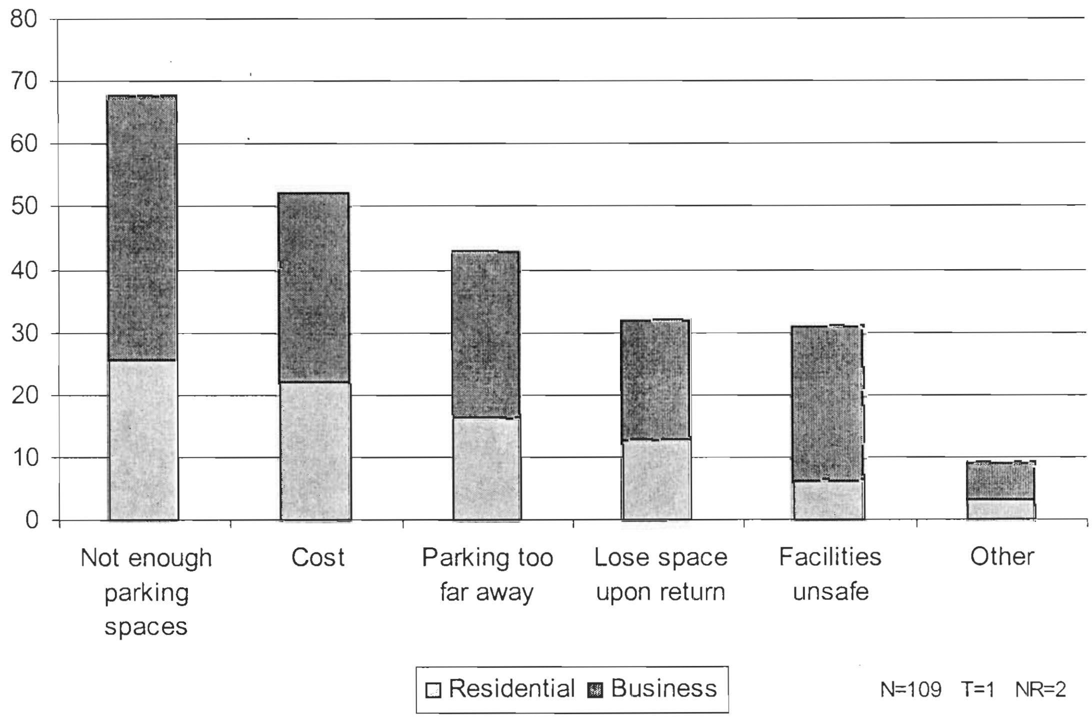

Figure 5.28 Parking Problems (Question 20 cross tab Question 23)

[25] Question 20: If no, what are the parking problems?

Similar to the previous graph, the perception of availability of parking in downtown Worcester was found to be mostly below average, as shown by Fig. 5.29. Of the people surveyed, 47% rated availability of parking as poor, and only 17% said it was better than average. Business people rated parking as poor, despite the fact that 69% receive free parking from their employer. Questions 18[26] and 23 were used to gather this data.

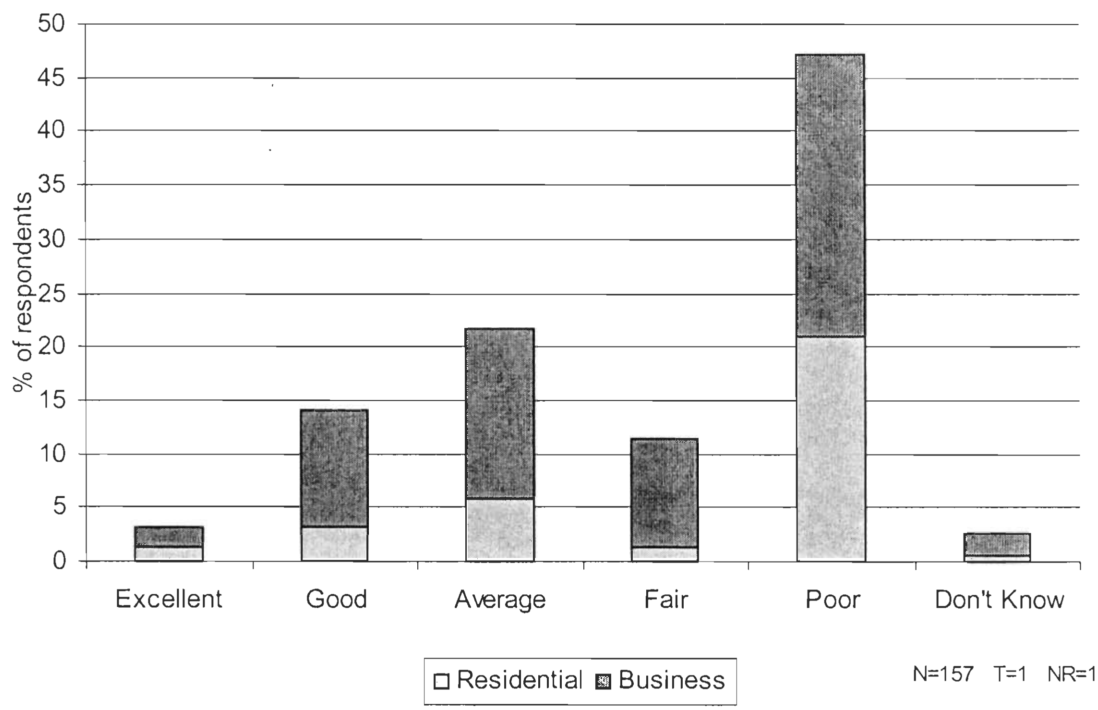

Figure 5.29 Availability of Parking (Question 18 cross tab Question 23)

[26] Question 18: How would you rate the availability of parking in downtown Worcester?

5.3 Possible Sources of Error

Several issues arose when surveying people in the project area. Nonresponse of certain questions or failure to fill out the survey correctly led to missing or unclear data. These were noted and included in the charts. Many people, who did not own cars, or the elderly, were unwilling to fill out the survey. Appendix C contains the survey, as provided.

For questions requiring a single answer, a common error resulted when some people provided multiple responses. For example questions 4 and 7, which asked the respondent what mode of transport they used and how often, people provided answers only for modes of transportation they used but did not indicate "never" for the ones they do not use. There was also confusion about the difference between question groups 3 to 5 and 6 to 8, both of which referred to the modes of transport currently used but different in scope. The differences were explained during face-to-face surveying, a technique that was unavailable for those surveys that were dropped off and collected at a later time. As a result, the data from the two sets of questions was very similar and data from questions 6 to 8 was discarded.

The next problem arose with the placement of the questions regarding safety, questions 11 to 13. Some people skipped from question 10, asking about alternative modes of transport, to question 14, a parking question. This happened even though the two questions were in a different section. Most of the time this only changed the order in which the questions were answered, as after question 14, people went back to 11-13. However, those people who did not have a car skipped questions 11-13 because question 14 instructed them to skip to question 23 if they do not have a car.

Other problems arose from question 14, which asked them where they park. Again, some people checked off more than one answer, and very few specified which garage or parking lot they used. Some people who do not own cars followed directions and skipped to question 23, but did not check off that answer in question 14. Fortunately, if they were residents, question 24 provided a way to verify if they had a car by asking how many cars were available for their use.

Question 15, asking the price they pay now for parking, presented some problems, as some people skipped it entirely while others checked off how they pay instead of filling in a dollar amount.

Data from question 22 was difficult to analyze. The question asked what "is the maximum you would be willing to pay to park in a garage in the area", but many people checked off the lowest possible response, $40. As a result, it is unclear if this represents the actual attitude of the people, or if they checked it off because it was the lowest possible response. Some of those who selected this value indicated that they presently pay a much higher parking fee. This problem was anticipated when the survey was drafted, and the addition of the word maximum was supposed to make it more clear. However, some people may have thought the question meant how much would they want to pay, even marking free on the paper.

The next problem arose from question 23, which was intended to identify whether the respondent was a resident or businessperson. Some people checked off both responses. The question referred to downtown Worcester, but there was no way of knowing if people who checked each response worked or lived in the project area. To make sure not to include data from outside the area, responses from residents who checked that they worked downtown and from businesses people who checked off that they lived in downtown were disregarded. The disregarded questions were then noted on the charts.

The last problem included failure to skip certain questions based on directions and to check off Yes/No/Don't know in questions 33, 35, 36, while still checking off follow up responses to those questions. This was corrected by disregarding data from questions that should have been skipped.

6.0 Conclusions

The following chapter is composed of the conclusions based on the data analysis. The chapter presents recommendations for possible solutions to the parking and transportation issues based upon the analysis.

6.1 Transportation

The automobile was determined to be the most widely used form of transportation. Of those surveyed, 79% used an automobile to get to and from downtown Worcester. Differences existed between business people and residents, as 92% of business people tended to use the automobile compared with 62% of the residents. The high percentage of automobile users in the area suggests that there is a demand for parking spaces, especially by those working in the area. However, this does not necessarily mean that more parking spaces are needed, as current facilities could have enough spaces to satisfy the demand.

Riding the bus and walking were the other primary means of transportation to and from downtown Worcester, accounting for 26% and 25% of respondents, respectively. Residents tended to use these modes of transportation much more than business people, with 44% riding the bus and 42% walking, compared with fewer than 15% of business people for each mode of transportation.

Convenience was the main issue that influenced choice of transportation, accounting for 73% of respondents. Travel time, cost, and "job requiring a car" were the next factors considered each selected by more than 20% of the respondents. The data suggests that people would be reluctant to switch from a car, which is much more convenient, to an alternative means of transportation unless some other factors were involved.

6.2 Parking

The project area contains 6,413 parking spaces, divided into 6,286 off-street and 127 on-street spaces. A majority of the parking, 5,711 spaces are located in the four parking garages, with the Common Outlet having 3,800 parking spaces.

From the occupancy rates of the garages, it was concluded that there are enough spaces to meet demand, as all the garages rarely fill up. However, distance to desired location and price are the major problems that create the perceived parking problem in downtown Worcester.

Private lots comprised the majority of parking, accounting for 49% of respondents. Garages came in second, with 27% of respondents. Business people tended to use off-street parking, representing 40% of respondents for private lots and 18 % for garages. On the other hand, residents used all possible categories of parking more equally, but took up the majority of on-street parking.

Private lots, which were used the most, were closer to the desired location than garages. The parking lots include the Portland and Federal Street lot, which is used by Telegram & Gazette and Bay State Savings Bank employees, the lot on Main and Chatham Street, which is used by residents of the Bancroft and Park Plaza buildings.

The demand for parking was found to be mainly long term, as 90% of people parked their cars for more than 5 hours. Distance to desired location was very important, with 78% of people seeking parking within 2 blocks.

Price of parking was another important factor. Of the people surveyed, 37% do not pay for parking, either by using non-metered on street parking or by receiving free parking from their employers. Business people represent 31%, and residents make up the other 6% of the respondents that do not pay for parking. The percentage of respondents, 46%, that pays for parking, pay between $40 and $80 per month. Few people pay more than $80 per month, accounting for only 15% of respondents.

The importance of price is also shown in the data gathered on what is the maximum people are willing to pay to park in a Commons area garage. Most people chose the lowest available response, $40, even though many actually pay more than that now. This shows people are used to and expect free parking, and want to avoid paying for parking whenever possible.

6.3 Residential

Availability of parking is viewed to be a significant factor when choosing housing, with 68% of the residents saying it is "very important". Unfortunately, currently parking is not provided for the residents.

Parking is important not only to the 61% of the residents that have one car, but also to many of the 37% that do not have a car. Of the residents surveyed, 33% say that lack of parking discourages them from owning a car, with 13% wanting to get their first car and another 19% looking for an additional vehicle. Also, people who do not have cars expressed concern for parking for their visitors. Visitors of the residents are forced to park several blocks away, because of the lack of convenient parking.

Convenience and distance to desired location was determined to be very important for the residents. Of those that own a car, 84% use their vehicle 5 days per week or more. All of the residential buildings surveyed were at least two blocks from the nearest garage, which may explain that only 7% of respondents were residents that parked in a garage.

6.4 Business

Most of the business people surveyed, 96%, worked a regular weekday shift, increasing the demand for parking in the area during this time period. Even though half of the business respondents live with-in 5 miles of their employer, over 90% use an automobile for the commute.

Financial assistance, along with convenience, plays an important role in choosing the automobile as the main mode of transportation. Employers favor the automobile, as 69% of business respondents received free parking and another 4% received partial subsidies towards parking fees. Of those that received financial assistance for parking, 33% would be more likely to use alternative modes of transportation if the parking subsidy was removed

As opposed to the automobile, mass transit and carpooling were not encouraged by employers. Only 18% of business people received financial assistance for transit and 1% had employers that encouraged carpooling. This helps explain why only 13% ride the bus and 5% carpool.

Relying on the automobile could be reduced, as 19% of the business people who do not receive financial assistance for transit would be more likely to use it if such aid were provided, and 22% of business people whose employers do not provide programs to encourage carpools would be more likely to use them if such programs were initiated.

6.5 Safety

Most of the respondents found downtown Worcester to be a safe location to walk, though men feel safer than women. The percentages do drop for nights but overall Worcester is seen as a safe place.

During the day, the percentage of men and women that feel at least somewhat safe was similar, with 79% and 78%, respectively. Similar trend existed for percentage that responded "slightly unsafe" or worse, with 11% of the men and 13% of the women.

During the night, the perceived level of safety drops for both men and women, with 40% and 19% responding at least somewhat safe, respectively. Majority of the women, 61%, felt slightly unsafe or worse, compared to 41% of the men.

6.6 Public Transportation

In general, the people of Worcester, especially those who ride the bus, felt that the public transportation was satisfactory. Few respondents that used the bus rated public transportation poor, with only 2%, as opposed to a significant 20% representing those that do not use the bus. This is probably because they have never used public transportation and assume it is not good. However, this could also mean that they have used it in the past and stopped using it because it was unsatisfactory.

Even though most people rated public transportation as being good, many still thought that it could be improved. More frequent scheduling was the highest response, accounting to 28% of the respondents. Extending hours of service, increasing the availability of bus routes and bus pass subsidies were the other major responses.

6.7 Attitudes Toward Parking

Most people have negative feeling about parking in downtown Worcester. Of the people surveyed, 70% were not satisfied with parking in downtown Worcester. Availability of parking was rated as poor by 47% and only 17% said it was above average. Business people rated parking as poor, despite that 69% receive free parking from their employer. This shows that cost is not the only factor considered, as distance to desired location is also important.

The respondents felt there are many problems with parking in downtown Worcester. Shortage of parking spaces was the highest response, accounting for 68% of the respondents. The next highest responses were cost and distance from destination, with 52% and 43%, respectively. Lastly, losing parking space and unsafe parking facilities each came in with more than 30% of respondents.

With respect to shortage of spaces, this is not true as was shown in the inventory of parking spaces. Although there are plenty of available spaces in both garages and lots, there is a shortage of free parking spaces. The negative feelings towards parking is attributed to the people's perception that free parking should be available everywhere.

7.0 Recommendations

From the conclusions that were drawn from the data analysis the following recommendations have been made to alleviate the parking and transportation problems in downtown Worcester.

7.1 Garage

The results of this study indicate that there is enough demand to support a parking garage in the Worcester Commons area. Even though there are four garages in the area, most are located too far away, especially for the residents. An exception is the Federal Plaza garage, which is located two blocks away from the residential buildings. However, this garage is full during the day, and in need of renovations.

One possible site for a new garage would be the surface lot behind Telegram & Gazette. Currently, Telegram & Gazette uses this lot. It has about 250 – 300 employees. Spaces are also rented out to other businesses. Bay State Savings Bank rents out 30 spaces, but it used to be 50 before the second story of the two-story garage was demolished as discussed in 3.X. Other businesses also rent spaces from this lot, such as the Printer's building. Altogether, these businesses represent a demand of at least 300 parking spaces.

Adjacent to the lot, there are two residential buildings, the Bancroft and Park Plaza, that do not have parking for their residents. The Bancroft building has 187 units and 150 residents. The Park Plaza building has 90 units and 180 tenants. Both buildings are not filled, with lack of parking as one of the reasons. Most of the residents of these buildings, 61%, have one car. Thus, providing demand for at least another 277 spaces.

If a garage is built, parking should be included in the rent. There should be one parking space per apartment, with the availability of extra spaces as needed for an extra charge. If this is implemented, a demand of approximately 300 parking spaces would be created.

The Tower at Franklin Square located on 600 Main Street, two blocks away from the Bancroft and Park Plaza buildings, provides a good example of the importance of parking and should be further looked at. It is a large residential building with a mixed-use parking garage next to it that has 300 spaces. One parking space is included with each apartment, and extra spaces are available to the tenants for an extra fee. Some spaces are also rented out to local businesses and offices. The rest of the spaces are available for the public. Based on the 1999 Department of Public Works study, this garage is usually 80% full most of the time.

This is what is hoped for the Bancroft and Park Plaza buildings, and a garage being built nearby is one way to accomplish this. With available parking, these buildings are more likely to fill up, as well as rise in market value, thus helping the revitalization of downtown Worcester.

Hours of availability are an important factor to consider when building a garage. All the garages in the area currently close overnight. Overnight parking, although discouraged, is allowed, but you can only retrieve your car on the next business day when the garage opens. Currently, there are few people who park overnight in any of the garages. Federal Plaza garage has about 30-40 regular overnight parkers, while the rest of the garages have very few people who park overnight.

This poses a problem for residents. If a garage is built, it should operate 24 hours a day if possible. This will not only serve the residents better, but also provide parking for Telegram & Gazette employees who work the late or irregular shift. Drawbacks of longer hours of operation include increased operating costs and security concerns.

Unfortunately, conclusions about how much people are willing to pay per month to park in a garage cannot be made. The data from that question was biased towards $40 because many people chose the lowest response even though they actually pay more than that now. However, based upon what people pay now, monthly rates between $40 and $80 are reasonable.

7.2 Alternatives

One alternative to building a new parking garage is subsidizing resident parking in the Federal Plaza garage. It is the closest garage, located two blocks from the buildings. Only 30-40 people park there overnight, so there are plenty of spaces left, as the garage has 511 spaces. One problem with this solution is the question of what to do with the residents during the day, at which time the garage is already full. This is especially problematic because residents who work in downtown or to the College of Pharmacy are not likely to take their car with them because they are so close. Another problem is the deteriorating condition of the Federal Plaza garage, something that many people who park their cars there mentioned.

7.3 Business

Encouraging other modes of transportation can reduce parking demand. Many businesses provide subsidies for parking to their employees, but not many encourage use of public transportation or carpooling. Increased carpooling can be accomplished by providing financial assistance, having ride matching service, or through preferential parking for people who carpool. Ride matching service is an especially attractive option because most of the employees that work in downtown live within a 5-mile radius. Giving employees a travel allowance discounts on bus fares or tax-free commuter checks can encourage public transportation. Another option is to institute a cash out program where employees have the option of taking subsidies toward parking or their cash equivalent.

7.4 Safety

People perception is safety is usually good, but drops during the night. Increased police presence during the night hours as well as brighter lighting on sidewalks, alleys and parks would help people feel safer when walking in downtown Worcester.

7.5 Public Transportation

Public transportation in downtown Worcester is satisfactory, but can still be improved. With half of the employees living within 5 miles of their employment, more frequent scheduling, extending hours of service, or increasing the availability of bus routes would possibly lead to more users of mass transit. Providing better information to the potential customer is another way to increase the use of public transportation, especially because most of the people who rate it poor do not use the bus. Overall, increased use of mass transit would reduce the dependency on the automobile and help reduce parking demand.

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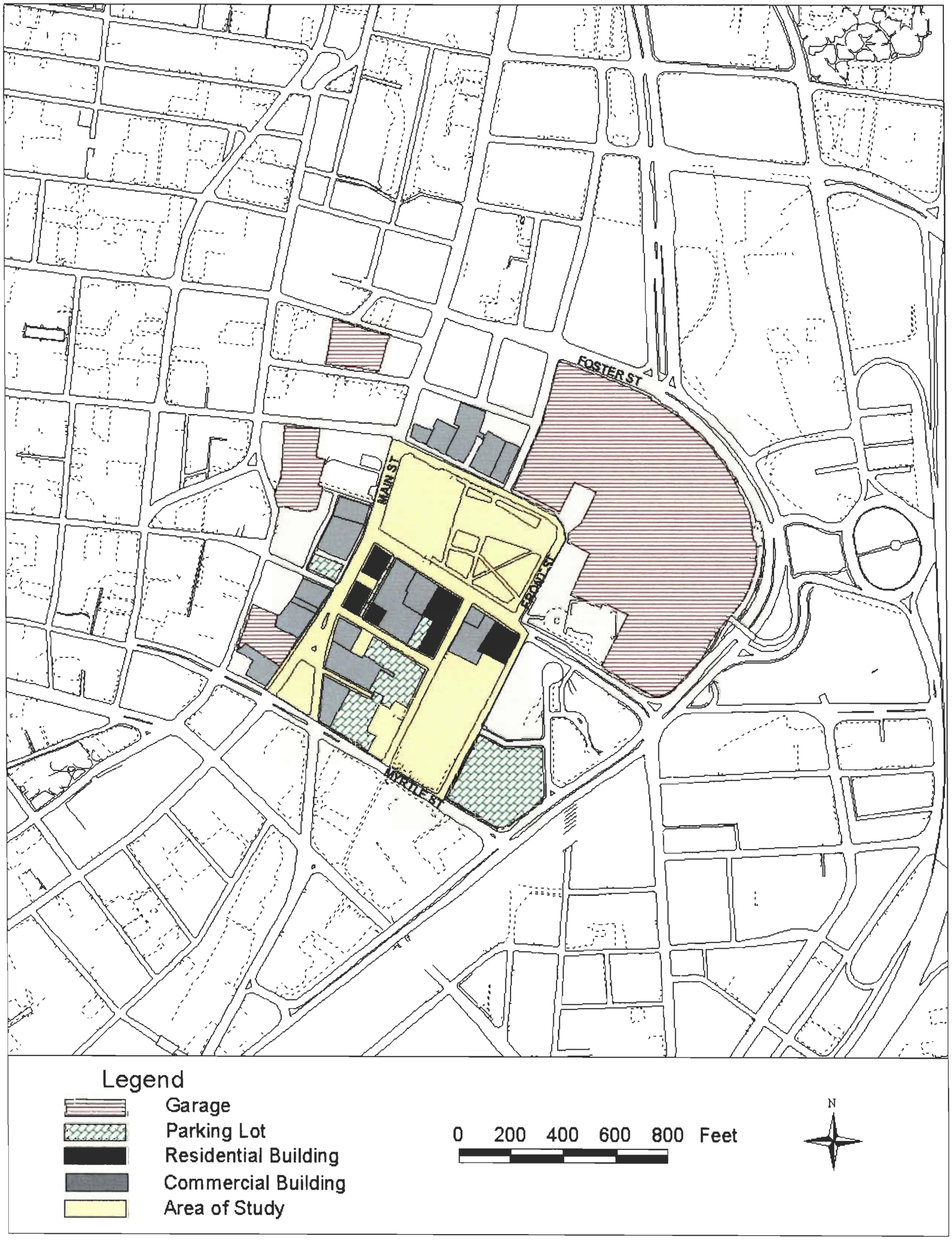
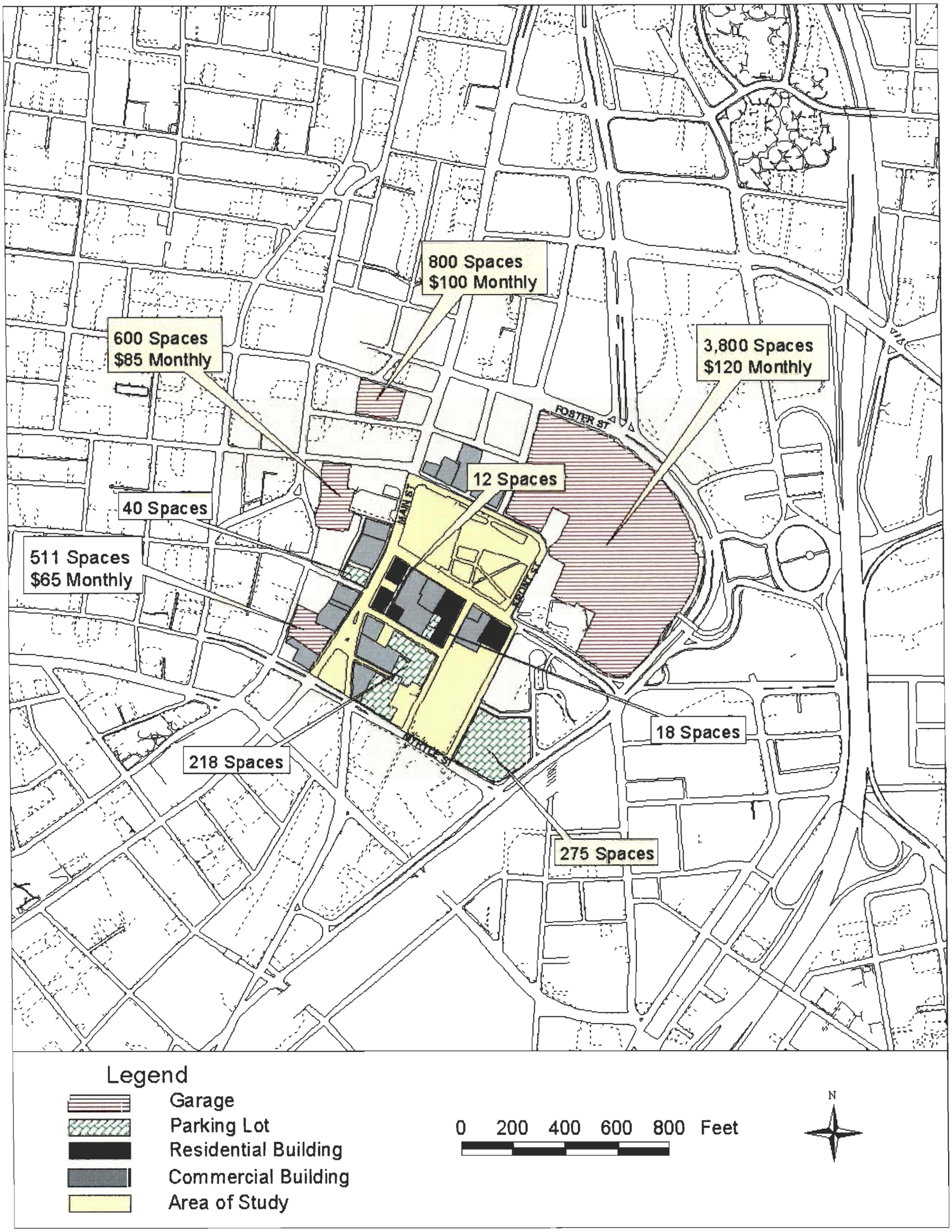
Appendix A

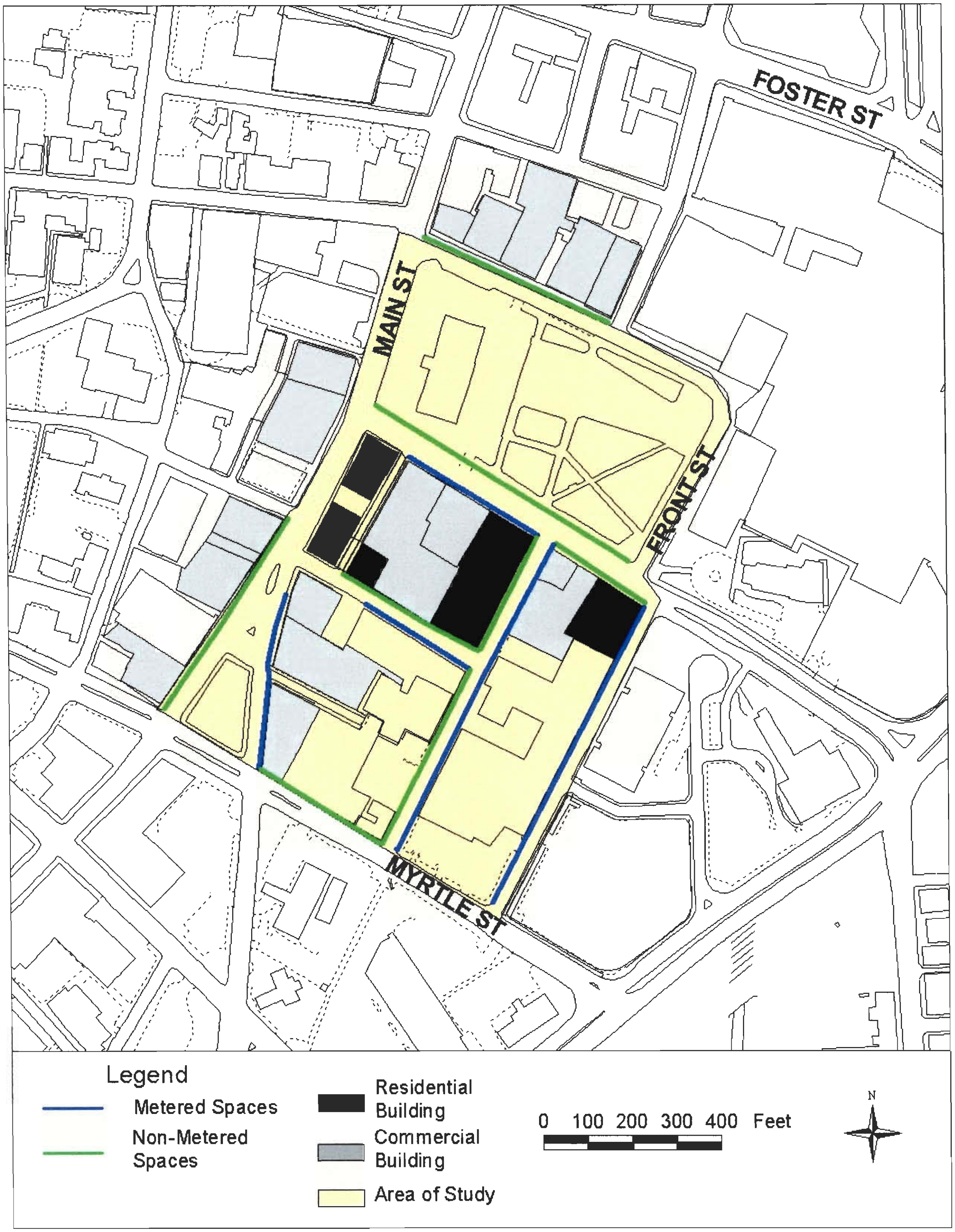
Maps



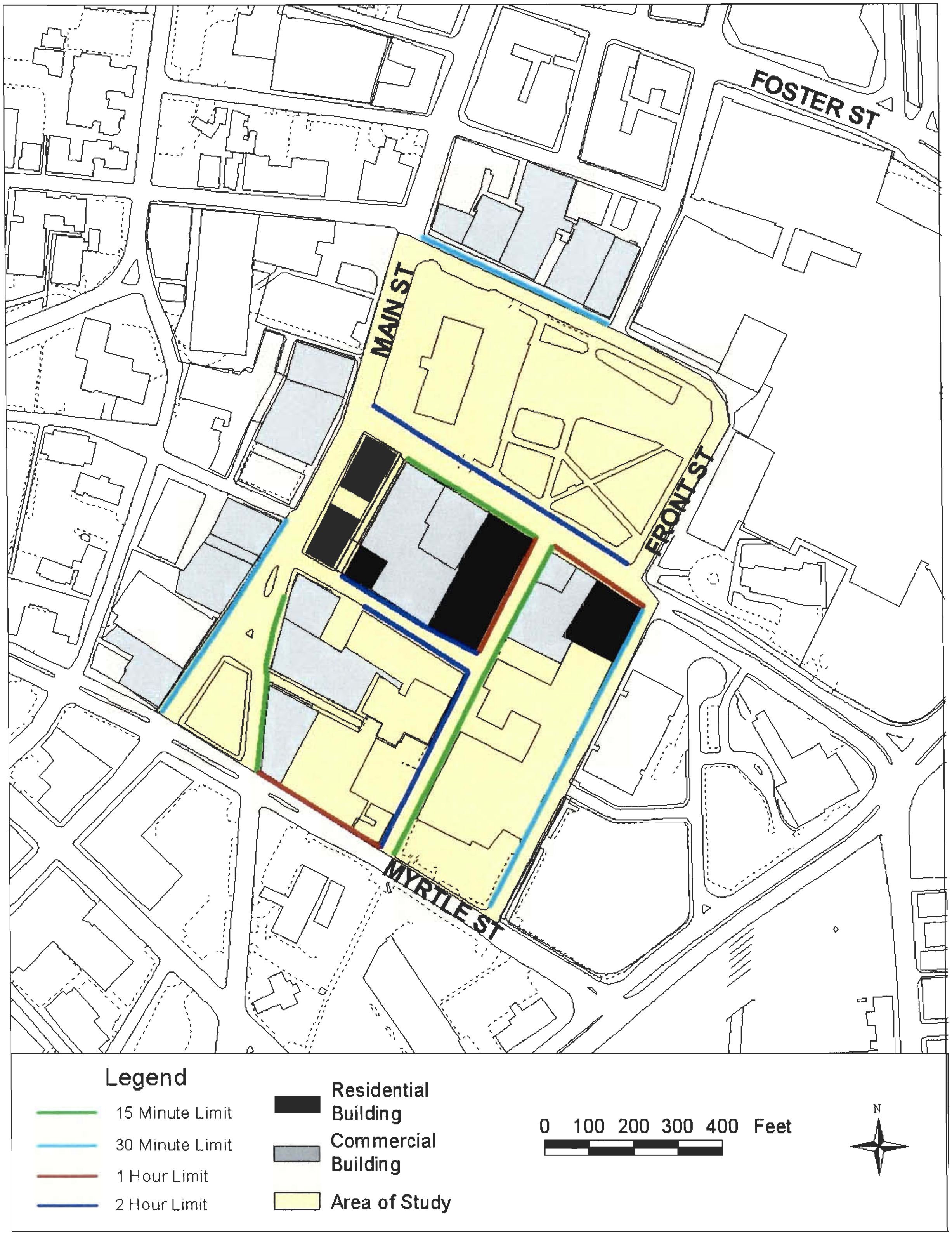
Map of Area of Study



Map of Garages, Parking Lots, and Area of Study



Map of On-Street Parking



Map of Time Limits

Appendix B

Parking Data

On-Street Parking

Street	Side	Between		Type	Price ($/hour)	Limit (hrs)	# of spaces
Front							
	North	Commercial	Main	Metered	0.4	0.5	10
	South	Commercial	Main	40ft handicap			2
total							15
Franklin							
	North	Main	Front	Metered	1	2	6
	South	Main	Portland	Non-metered		0.25	2
	South	Main	Portland	Metered	1	0.25	9
	South	Main	Portland	Handicap			1
	South	Portland	Salem	Metered	1	0.25	5
total							23
Portland							
	East	myrtle	Federal	Metered	0.2	2	16
	East	myrtle	Federal	Handicap			1
	East	federal	Franklin	Metered	1	1	12
	West	myrtle	Franklin	Non-metered		0.25	8
total							37
Federal							
	North	Portlan	Main	Metered	0.2	2	6
	North	Portlan	Main	Handicap			1
	North	Portlan	Main	Non-metered		0.25	2
	South	Portlan	Main	Metered	0.2	2	10
	South	Portlan	Main	Non-metered		0.25	3
total							22
Main							
	East	Federal	Franklin	Metered	0.4	0.5	8
total							8
Southbridge							
	East	Main	Myrtle	Non-metered		0.25	13
total							13
Myrtle St.							
	North	Portland	Southbridge	Metered	1	1	9
total							9
Total							127

Parking Lot Data

Main & Chatham	
Side	North/West
Type	Private Permit
# of Spaces	40
Residential Cost (per month)	$65
Commercial Cost (per month)	$75
Federal	
Side	North
Type	Private Permit
# of Spaces	18
Residential Cost (per month)	N/A
Commercial Cost (per month)	N/A
Federal & Portland	
Side	South/West
Type	Private Permit
# of Spaces	218
Residential Cost (per month)	N/A
Commercial Cost (per month)	N/A
Allen Ct.	
Side	West
Type	Private
# of Spaces	12
Residential Cost (per month)	N/A
Commercial Cost (per month)	N/A
Salem & Myrtle	
Side	South/East
Type	Municipal
# of Spaces	275
Residential Cost (per month)	N/A
Commercial Cost (per month)	N/A
Total # of Spaces	563

Parking Garage Data

Worcester Plaza

Hours	Charge ($)		
1hr (said up to 2 hrs)	2		6:30-11:00
1-3	3	600 spaces total	
3-4	4	~ 100 empty a day (never full)	open
4-5	5		
5-12	6		
12-24	7		
monthly	85 (public)		
after 5pm	1		

Federal Plaza

Hours	Charge ($)	511 spaces	closes at 12
1	1		
2	2		
3	3		
4	4		
5	5		
monthly	65	no openings	
after 5pm	1		

Pearl Elm

Hours	Charge ($)	open	weekdays 7:00-10:00
1	1	800 spaces	Fri & Sat 7-12
2	2		closed Sundays
3	3		
4	4		
5	5		
6	6		
monthly	100	no openings	
after 5pm	1	always full	

Common Outlet

0-2.5	0.99	closes at 10
2.5-3.5	1.99	3800 spaces
3.5-4	2.99	
4-5	4.99	
5-6	6.99	
6-7	8.99	
7-24	9.99	
monthly	120	
Event Parking	10	
Foothills Parking	2	

Appendix C

Sample Survey

THOMAS R. HOOVER
City Manager

PHILIP J. NIDDRIE
Chief Development Officer

CITY OF WORCESTER

EXECUTIVE OFFICE OF ECONOMIC DEVELOPMENT
Suite 300
418 Main Street
Worcester, Massachusetts 01608

Telephone
(508) 799-1523

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(508) 799-1524

March 26, 2002

The City Manager's Executive Office of Economic Development is working with the business and property owners surrounding the Worcester Common to revitalize the neighborhood. At a meeting held this winter the City was asked to evaluate the demand for parking in the Worcester Common neighborhood, as well as the rates the market will support if additional parking in the neighborhood is needed.

Students from Worcester Polytechnic Institute are assisting the City in this matter and have drafted the attached survey to determine the parking and transportation needs in the Worcester Common neighborhood. The survey should take approximately ten minutes to complete and all responses will be held strictly confidential.

Please take the time to complete this survey. Your participation will allow the City of Worcester to determine your parking and transportation requirements and assist the City in its continued revitalization efforts for the area around the Worcester Common and ultimately, the entire downtown.

Sincerely,

Philip J. Niddrie
Chief Development Officer

Worcester
All-America City

Parking and Transportation Survey

Section I - General

1. What is your age?
   - _____ 18 - 20
   - _____ 21 - 30
   - _____ 31 - 40
   - _____ 41 - 50
   - _____ 51 - 60
   - _____ 61 and over

2. Gender _____ M _____ F

3. What mode of transportation do you use the most to get to and from downtown Worcester? **(Please check one)**
   - _____ Car
   - _____ Carpool/Vanpool
   - _____ Bus
   - _____ Bicycle
   - _____ Walk
   - _____ Rail
   - _____ Other (specify)_______________

4. How often do you use each form of transportation to get to and from downtown Worcester? **(Please check one for each row)**

	Daily	2-4 times a week	1 day a week or less	Never
Car	___	___	___	___
Carpool	___	___	___	___
Bus	___	___	___	___
Bicycle	___	___	___	___
Walk	___	___	___	___
Rail	___	___	___	___
Other	___	___	___	___

(specify)____________________

5. Which of the following factors most influences your decisions regarding transportation to and from downtown Worcester? **(Please check all that apply)**
   - _____ Convenience
   - _____ Cost
   - _____ Travel time
   - _____ Bus route not available
   - _____ Weather
   - _____ Do not own a car
   - _____ Job requires car
   - _____ Other (specify)_______________

6. What mode of transportation do you use the most to get around Worcester? **(Please check one)**
   - _____ Car
   - _____ Carpool/Vanpool
   - _____ Bus
   - _____ Bicycle
   - _____ Walk
   - _____ Other (specify)_______________

7. How often do you use each form of transportation to get around Worcester? **(Please check one for each row)**

	Daily	2-4 times a week	1 day a week or less	Never
Car	___	___	___	___
Carpool	___	___	___	___
Bus	___	___	___	___
Bicycle	___	___	___	___
Walk	___	___	___	___
Rail	___	___	___	___
Other	___	___	___	___

(specify)____________________

8. Which of the following factors most influences your decisions regarding transportation around Worcester? **(Please check all that apply)**
   - _____ Convenience
   - _____ Cost
   - _____ Travel time
   - _____ Bus route not available
   - _____ Weather
   - _____ Do not own a car
   - _____ Job requires car
   - _____ Other (specify)_______________

9. Which of the following means of transportation would you consider using in the future to get around Worcester? **(Please check all that apply)**
   - _____ Carpool/Vanpool
   - _____ Bus
   - _____ Bicycle
   - _____ Walk
   - _____ Other (specify)_______________
   - _____ None

Continue→

17. How far do you usually park your car from your destination? **(Please check one)**
    - _____ Less than 1 block
    - _____ 1 – 2 blocks
    - _____ 3 – 5 blocks
    - _____ 6 – 10 blocks
    - _____ More than 10 blocks

18. How would you rate the availability of parking in downtown Worcester? **(Please check one)**
    - _____ Excellent
    - _____ Good
    - _____ Average
    - _____ Fair
    - _____ Poor
    - _____ Don't know

19. Are you satisfied with parking in downtown Worcester? **(Please check one)**
    - _____ Yes **(skip to question 21)**
    - _____ No
    - _____ Don't know **(skip to question 21)**

20. If no, what are the parking problems? **(Please check all that apply)**
    - _____ Not enough parking spaces
    - _____ Cost
    - _____ Parking too far from destination
    - _____ Lose parking space upon return
    - _____ Parking facilities aren't safe after dark
    - _____ Other (specify)_______________

21. Would you be willing to park away from downtown Worcester for a reduced fee if shuttle services were provided? **(Please check one)**
    - _____ Yes
    - _____ No
    - _____ Don't know

22. If a parking garage was built in the Worcester Common area, what is the maximum you would be willing to pay per month to park there? **(Please circle one)**

    $40 $50 $60 $70 $80 $90 $100+

23. Your primary downtown needs are **(Please check all that apply)**
    - _____ Residential
    - _____ Business/Work **(skip to question 29)**

Section III - Residents

24. How many vehicles do you have available for use? **(Please circle one)**

    0 1 2 3 4 5+

25. How many days per week on average do you use your vehicle? **(Please circle one)**

    0 1 2 3 4 5 6 7

26. Is parking included with your housing?
    - _____ Yes → ___ Assigned space
      - ___ Guaranteed space
      - ___ First come, first serve
    - _____ No
    - _____ Don't know

27. How important is the availability of parking when choosing housing?
    - _____ Very important
    - _____ Somewhat important
    - _____ Neutral
    - _____ Not very important
    - _____ Not important at all

28. Is lack of parking restricting you from owning a car?
    - _____ Yes
    - _____ No
    - _____ Don't know

STOP

Thank you for completing the survey

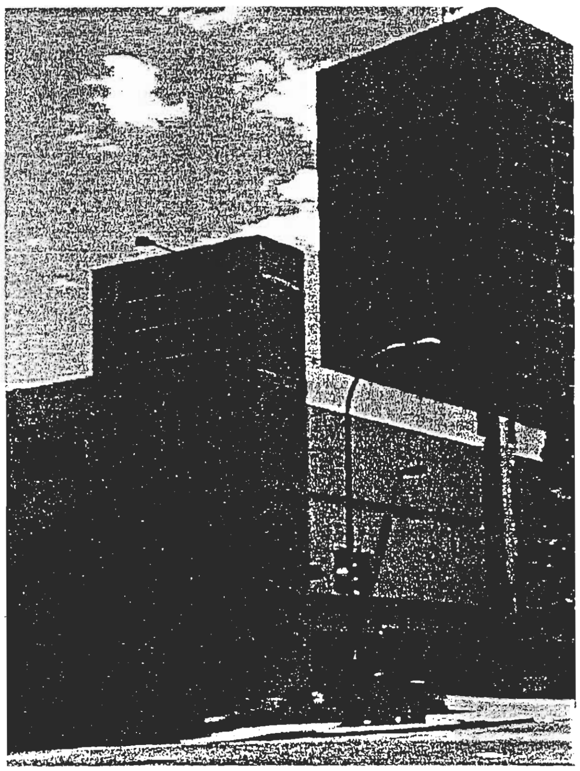
Continue→

Appendix D

1999 Worcester Parking Study

Parking

Supply and Demand



Downtown Worcester

Department of Public Works
Division of Traffic Engineering
City of Worcester

August 20, 1999 – PRG, EBM

List of Figures

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Table of Contents

1. Introduction

The Division of Traffic Engineering, Public Works Department, City of Worcester, has conducted a parking supply and demand study of the city's Central Business District (CBD). This study was done in response to requests made for the City Council and the Off-Street Parking Board to update a previous study done by this division in 1986. Increased development and the planning of future projects for the Worcester CBD has put a high demand on parking in the downtown area.

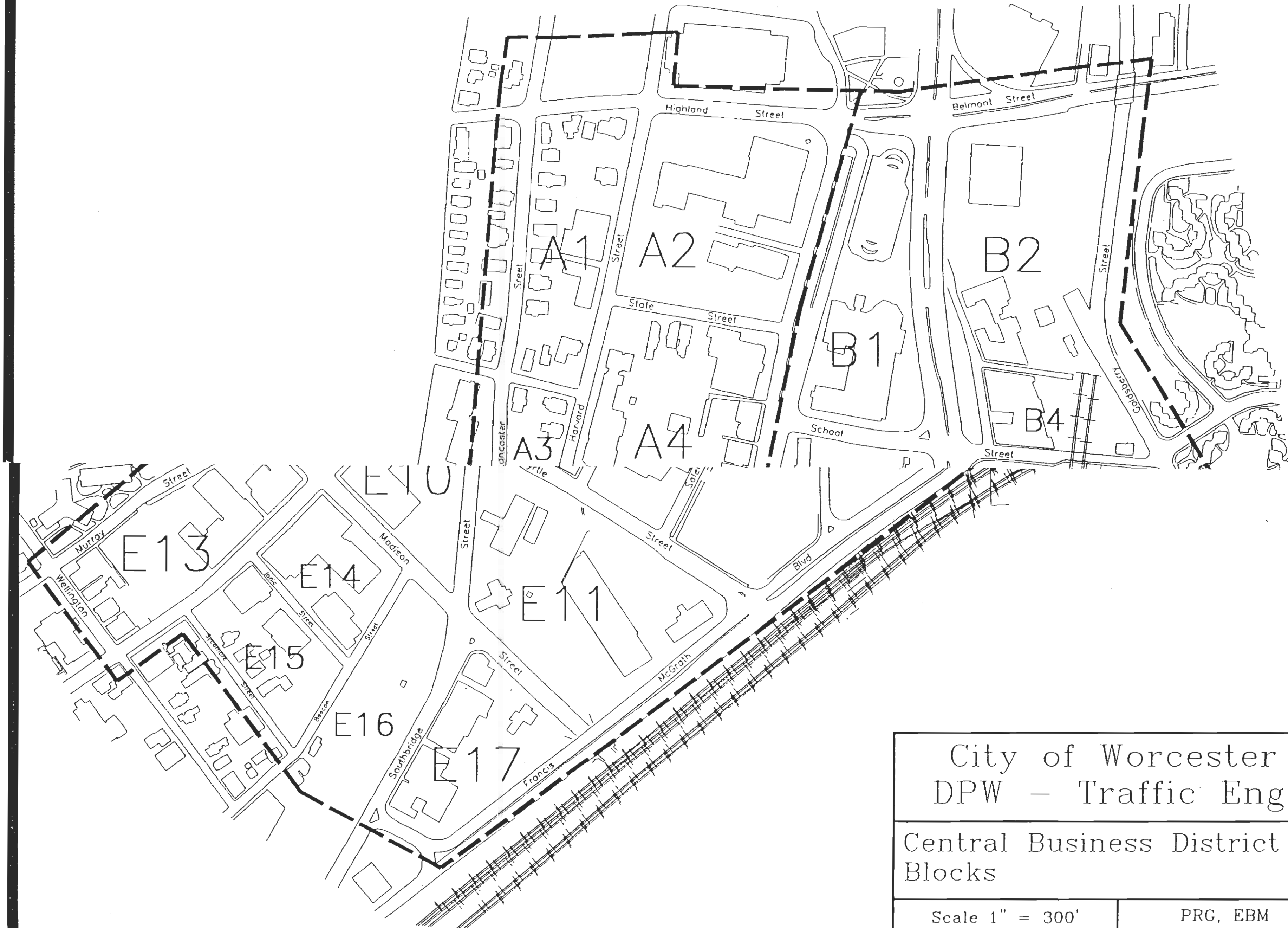
The purpose of this study is to give the reader the best knowledge of the City of Worcester parking situation. This study focuses on the types of parking, private and public, on and off-street parking, that exist in the Worcester CBD. The distinction between public and private parking is important in understanding the data that was collected. The number of parking spaces available in a certain area may indicate that there is adequate parking, but these parking areas may be restricted to employees or residents, leaving the general public to search elsewhere for parking. A surplus of parking in one area does not necessarily mean there is enough public parking. This study will help the reader have a better understanding of the parking demand and parking supply.

2. Parking Supply Determination

Maps of the CBD were taken from GIS (Geographic Information Systems) software. These CBD maps were divided into five different sections labeled A, B, C, D, and E and then the blocks in each section were individually labeled. For example, the block containing the Crowne Plaza Hotel is located in area B, and labeled B-1. Figure 2.1 on pg. 3 shows how the Worcester CBD was divided up. Parking data was determined by field survey of existing parking lots, garages, and street side parking. Surveys of occupancy were taken during the morning and afternoon for each parking lot. These parking lots were located using a map from the previous parking and demand report. Parking lots or spaces that were not on the old map were recorded and appropriate changes were made. Observations of capacity, number of cars currently parked, time of day, and other additional information were recorded. Parking lots were determined to be either private or public lots. Private lots were further broken down by type, such as private employee or private resident. Figure 2.2 on pg. 4 shows each parking lot.

Street-side parking surveys were also conducted in the same manner as lot parking. Street parking was categorized by metered spaces, restricted spaces such as 15 minute parking zones and unrestricted (parking anytime) zones. The parking spaces were also observed to determine capacity, occupancy, and other information.

Information and records of all parking in the CBD were obtained through our office resources. Parking information for the six major garages in the Worcester CBD area such as average occupancy and parking space supply, was obtained through phone calls to the garages or their operators. Capacity and approximate number of cars parked on an average day were received.



City of Worcester
DPW – Traffic Eng.

Central Business District Blocks

Scale 1" = 300'	PRG, EBM

3. Parking Demand Determination

Calculating the parking demand in the CBD was the next step for the parking study. GIS and information from the Assessor's Office were used with the zoning ordinances, shown in Table 3.1, to determine the demand. Building information for each parcel in the CBD was determined and the Assessors' Office was able to supply the floor space areas. For restaurants, hotels, and places of assembly, phone calls were made to determine the capacity of the buildings.

The demand values calculated for each block in the different CBD areas may be different from the actual number of parking spaces needed by a certain business or building. Certain parts of the building may be vacant, used for storage, or in general there may be a higher or lower need for parking spaces than the zoning ordinance values. Supply and demand values may also show discrepancies because many businesses supply parking lots for their employees or customers that are not located on the same block as the business. This leaves the block with the parking lots with a high supply number and low demand, while the blocks containing the businesses have a higher demand and lower supply.

Parking Demand Factors

Type of Use	Factor
Retail	1 space per 300 sq. ft.
Office	1 space per 300 sq. ft.
Warehouse	1 space per 3000 sq. ft.
Manufacturing	1 space per 1000 sq. ft.
Places of Assembly	1 space per 4 people
Restaurant	a) 1 space per 4 dining room seats
	b) 1 space per 2 lounge seats
Residential	2 spaces per dwelling unit

Table 3.1 Zoning Parking Requirements

Parking demand is modified by other factors. Employee absenteeism, due to vacations, sick time, or holidays reduces the parking demand in the downtown area. The absenteeism rate is about 9% according to the Personnel Office of the City of Worcester. Also, every day is not a peak shopping day so the retail demand was discounted 25%.

4. Results

The Central Business District of the city of Worcester has been broken down into five sections for this parking supply and demand study. The figures and results are based on and calculated by each individual block. Figure 3.1 on pg. 5 displays how each section and block of the Worcester CBD has been broken down. All figures and charts represent a regular business day in Worcester with retail operating at 75%; business zoning operating at 91%, and restaurants and places of assembly operating at full capacity.

Each section in the Worcester CBD has three types of parking. As mentioned earlier, the three types of parking are lot parking, on-street parking, and garage parking. Parking lots have been categorized into private and public parking and on-street parking has been categorized into metered parking, restricted parking, and unrestricted parking.

4.1 Area A

Area A is bounded by Highland St., Main St., Walnut St., Cedar St., and Lancaster St. This area also includes the Highland St. Municipal Parking Lot. There are two types of parking in this area, lot parking and on-street parking. Figure 4.3 on pg. 10 shows each block in Area A. There are no garages located in Area A.

The largest parking demand in this area is the Worcester County Courthouse in the northern section. Its daily demand is about 400 spaces. The courthouse itself supplies about 340 spaces and some of the demand is accommodated by street side parking and illegally parked cars. The Highland Municipal Parking Lot across Highland St. from the courthouse is used for additional parking. The courthouse also uses the Crowne Plaza Garage for parking. Figure 4.1 is a photo of the courthouse employee parking lot on the corner of State St. and Harvard St. The photo shows numerous cars over crowding the parking lot. Figure 4.2 displays the same situation on the parking lot at the corner of Harvard St. and Highland St.

Figure 4.1 Courthouse employee parking lot, corner of State St. and Harvard St.

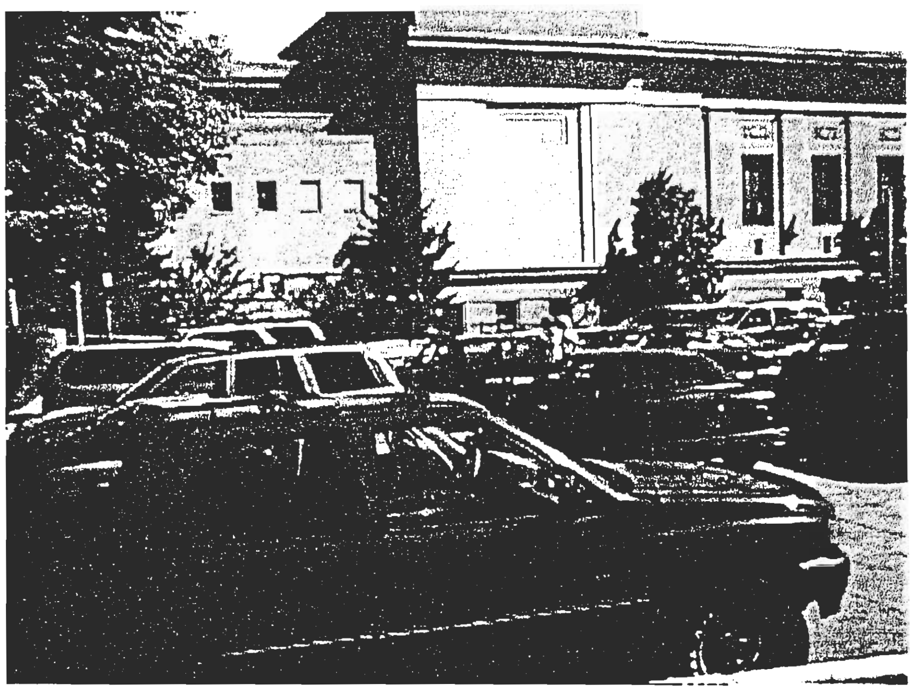
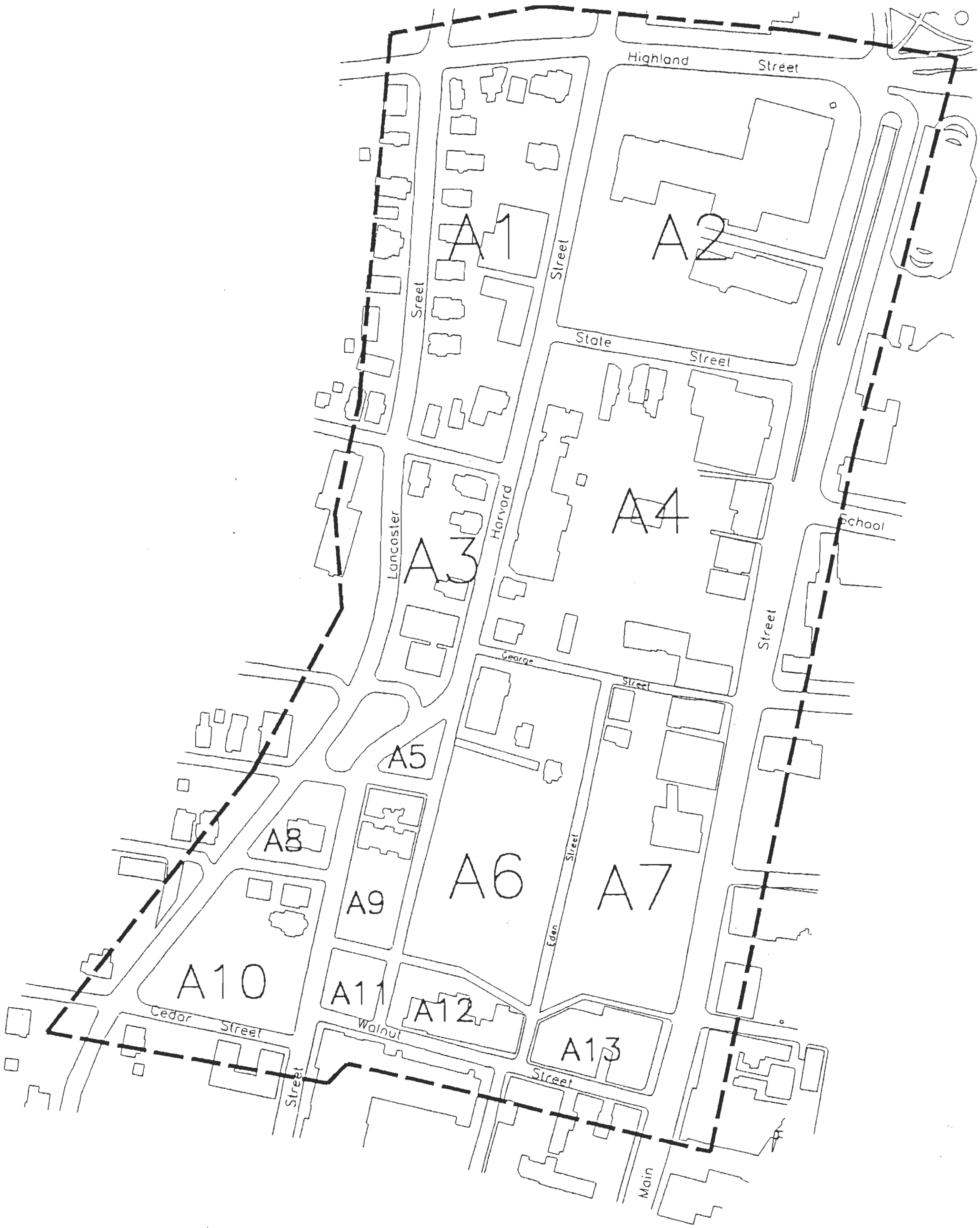


Figure 4.2 Courthouse employee parking lot, corner of Harvard St. and Highland St.

The rest of Area A has a lower parking demand and an overall surplus of parking. The southern sections of the area consist mostly of large parking lots. Most of the parking lots are for Paul Revere Insurance Company located in Area C. Most of these spaces are not available to the public. The only public parking in the southern area is on-street parking.

The overall parking situation shows a surplus of parking in Area A. Most of the surplus is due to the large private parking lots located in the southern area. Most small businesses and residents have adequate parking. This is not true for public parking. Usually the street side parking spots and the Highland Municipal Parking Lot, both of which are public parking areas, are filled to capacity and this makes finding a parking space difficult.

Table 4.1 shows parking supply and demand by block for Area A. The total demand in Area A is 1724 spaces, while the total supply is 2185 spaces. Most parking lots in Area A are between 70-100% full. The afternoon occupancy rate for Area A is slightly lower than the morning values. Table 4.1 shows that while most of Area A has adequate parking, block A2, the courthouse area, has a high rate of occupancy that exceeds its supply. This indicates that there is overcrowding in this block and a need for more parking facilities.



City of Worcester DPW - Traffic Eng.	
Central Business District Area A Blocks	
Scale NTS	PRG, EBM

Block No.	Supply**	Occupancy				Demand*	
		Morning		Afternoon			
A1	374	309	83%	284	76%	255	68%
A2	393	383	97%	371	94%	403	103%
A3	106	73	69%	57	54%	81	76%
A4	299	199	67%	200	67%	223	75%
A5	15	10	67%	7	47%	0	0%
A6	405	343	85%	311	77%	62	15%
A7	212	163	77%	139	66%	129	61%
A8	18	9	50%	9	50%	20	111%
A9	73	71	97%	65	89%	40	55%
A10	166	127	77%	117	70%	30	18%
A11	37	37	100%	34	92%	0	0%
A12	10	9	90%	9	90%	259	2590%
A13	77	60	78%	58	75%	222	288%
Totals	2185	1793	82%	1661	76%	1724	79%

*based on City of Worcester zoning regulations, see Table 3.1
**on and off street parking

Table 4.1 Parking Supply, Demand, and Occupancy for Area A

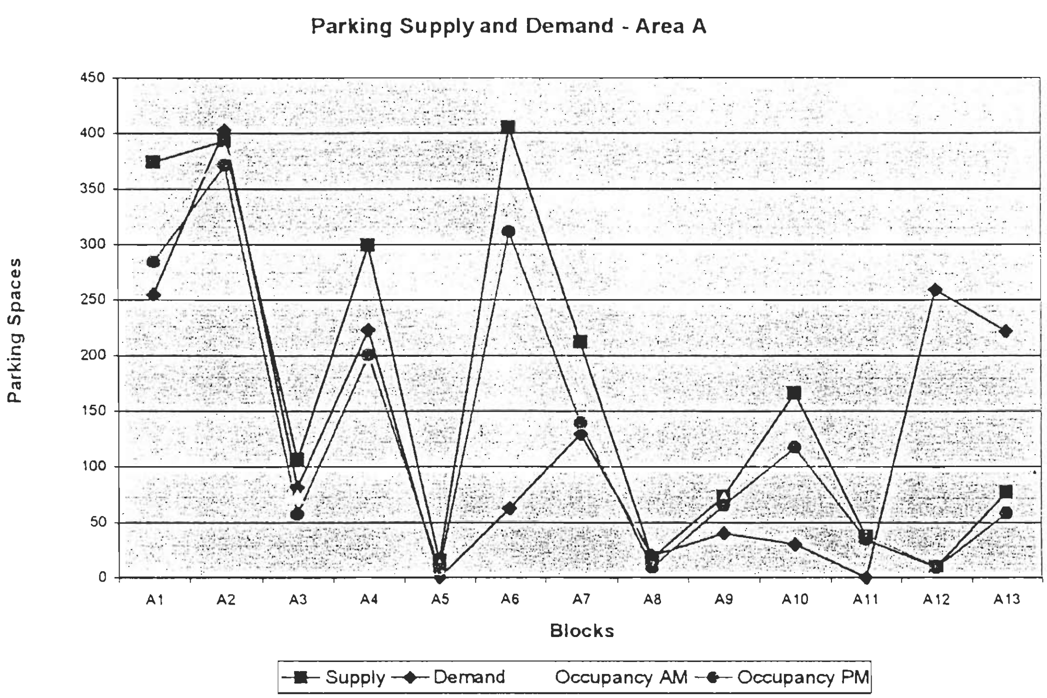


Figure 4.4 Parking Supply, Demand, and Occupancy for Area A

4.2 Area B

Area B is bounded by Lincoln Square, Belmont St., Goldsberry St., Summer St., Exchange St. and Main St. This area contains the Crowne Plaza Hotel, the Worcester Police Department headquarters, the Convention Center and Maxwell Silverman's Restaurant in the Union Place complex. Figure 4.7 on pg. 14 shows each of the blocks in Area B. All of these buildings put a high parking demand on this area.

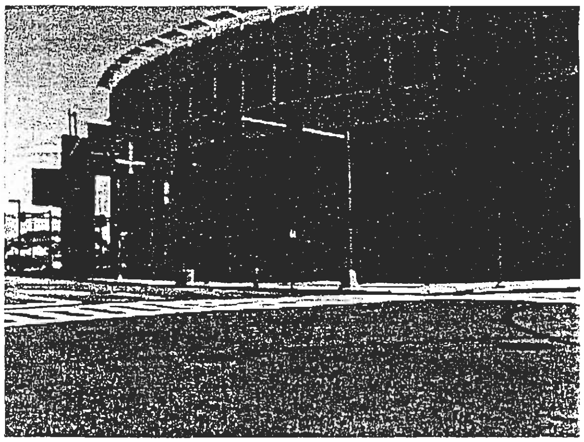


Figure 4.5 Worcester Convention Center

The parking demand for the Crowne Plaza Hotel is 470 spaces. This number assumes that the hotel is operating at 80% of the total spaces available with both its restaurant and lounge full. There is an additional demand when there is a banquet function at the hotel. The Crowne Plaza supplies a garage for parking and there is metered on-street parking available along Main St. and School St.

The Crowne Plaza Parking Garage located in block B1 provides 200 spaces. Approximately 180 of those spaces are occupied at any given time. The garages main use is for Crowne Plaza customers. People attending the courthouse located in Area A also park in the Crowne Plaza Garage. Large events at the Crowne Plaza Hotel will fill the garage to capacity.

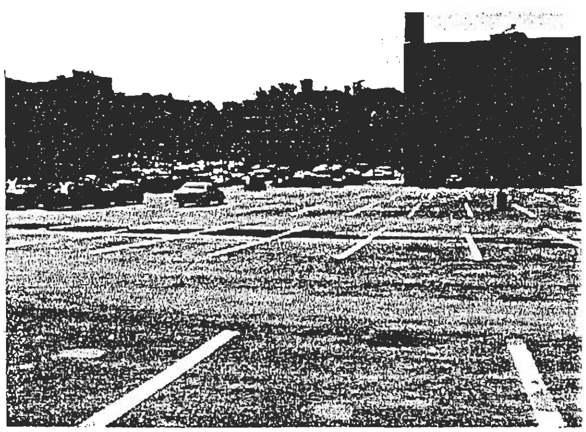


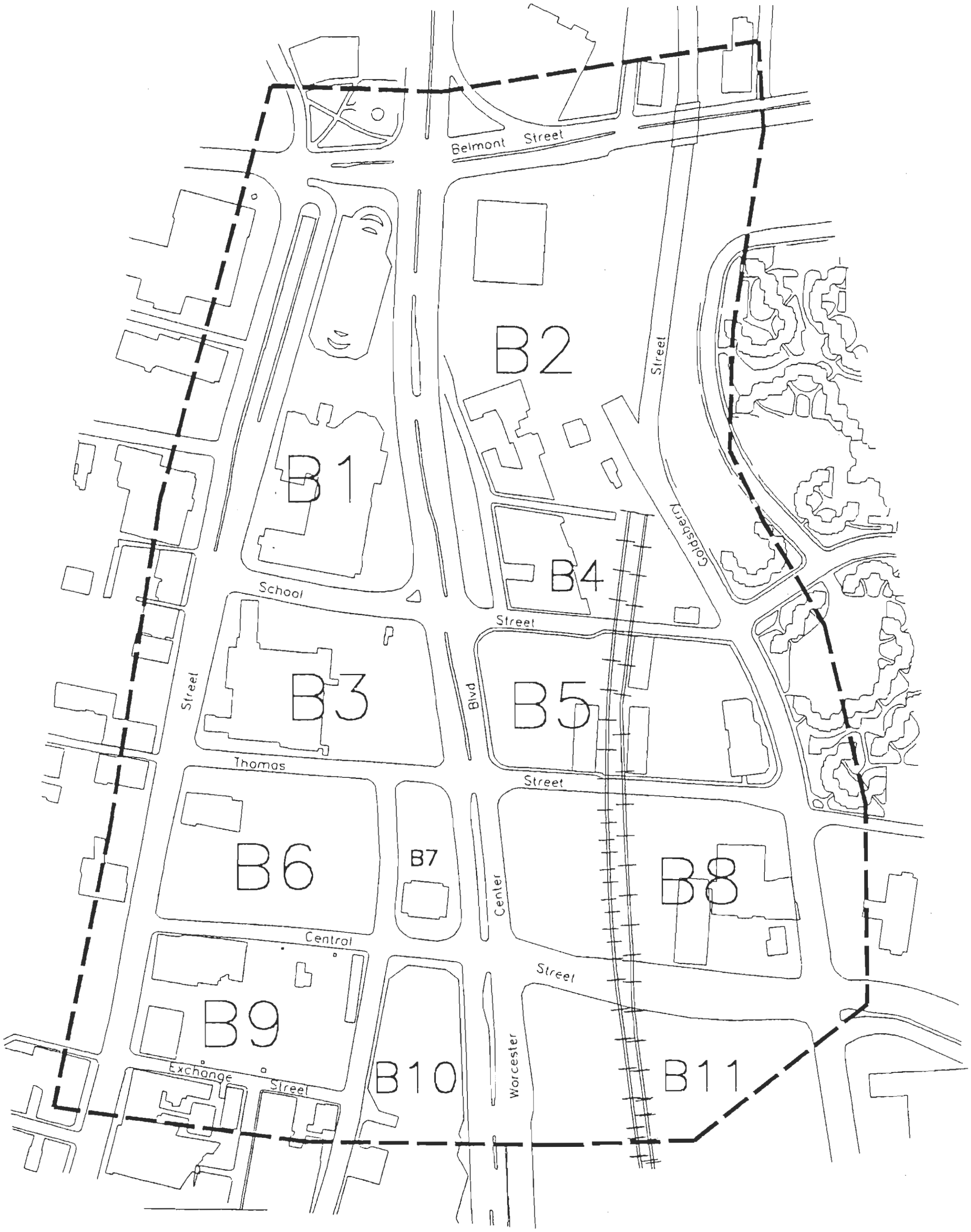
Figure 4.6 Central/Commercial St. Parking Lot

Block B2 contains the Worcester Police Department headquarters, Maxwell Silverman's Restaurant and Union Place. The daytime demand of the police headquarters exceeds the supply, with cars parking illegally on Summer St. and in the headquarters parking lot. The parking demands for Union Place are spread out over day and night time, with much of Maxwell Silverman's demand coming during the evening hours when the rest of the businesses are closed.

The new Worcester Convention Center, shown above in Figure 4.5, is located in block B10 and holds banquets and functions creating a demand of 500 spaces. The Convention Center relies on the Worcester Center garages located in Area D, street side parking on Commercial St., and a large parking lot shown above in Figure 4.6 and located on the corner of Commercial St. and Central St. to meet its demand.

The Crowne Plaza Garage and the large Centrum surface parking lot located in block B6 help provide public parking during business hours. The street parking spaces located in the area also relieve some of the demand. Only Worcester Center Boulevard and Central Street do not provide on-street parking.

Table 4.2 shows the parking supply and demand in Area B. The total demand in Area B is 2422 and the total supply is 2083 parking spaces. Most of the spaces available are between 50 and 94% full, with the morning occupancy higher than the afternoon occupancy. The parking lots in area B provide adequate parking for the businesses in the area. The Centrum and the Convention Center use street parking in Area B as well as the large parking lot in block B6, which supplies 370 spaces, to accommodate their demands. If an event at either of these two buildings were to occur during a weekday, there would be a parking deficit in Area B.



City of Worcester
DPW – Traffic Eng.

Central Business District
Area B Blocks

Scale NTS	PRG, EBM

Block No.	Supply**	Occupancy				Demand*	
		Morning		Afternoon			
B1	288	252	88%	239	83%	470	163%
B2	425	398	94%	400	94%	378	89%
B3	146	73	50%	45	31%	659	451%
B4	96	77	80%	79	82%	60	63%
B5	296	254	86%	252	85%	33	11%
B6	382	182	48%	168	44%	10	3%
B7	30	21	70%	19	63%	0	0%
B8	167	84	50%	67	40%	30	18%
B9	250	219	88%	194	78%	802	321%
B10	3	0	0%	0	0%	0	0%
B11	0	0	0%	0	0%	0	0%
Totals	2083	1560	75%	1463	70%	2442	117%

*based on City of Worcester zoning regulations, see Table 3.1
**on and off street parking

Table 4.2 Parking Supply, Demand, and Occupancy for Area B

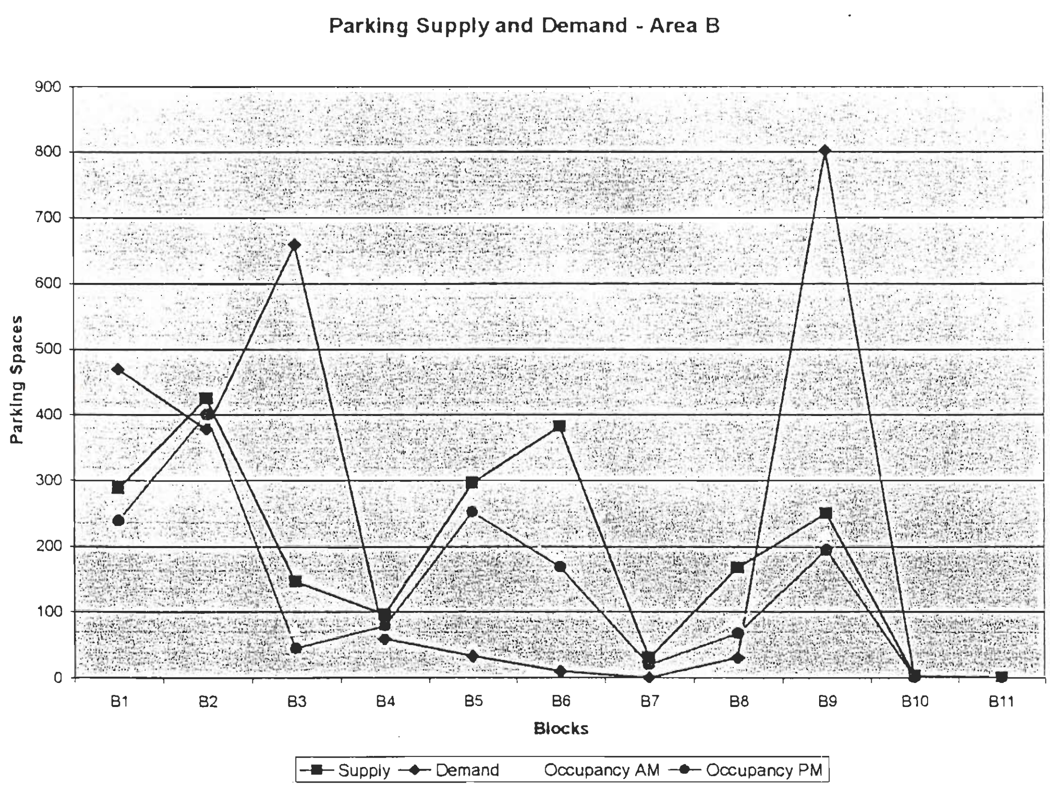


Figure 4.8 Parking Supply, Demand, and Occupancy for Area B

4.3 Area C

Area C is bounded by Cedar St., Walnut St., Main St., Chatham St., Irving St., and Linden St. This area is one of the most densely developed areas of Worcester. Figure 4.10 on pg. 18 shows each block in Area C. There are many large offices and financial businesses as well as many small retail shops and office buildings. The area has two garages to make up for the parking demand for the dense development.

The northern section of the area has Paul Revere Insurance and the New England Telephone Company both of which produce a large demand. Paul Revere Insurance has two large parking spots in area A to provide for the large demand. The Fleet tower, shown in figure 4.9 at left, in the southern part of area C creates a large demand of 800 spaces. There are many small retail shops along Main St. and Pleasant St. that add to the overall demand. On-street parking and garage parking help alleviate their parking needs.

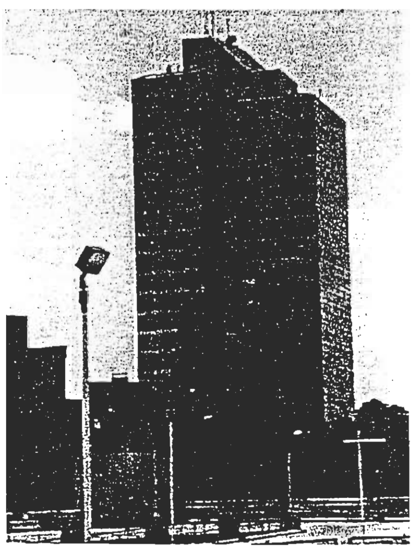
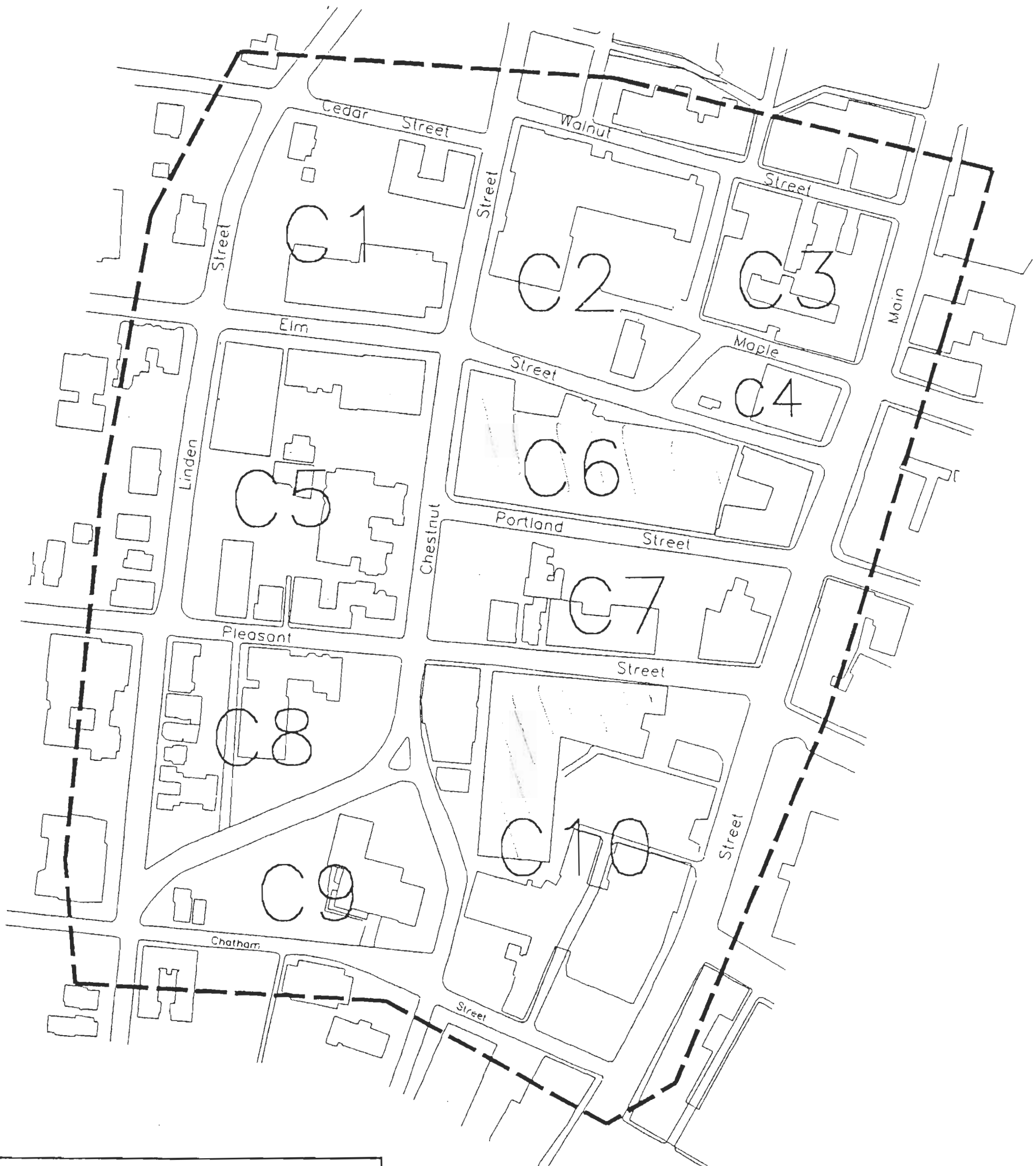


Figure 4.9 Fleet Bank Tower

The Worcester Plaza Garage located in block C10 and the Pearl Elm Garage located in block C6 provide public parking for Area C. The Worcester Plaza Garage provides a total of 600 spaces. Approximately 500 spaces in the garage were observed occupied. The majority of the people who park at the Worcester Plaza Garage are employees of Fleet Bank. This garage also provides parking for Centrum events in the evening. The Pearl Elm Garage provides 800 parking spaces of which approximately 620 are occupied on an average weekday. The majority of the people who park in the Pearl-Elm garage have business at Chestnut Place or the UMass Medical Health Care Group.

The demand for Area C is 5945 while the supply is 2932. A total of 179 on-street parking spots and over 2500 off street parking spaces make up the parking supply for Area C. The occupancy percentage of the parking spaces in Area C is 77% full, approximately 2250 cars. The demand is much higher than the supply in this area because of large office buildings. Some office buildings have parking in another area. For example, Paul Revere supplies parking lots in Area A. Another reason for the low occupancy rate could be the availability of vacant office spaces in the area. There is adequate public parking in Area C. About half of the total spaces in Area C provided are for public usage. There is an overall deficiency of parking spaces in the area. Table 4.3 displays the overall parking supply and demand for each block in Area C.



City of Worcester DPW - Traffic Eng.	
Central Business District Area C Blocks	
Scale NTS	PRG, EBM

Block No.	Supply**	Occupancy				Demand*	
		Morning		Afternoon			
C1	157	124	79%	118	75%	554	353%
C2	170	146	86%	142	84%	953	561%
C3	35	33	94%	32	91%	1255	3586%
C4	12	5	42%	5	42%	587	4892%
C5	313	223	71%	216	69%	216	69%
C6	1007	847	84%	857	85%	1164	116%
C7	174	109	63%	126	72%	152	87%
C8	176	82	47%	87	49%	223	127%
C9	100	47	47%	34	34%	0	0%
C10	788	642	81%	634	80%	841	107%
Totals	2932	2258	77%	2251	77%	5945	203%

*based on City of Worcester zoning regulations, see Table 3.1
**on and off street parking

Table 4.3 Parking Supply, Demand, and Occupancy for Area C

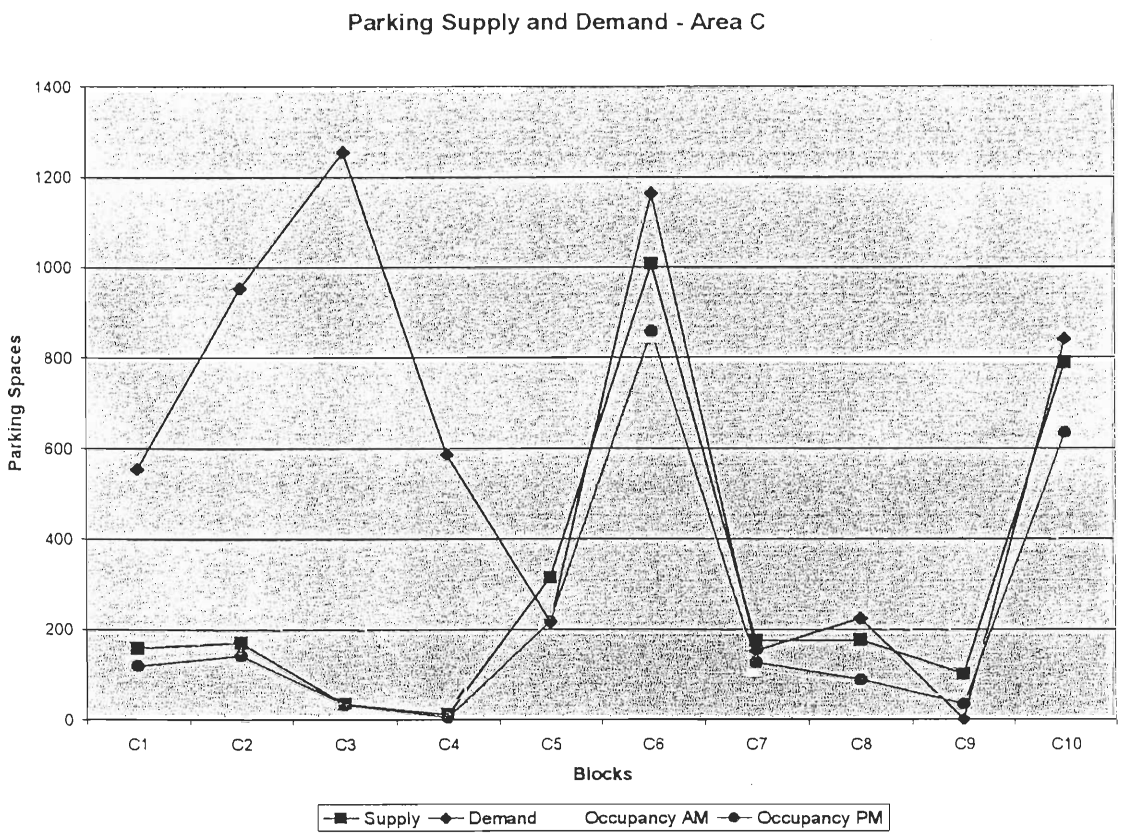


Figure 4.11 Parking Supply, Demand, and Occupancy for Area C

4.4 Area D

Area D is bounded by Exchange St., Summer St., Worcester Center Boulevard, Franklin St., and Main St. Figure 4.13 on pg. 22 shows each block in Area D. This area contains a relatively high amount of commercial development, including buildings with high parking demands such as the Worcester Centrum, located in block D3, and the Worcester Common Fashion Outlets as well as the Flagship Bank building, located in block D9.

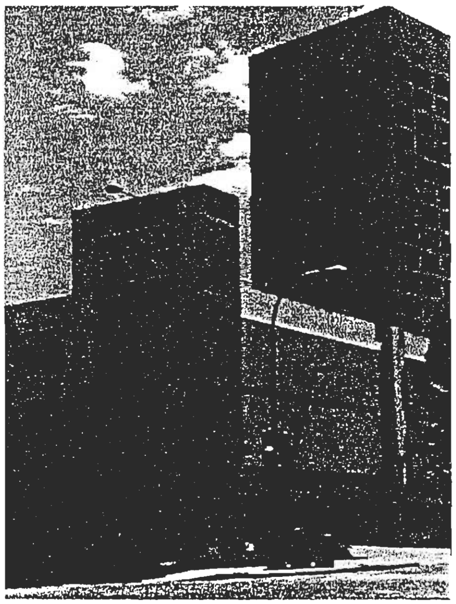


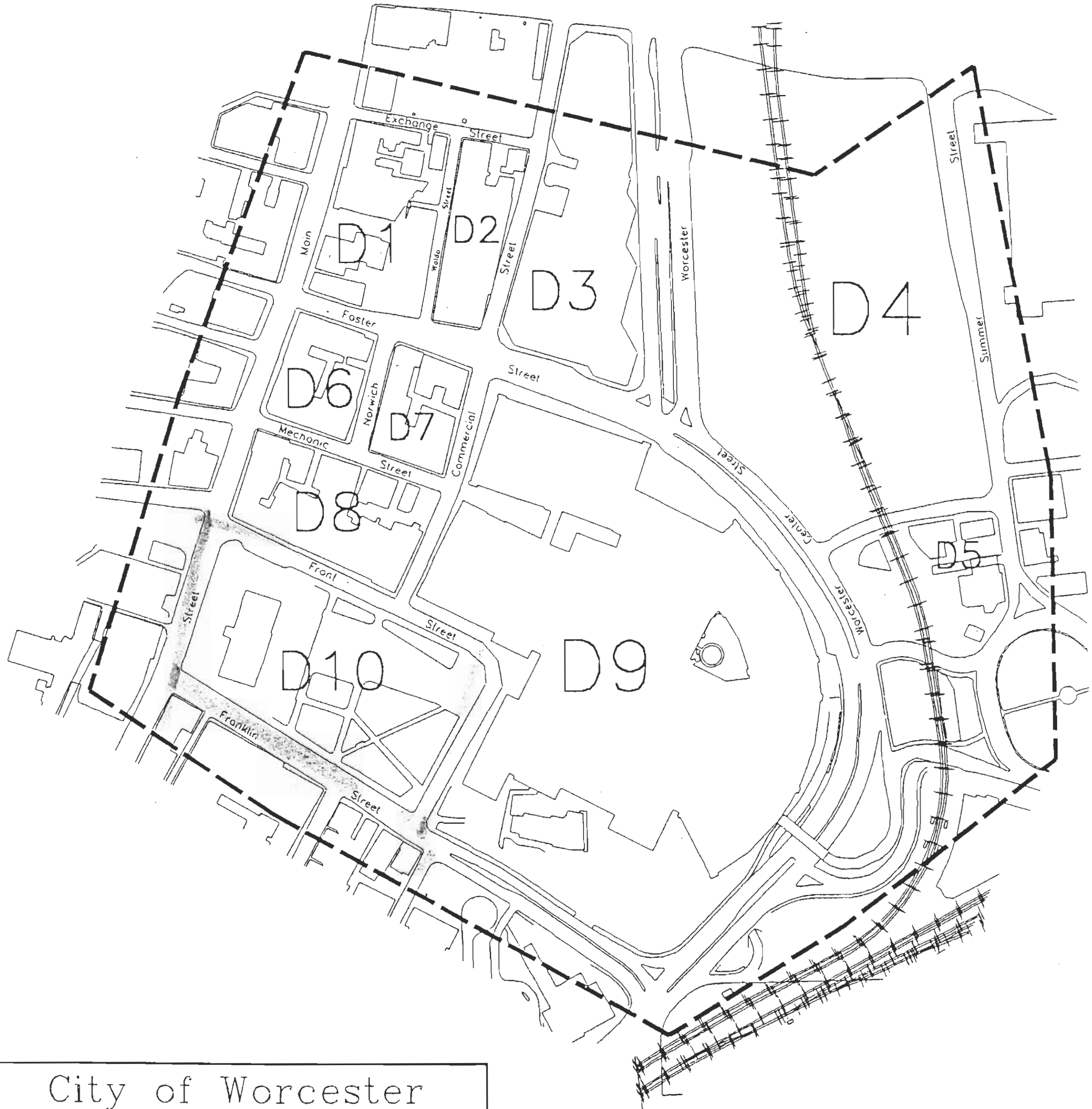
Figure 4.12 Worcester Common Fashion Outlets

A Centrum event puts a large demand of approximately 4000 spaces in Area D, but because most Centrum events take place at night, when most of the downtown businesses are closed, parking is not a serious problem. The Centrum uses the two Worcester Center garages for the majority of their parking. The Common Fashion Outlets, shown above in Figure 4.12, has a demand of 1330 and this is met by the two garages. Mechanics Hall located in block D3 and the Paladium in Area B create a large demand for parking spaces in the evening hours. On-street parking on Commercial St., Front St., Franklin St., and Foster St. meets some of the demand of other businesses in the area including restaurants on Commercial St. such as The Firehouse Café, Nantucket Seafood and Valentino's.

The Worcester Center Outlet Garages provide a large supply of off-street parking spaces in Area D. The Worcester Center A Garage located at the corner of Commercial St. and Foster, block D9, provides a total of 1450. The occupancy of the Worcester Center A Garage is approximately 61%. The intended use of the garage is for businesses in the downtown area as well as providing parking for the Worcester Common Fashion Outlets. The Worcester Center B

Garage located in block D9 on Worcester Center Boulevard provides a total of 2130 parking spaces. The occupancy of the garage is approximately 53%. Customers use the garage primarily for parking for the Worcester Common Fashion Outlets. Both garages provide parking for a Centrum event. The garages are usually filled to capacity during a large Centrum event.

Table 4.4 shows the parking supply and demand values for Area D. the total demand for Area D is 5653 and the total supply is 4391. Block D9, containing the Common Fashion Outlets and Flagship Bank, has the highest demand, 2826 spaces, for this section. There is a 1012-space surplus of parking spaces for this block. The occupancy in area D shows that the parking supply is more than adequate. Approximately 55% of the parking spaces in the area are filled to capacity. Many factors can be attributed to this. There is adequate public parking for the area with the two outlet garages and street side parking.



City of Worcester DPW – Traffic Eng.	
Central Business District Area D Blocks	
Scale NTS	PRG, EBM

Block No.	Supply**	Occupancy				Demand*	
		Morning		Afternoon			
D1	132	71	54%	60	45%	930	705%
D2	135	81	60%	80	59%	308	228%
D3	17	2	12%	7	41%	0	0%
D4	0	0	0%	0	0%	0	0%
D5	42	13	31%	11	26%	30	71%
D6	87	83	95%	79	91%	487	560%
D7	40	35	88%	28	70%	366	915%
D8	56	46	82%	22	39%	706	1261%
D9	3838	2034	53%	2041	53%	2826	74%
D10	44	33	75%	33	75%	0	0%
Totals	4391	2398	55%	2361	54%	5653	129%

*based on City of Worcester zoning regulations, see Table 3.1
**on and off street parking supply

Table 4.4 Parking Supply, Demand, and Occupancy for Area D

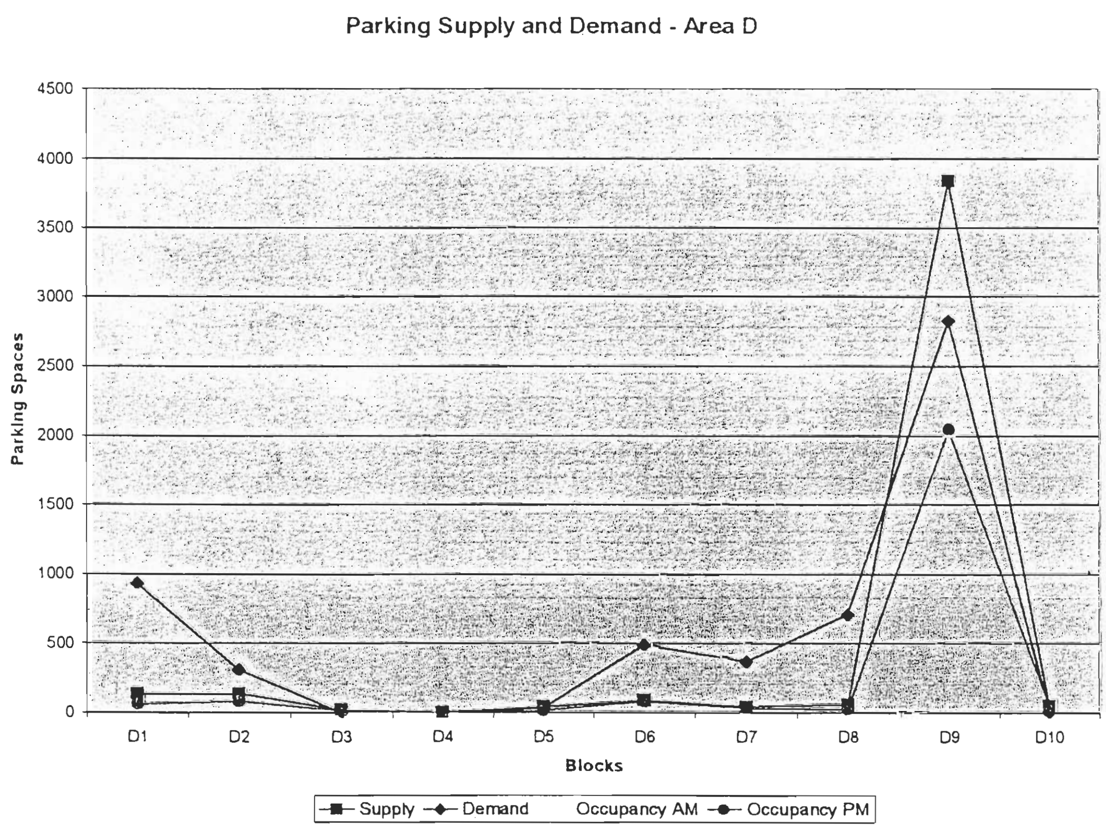


Figure 4.14 Parking Supply, Demand, and Occupancy for Area D

4.5 Area E

The largest of the five areas, Area E, encompasses the southern end of the Worcester CBD. This area is bounded by Chatham St., Franklin St., Francis McGrath Blvd., Sycamore St., Wellington St., Murray St., and Irving St. Figure 4.17 on pg. 26 shows each block in Area E. The area has several large buildings spread out over the entire area. There are also two parking garages and one large municipal parking lot.

Figure 4.15 Abandoned building in Area E

The Telegram and Gazette in the northern section generates a high parking demand. They supply their own parking with a two-story parking lot in block E7, just south of the building. The Franklin tower located in block E9 creates a large parking demand as well. There are two large parking garages located in the northern section of Area E.

The demand in the northern section is higher than the demand in the southern. The YWCA, Registry of Motor Vehicles, The Regency Hotel, and the Madison Place Plaza produce large amounts of demand as well. All of these businesses supply their own parking lots.

The southern end of Area E has a lower parking demand. There are a few abandoned buildings in blocks E13 and E14, shown in figures 4.15 above and 4.16 below, have parking lots that are also abandoned. There are also two large parking lots located next to the Worcester Bus Station and Coney Island Hot Dog.

There are two parking garages located in Area E. The Federal Municipal Parking Garage located in block E2 produces a capacity of 511 parking spaces. There are approximately 140 spaces available on any day of the week. UMass Medical Health Care Group employees and patients as well as small business employees in the area park in the Federal Municipal Garage.

The Austin Murray Garage located in block E8 has a capacity of 300 spaces. The garage is approximately 80% full at any given time. This garage provides parking for the Franklin Tower located in block E9. Public parking is also available in this garage.

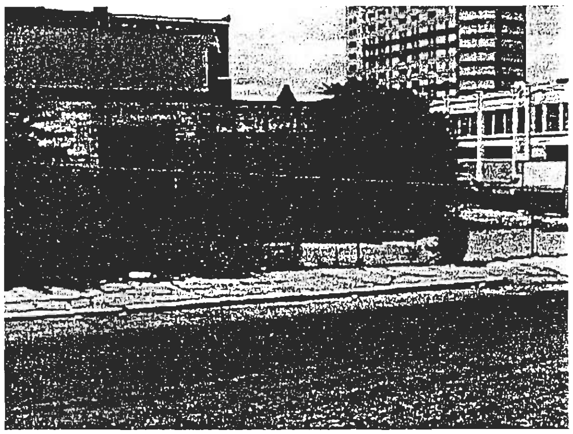
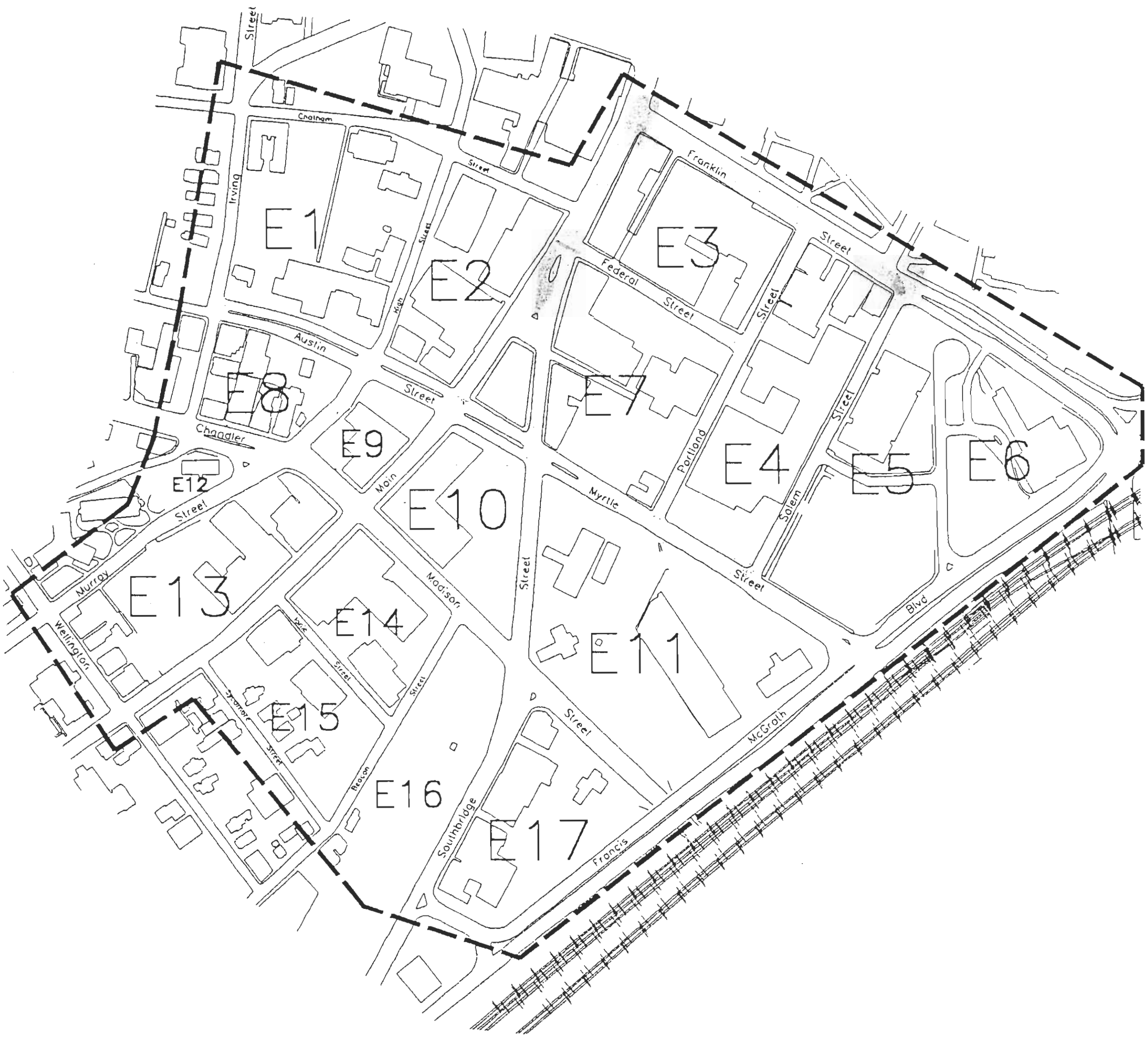


Figure 4.16 Abandoned Building and Parking Lot in Area E

Table 4.5 shows the parking demand and parking occupancy of Area E. The total demand for this area is 2303 while the total supply is 3579 parking spaces. The table shows that between 27-89% of the parking spaces are occupied, with at least five blocks in this are having less than 50% of their parking spaces occupied. This shows that there is more than enough parking supply to meet demand.



City of Worcester
DPW – Traffic Eng.

Central Business District
Area E Blocks

Scale NTS	PRG, EBM

Block No.	Supply**	Occupancy				Demand*	
		Morning		Afternoon			
E1	297	189	64%	157	53%	53	18%
E2	521	374	72%	378	73%	311	60%
E3	64	48	75%	55	86%	520	813%
E4	143	108	76%	111	78%	475	332%
E5	329	174	53%	143	43%	0	0%
E6	123	87	71%	68	55%	0	0%
E7	399	357	89%	357	89%	212	53%
E8	320	257	80%	256	80%	67	21%
E9	17	9	53%	10	59%	33	194%
E10	131	116	89%	83	63%	30	23%
E11	432	232	54%	281	65%	234	54%
E12	22	6	27%	3	14%	25	114%
E13	214	57	27%	43	20%	82	38%
E14	35	28	80%	23	66%	75	214%
E15	120	24	20%	15	13%	76	63%
E16	180	159	88%	133	74%	9	5%
E17	232	54	23%	84	36%	101	44%
Totals	3579	2279	64%	2200	61%	2303	64%

*based on City of Worcster zoning regulations, see Table 3.1
**on and off street parking

Table 4.5 Parking Supply, Demand, and Occupancy for Area E

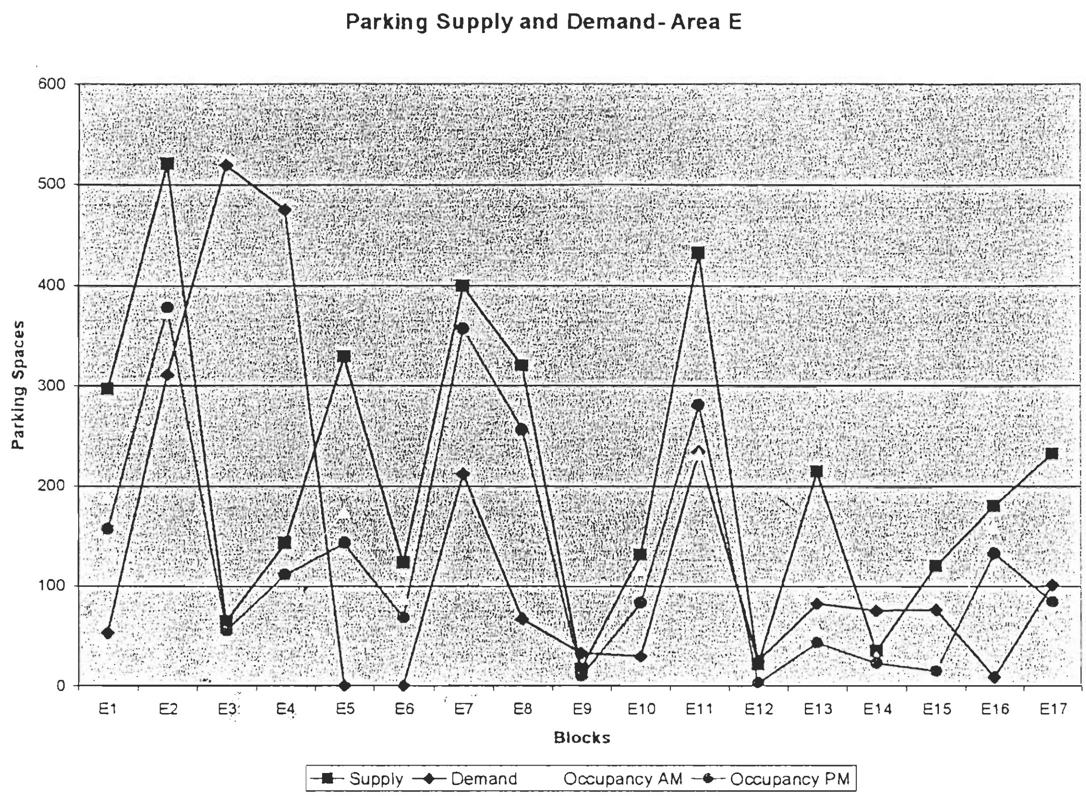


Figure 4.18 Parking Supply, Demand, and Occupancy for Area E

5. Centrum Events

The Worcester Centrum is located in area D. When there is a Centrum event being held, there is a large parking demand. The Centrum has a capacity of over 14000 people that will produce a demand of about 4000 parking places. Parking demand was determined assuming that the Centrum has a sold out show. Most events occur at night and rarely will there be an event during the day. The Centrum, shown in Figure 5.1 at left, hosts numerous concerts and is the home arena of the Worcester Ice Cats.

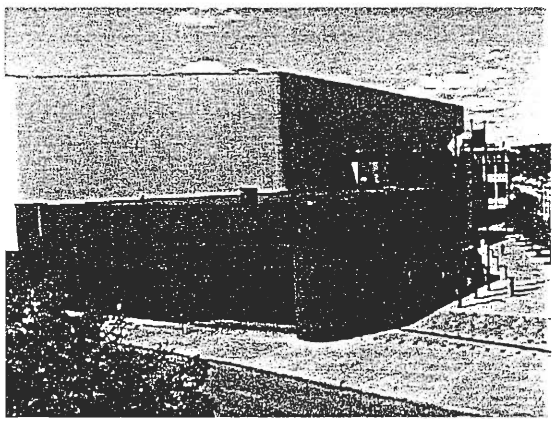


Figure 5.1 Worcester Centrum

Parking for the Centrum is spread out over the CBD. Area D does not supply enough parking for a Centrum event. The two Outlet Garages only provide about 2800 parking spaces. There is one surface parking lot in area B that supplies over 300 parking spaces and these are available for Centrum parking. The Worcester Pearl Elm Garage and the Fleet Garage also provide parking for a Centrum event. In the evening, these garages will mostly be empty because the businesses using the garages during the day are closed at night. Many private parking lots in areas not usually open to the public become available during a Centrum event. This helps alleviate the parking problem.

Other parking demand situations also have to be taken into account. Mechanics Hall and the Paladium can also be having an event during a Centrum event. This will cause an overall parking deficit in the CBD. Mechanics Hall has a capacity of approximately 2000 people and the Paladium has a capacity of about 2300 people. These two buildings will generate a demand of about 1000 spaces if both are filled with people to capacity. If Mechanics Hall, the Paladium, and the Centrum were filled to capacity with people at the same time, there would be an overall parking deficit in the Centrum area. However, events are usually scheduled around each other and this situation would rarely if ever occur. In addition, the new medical center will be supplying two more garages that will provide over 3000 parking spaces. This should help the parking situation during a Centrum event.

6. Future Developments

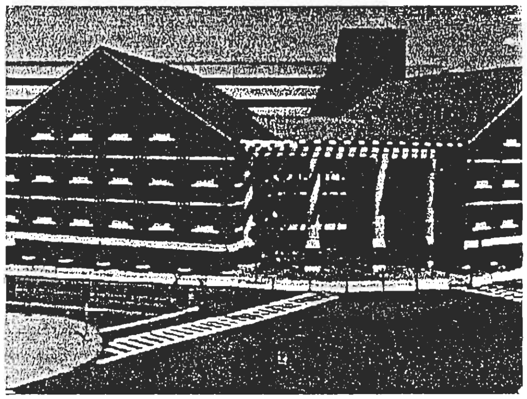


Figure 6.1 The New Medical City Complex

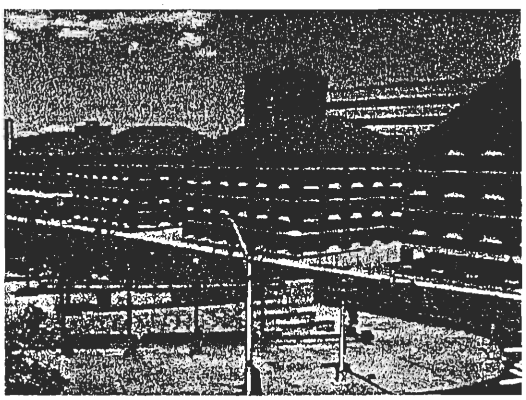


Figure 6.2 The New Medical City Complex

A new medical complex called The Fallon/St. Vincent Medical City is under construction in the CBD at this time and is scheduled to open in the fall of 1999. This medical center, shown at left, is located in Areas B and D (specifically blocks D4 and B11). It has an estimated 683, 415 square feet of floor space and 379 beds for patients. Two garages are being built in conjunction with the medical center. One garage will supply approximately 1500 parking spaces for the medical center itself and the other will be a municipal garage supplying an estimated 1000 parking spaces for public use.

7. Summary

The parking supply, demand, and occupancy totals are shown in Table 7.1. Overall, there is a parking surplus in the Worcester Central Business District. Only a few areas in the CBD have a deficit. Some of the spaces may be undesirable due to the locations, price, or distance, but the spaces do exist.

There are a few parking problems in the Worcester CBD. The courthouse area located in Area A has a large parking deficit because the courthouse does not provide enough parking spaces for its demand. The Highland Municipal Parking Lot and the on-street parking located near the courthouse are usually filled to capacity. Area B has a parking deficit in block B2 and B4. Block B2 contains the Worcester Police Station and Block B4 contains a few office buildings. The parking spots are filled to capacity and there are illegally parked cars. Area C has an overall parking deficit. There are many large office buildings in the area that produce high rates of demand. However, even though there is a parking deficit, parking spaces do exist. The reason for this could be that some of the office buildings may be vacant. The only other area that has a parking problem is the area around the Centrum during a large Centrum event. The Worcester Center Garages are filled to capacity during events. The new municipal parking garage being built next to the new medical center should help alleviate the parking needs during a Centrum event.

The entire area overall has a parking surplus. On-street parking is harder to find in the Worcester CBD, but its there. There are plenty of garages and parking lots to fulfill Worcester's parking needs. Table 7.1 and Figure 7.1 shows the total parking supply, demand, and occupancy for the entire CBD. The Worcester CBD has a total of 15170 parking spaces. Approximately 68% of the parking spaces are occupied in the morning and about 65% are occupied in the afternoon. The amount of parking spaces available is less than the parking demand. Figure 7.2 displays the percentages of types of parking available in each area.

Area	Supply**	Occupancy				Demand*	
		Morning		Afternoon			
A	2185	1793	82%	1661	76%	1724	79%
B	2083	1560	75%	1463	70%	2942	141%
C	2932	2258	77%	2251	77%	5945	203%
D	4391	2398	55%	2361	54%	5653	129%
E	3579	2279	64%	2200	61%	2303	64%
Totals	15170	10288	68%	9936	65%	18567	122%

*based on City of Worcester zoning regulations, see Table 3.1
**on and off street parking supply

Table 7.1 Parking Supply, Demand, and Occupancy for the CBD

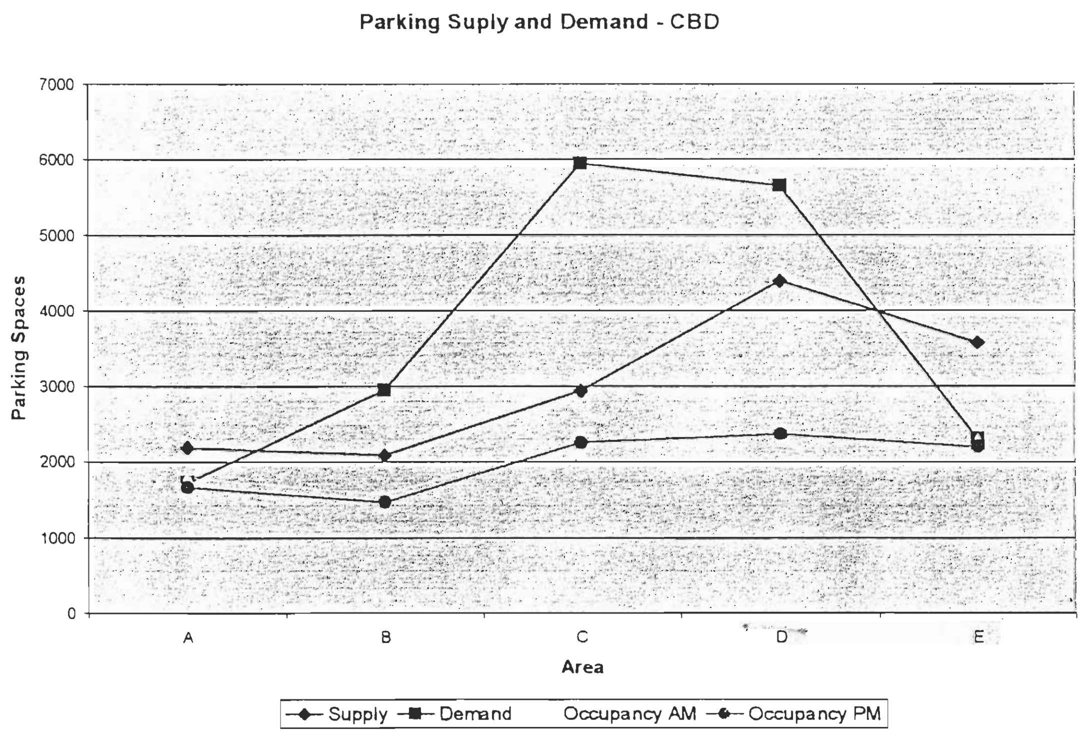


Figure 7.1 Parking Supply, Demand, and Occupancy for the CBD

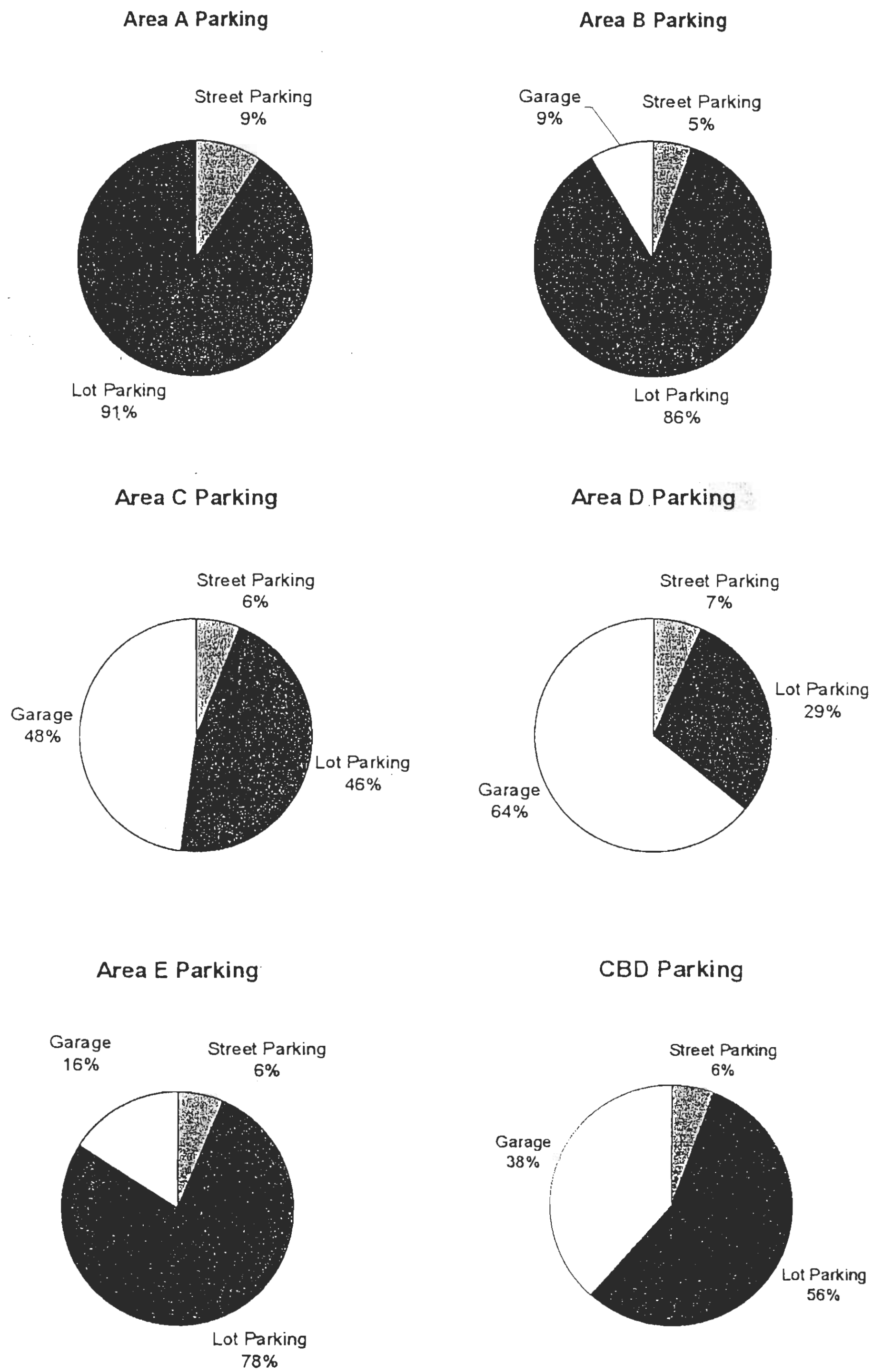


Figure 7.2 Percentages of types of parking in each area

7. Conclusion

Outside of a parking deficit occurring if the Centrum were having a major event during the weekday hours, there is sufficient parking in the CBD to meet the current demand. Spaces may be located at a distance from the desired location, however, they do exist. For example Area C shows a deficit in parking supply, but parking is available to meet its demands, in other areas of the CBD. There are some shortages, such as the courthouse block and the Crowne Plaza Hotel during a banquet, but these occur in the immediate area of these sites. Adequate parking is otherwise available in the CBD within reasonable walking distance. All new developments in the CBD should supply sufficient parking to meet its own demand as well as replace any parking that the new developments take away. The new Medical City complex is providing its own garage parking as well as a city owned garage available for public use.

It is believed that one of the factors is the availability of parking and reasonable rates that makes Worcester an attractive area for new developments. The continuation of the current parking situation is important to the economy and viability of the city.

APPENDIX A: PARKING STUDY METHODS

A.1 Parking Lots

Worcester C.B.D. Parking Study
Area A

ID	location	# spaces	# handi	am	# empty	pm	#empty	lot description
1	Highland St.	102	2	10:15	0	1:55	0	public unrestricted
2	Highland St.	14	0	11:10	3	2:20	4	private employee
3	Highland St.	12	1	11:10	3	2:18	2	private employee
4	Lancaster	8	0	11:15	1	2:20	1	private residential
5	Lancaster	10	0	11:15	9	2:20	8	private residential
6	Lancaster	5	0	11:15	4	2:21	5	private residential
7	Lancaster	6	0	11:15	3	2:21	5	private residential
8	Lancaster	7	0	11:15	4	2:22	5	private residential
9	Lancaster	9	0	11:15	1	2:22	4	private residential
10	Lancaster	2	0	11:15	1	2:23	0	private residential
11	Harvard	49	1	11:00	10	2:16	28	private employee
12	Dix St	22	0	11:00	1	2:15	4	private customer
13	Harvard	54	0	11:05	14	2:17	12	private employee
14	Dix St	2	0	9:30	2	2:30	2	private residential
15	Lancaster	18	0	11:25	7	2:35	8	private employee
16	Lancaster	37	1	11:25	16	2:36	21	private employee
17	Lancaster	7	0	11:25	4	2:37	6	private customer
18	Chestnut	86	0	9:30	21	1:15	24	private employee
19	Chestnut	52	0	9:30	8	1:16	11	private employee
20	Chestnut	10	0	9:30	3	1:17	5	private employee
21	Sudbury	37	0	9:30	0	1:17	3	private employee
22	Harvard	68	0	9:40	2	1:20	8	private employee
23	Harvard	15	0	9:40	5	1:22	8	private employee
24	Lancaster	14	0	9:45	9	1:22	8	private employee
25	Williams	no park						
26	Lancaster	12	0	9:50	7	1:25	9	private residential
27	Sudbury	6	0	10:00	0	1:30	1	private employee
28	Harvard	222	4	10:00	21	1:35	45	private employee
29	Sudbury	105	0	10:15	16	1:54	21	private employee
30	Harvard Place	36	0	10:10	13	1:50	12	private customer
31	Harvard Place	6	0	10:15	3	1:52	2	private residential
32	George	18	0	10:15	6	2:00	11	private employee
33	George	4	0	10:15	0	2:00	0	private residential
34	George	12	0	10:20	0	2:01	2	private employee
35	George	20	0	10:25	8	2:02	12	private employee
36	Main	30	1	10:30	9	2:03	14	private customer
37	Main	110	3	10:30	27	2:05	38	private restricted
38	Walnut	74	0	10:45	17	2:07	18	private employee
39	Harvard	4	0	11:00	0	2:16	0	private employee
40	Harvard	14	0	11:10	6	2:17	5	private customer
41	Dix St	12	0	11:15	0	2:30	1	private employee
42	Harvard	20	1	11:30	2	2:40	11	private customer
43	Harvard	2	0	11:30	2	2:40	1	private customer
44	Harvard	22	0	9:35	3	1:57	3	private restricted

45	George	50	3	9:35	17	2:00	5	private restricted
46	George	4	0	9:40	2	2:02	1	private customer
47	Harvard	7	0	9:40	2	2:02	1	private customer
48	Main	10	0	9:40	6	2:10	0	private customer
49	Main	37	1	9:45	15	2:10	17	private customer
50	Main	20	1	9:45	10	2:10	6	private customer
51	Main	18	0	9:50	7	2:12	6	private residential
52	State	60	0	9:50	26	2:15	37	private restricted
53	State	50	0	10:00	4	2:15	17	private restricted
54	Main	56	0	10:00	2	2:20	0	private employee
55	Main	22	0	10:00	0	2:20	0	private employee
56	Highland St.	120	7	10:00	0	2:25	3	private customer
57	Harvard	24	0	10:15	0	2:25	0	private employee
58	Harvard	51	0	10:15	0	1:55	0	private customer
59	Harvard	30	0	10:20	0	1:55	0	private customer
60	State	8	0	11:15	3	2:00	3	private residential

Totals	1942	26		365		484

Worcester C.B.D. Parking Study
Area B

ID	location	# spaces	# handi	am	# empty	pm	#empty	lot description
1	Thomas	72	2	10:40	33	2:30	26	private customer
2	School	103	3	10:40	0	2:32	1	private employee
3	Union	53	1	10:45	0	2:35	2	private customer
4	Union	11	0	10:45	0	2:36	2	private customer
5	Union	50	0	10:47	17	2:40	17	private customer
6	Market	44	0	10:50	0	2:40	0	private employee
7	Market	19	0	10:50	1	2:40	4	private employee
8	School	32	0	10:55	19	2:45	17	private employee
9	School	103	4	11:00	9	2:45	17	private employee
10	School	151	4	11:05	75	2:50	93	private customer
11	Goldsberry	12	0	11:10	8	2:50	7	private customer
12	Belmont	221	4	11:25	0	3:00	0	private employee
13	Worc Cent Blvd	60	0	11:30	9	3:00	0	private employee
14	Exchange	151	0	11:30	0	2:41	22	private employee
15	Central	13	0	11:30	13	2:40	13	private customer
16	Exchange	68	0	11:30	16	2:45	20	private employee
17	Central	361	9	11:50	192	2:40	207	public unrestricted private ownership
18	Commercial	30	0	11:40	9	2:50	11	private employee
19	Worc Cent Blvd	81	0	11:45	35	2:50	54	private employee
20	School	42	0	11:46	34	2:50	28	private employee
21	School	34	0	11:50	15	2:50	15	private employee
22	Worc Cent Blvd	14	6	11:50	0	2:55	0	private employee

Totals	1725	33		485		556

Worcester C.B.D. Parking Study
Area C

ID	location	# spaces	# handi	am	# empty	pm	#empty	lot description
1	Cedar St	41	0	9:20	20	2:30	22	private employee
2	Lancaster	9	0	9:20	7	2:30	5	private employee
3	Elm St	68	0	9:25	0	2:35	2	private employee
4	Chestnut	23	1	9:30	0	2:35	0	private employee
5	Chestnut	16	0	9:30	2	2:25	1	private employee
6	Maple Ter.	111	9	9:30	12	2:35	15	private employee
7	Elm St	43	0	9:30	10	2:35	12	private employee
8	Elm St	12	0	9:40	7	2:40	7	private employee
9	Maple Ter.	13	0	9:40	2	2:40	2	private employee
10	Pleasant St.	2	0	10:00	0	2:10	2	private customer
11	Chestnut	2	0	10:00	0	2:10	2	private employee
12	Chestnut	30	2	10:10	24	2:05	25	private restricted
13	Chestnut	14	0	10:10	8	2:05	9	private residential
14	Lancaster	107	4	10:15	45	2:05	41	private restricted
15	Pleasant St.	35	1	10:15	13	2:10	14	private customer
16	Pleasant St.	4	0	10:15	0	2:05	0	private residential
17	Chestnut	61	3	10:20	18	2:15	20	private employee
18	Pearl St	26	0	10:30	11	2:20	13	private residential
19	Pearl St	29	0	10:30	7	2:20	6	private employee
20	Main St	17	1	10:30	9	2:20	3	private customer
21	Pleasant St.	3	0	10:30	1	2:20	1	private residential
22	Pleasant St.	2	0	10:35	0	2:15	0	private employee
24	Pleasant St.	69	0	10:40	33	3:00	38	private employee
25	Aldrich St.	12	0	10:40	8	3:00	7	private employee
26	Clinton St	2	0	10:40	0	3:00	0	private employee
27	Clinton St	8	0	10:40	6	3:00	4	private residential
28	Clinton St	18	0	10:40	10	3:00	7	private residential
29	Clinton St	16	0	10:40	1	3:00	5	private customer
30	Chatham	37	0	10:50	33	2:55	37	private employee
31	Chatham	37	0	10:50	6	2:55	22	private employee
32	Aldrich St.	17	0	10:55	3	2:50	4	private employee
33	Aldrich St.	2	0	10:55	0	2:50	0	private customer
34	Aldrich St.	37	4	11:00	2	2:50	7	private employee
35	Chatham	34	0	11:00	7	2:50	7	private restricted

Totals	957	25		305		340

Worcester C.B.D. Parking Study
Area D

ID	location	# spaces	# handi	am	# empty	pm	#empty	lot description
1	Waldo St	80	3	10:15	24	2:30	27	private employee
2	Waldo St	6	0	10:15	0	2:25	3	private employee
3	Exchange St	6	0	10:15	3	2:25	4	private employee
4	Foster St	107	4	10:15	49	2:30	58	private employee
5	Norwich St	12	0	10:20	2	2:30	7	private employee
6	Commercial St	4	0	10:25	1	2:45	1	private employee
7	Commercial St	15	0	10:25	2	2:35	7	private employee
8	Main St	36	0	10:30	11	2:40	11	private employee
9	Mechanic St	4	0	10:35	0	2:35	2	private employee
10	Mechanic St	4	0	10:35	2	2:35	2	private employee
11	Franklin St	43	2	10:50	34	2:50	32	private restricted
12	Franklin St	196	2	10:50	194	2:50	193	private employee
13	Washington Sq.	26	1	11:00	17	3:00	17	private empoyee
14	Washington Sq.	15	0	11:00	12	3:00	14	private employee

Total					
554	12		351		378

Worcester C.B.D. Parking Study
Area E

ID	location	# spaces	# handi	am	# empty	pm	#empty	lot description
1	Madison St.	28	0	9:40	17	1:30	17	private customer
2	Southbridge St	20	0	9:45	7	1:30	10	private employee
3	Southbridge St	158	5	9:50	136	1:35	106	private restricted
4	Southbridge St	8	0	9:50	6	1:35	4	private customer
5	Southbridge St	21	1	9:55	8	1:35	8	private customer
6	Madison St.	144	0	9:55	0	1:40	26	private employee
7	Madison St.	0	0	0:00	0	0:00	0	private customer
8	Beacon St	12	0	10:00	0	1:40	2	private restricted
9	Ionic St	18	0	10:00	7	1:45	9	private customer
10	Ionic St	90	2	10:05	87	1:45	89	private restricted
11	Sycamore St	6	0	10:10	4	1:45	4	private residential
12	Sycamore St	4	0	10:10	2	1:45	2	private residential
13	Sycamore St	1	0	10:10	1	1:45	0	private residential
14	Main St	12	0	10:10	2	1:50	7	private employee
15	Main St	16	0	10:00	4	1:50	2	private customer
16	Wellington St	5	0	10:15	3	1:50	3	private employee
17	Murray St	4	0	10:15	1	1:50	2	private customer
18	Murray St	157	4	10:20	145	1:50	148	private employee
19	Murray St	13	1	10:20	10	1:55	12	private residential
20	Murray St	8	0	10:20	6	1:55	7	private customer
21	Irving St	6	0	10:25	2	1:55	2	private employee
22	Murray St	10	0	10:30	1	2:00	2	private customer
23	Chandler St	10	0	10:35	8	2:00	7	private customer
24	Madison St.	3	3	10:40	0	2:00	17	private customer
25	Madison St.	0	0	0	0	2:05	17	garage
26	Southbridge St	78	3	10:40	0	2:05	14	private customer
27	Southbridge St	143	2	10:45	67	2:15	35	private customer
28	Madison St.	20	0	10:50	7	2:15	3	private customer
29	Madison St.	201	6	10:55	73	2:20	62	private customer
30	Myrtle	60	0	11:00	53	2:20	51	private customer
31	Irving St	33	0	9:45	24	2:20	23	private employee
32	Irving St	150	0	9:50	31	2:25	54	private employee
33	High St	81	2	9:50	42	2:30	51	private restricted
34	Austin St	22	0	9:55	4	2:30	4	private employee
35	Austin St	6	0	9:55	5	2:30	6	private employee
36	Federal St	20	2	10:10	7	2:40	6	private employee
37	Federal St	262	1	10:15	30	2:45	29	private employee
38	Portland St	85	0	10:20	7	2:45	13	private employee
39	Myrtle St	40	0	10:25	9	2:45	15	private employee
40	Portland St	33	0	10:25	4	2:50	4	private employee
41	Portland St	24	0	10:25	6	2:50	3	private customer
42	Franklin St	3	0	10:30	1	3:00	1	private employee
43	Franklin St	3	0	10:30	1	3:00	3	private employee
44	YWCA Way	13	0	10:40	4	3:05	12	private employee
45	McGrath/Salem	286	8	10:40	136	3:00	164	public unrestricted
46	YWCA Way	106	6	10:45	31	3:05	51	private restricted
47	Franklin St	11	0	10:50	5	3:05	4	private employee

48	YWCA Way	12	1	10:50	7	3:10	2 private employee
49	Salem St	13	1	10:00	7	2:50	3 private customer
50	Salem St	12	0	10:00	2	3:00	1 private residential

Total	2471	48		1020		1117

A.2 On-Street Parking

Worcester Central Business District

Area A Street Side Parking

Location	Side	From	To	Description	AM	# Spaces	# Empty	PM	# Empty
A1									
Cedar	North	Lancaster	Chestnut	NPA					
Lancaster	East	Cedar	William	NPA					
Lancaster	East	Cedar	John	NPA					
William	North	Lancaster	Chestnut	NPA					
William	South	Lancaster	Chestnut	NPA					
Bowdoin	South	Lancaster	Chestnut	NPA					
Bowdoin	South	Chestnut	Harvard	NonMeter 1hr 85ft	9:45	5	0	2:15	0
Bowdoin	North	Lancaster	Chestnut	NPA					
Bowdoin	North	Chestnut	Harvard	NPA					
Chestnut	West	Bowdoin	William	4 Meter 2hr	9:45	4	0	2:15	1
Chestnut	West	William	Cedar	6 Meter 2 hr	9:45	6	0	2:15	0
Chestnut	East	Bowdoin	Walnut	NPA					
Harvard	West	Bowdoin	Walnut	NPA					
Sudbury	North	Harvard	Chestnut	NP 7am6pm 75ft					
Sudbury	South	Harvard	Chestnut	NPA					
Walnut	North	Harvard	Chestnut	NP 7am6pm 68ft					
A2									
Harvard	East	Walnut	Sudbury	4 Meter 2hr	9:50	4	1	2:20	0
Harvard	East	Sudbury	Harvard Pl	9 Meter 2hr	9:50	9	1	2:20	1
Harvard	East	Harvard Pl	George	5 Meter 1hr	9:50	5	2	2:20	2
George	South	Harvard	Main	NPA					
Harvard Pl	N/S	Harvard	Dead End	NPA					
Eden	West	George	Walnut	NPA					
Eden	East	George	125ft South of George	NPA					
Eden	East	125 South of George	Sudbury	NonMeter Unlimited 520ft	10:00	26	0	2:30	0
Eden	East	Sudbury	Walnut	NPA					
Sudbury	N/S	Harvard	Eden	NPA					
Sudbury	South	Eden	Main	NPA					

Sudbury	North	Eden	80ft East of Eden	Private 2marked spaces	10:30	2	2	2:30	2
Sudbury	North	80ft East of Eden	Main	Private 180ft	10:30	9	2	2:30	3
Main	West	George	Sudbury	11 Meter 30min	10:10	11	1	2:10	4
Main	West	Sudbury	Walnut	3 Meter 30min	10:10	3	0	2:10	1
Walnut	North	Main	Eden	NPA					
Walnut	North	Harvard	Eden	NP 7am6pm 230ft					
A3									
Lancaster	East	Highland	Dix	Uncontrolled 364ft	10:15	18	1	2:30	6
Higland	South	Lancaster	Main	NPA					
Harvard	West	Highland	Dix	1hr Meter	10:30	22	4	2:30	0
Harvard	East	Highland	State	2hr Meter	10:30	12	2	2:30	0
State	North	Harvard	Main	2hr Meter	10:30	10	1	2:33	3
Main	West	Higland	State	2hr Meter	10:30	11	1	2:30	0
Dix	N/S	Lancaster	Harvard	NPA					
A4									
Lancaster	East	Dix	John	NPA					
Harvard	West	John	Dix	175ft NonMeter 7am6pm					
George	N/S	Harvard	Main	NPA					
Harvard	East	George	State	2hr Meter	10:30	16	3	2:30	5
State	South	Harvard	Main	2hr Meter	10:30	10	1	2:30	7
Main	West	State	Gertrude	80ft 10min 6am7pm	10:30	4	3	2:30	4
Main	West	Gertrude	George	1hr Meter	10:30	12	2	2:30	2
						199	27		41

Worcester Central Business District

Area B Street Side Parking

Location	Side	From	To	Description	AM	# Spaces	# Empty	PM	# Empty
Goldsberry	west	Washington Circle	Belmont	NPA	3 illegally parked cars				
WCB	E/W	Belmont	Foster	NPA					
Union	east	School	Belmont	unrest. 121 ft.	9:30	6	0	2:20	0
Market	north	Union	Goldsberry	NPA (painted over sign) 117 ft.	9:30	6	0	2:20	0
Market	south	Union	Goldsberry	unrest. 133 ft.	9:30	7	0	2:20	0
School	north	WCB	railroad tracks	unrest. 116 ft.	9:20	7	0	2:20	0
School	south	WCB	railroad tracks	unrest. 205 ft.	9:20	9	0	2:20	0
School	N/S	railraod tracks	Goldsberry	NPA					
Union	west	School	Belmont	parking lot					
School	north	WCB	Main	2 hr. meter	9:30	7	0	2:20	3
School	south	WCB	Main	2 hr.meter	9:30	5	0	2:20	5
Thomas	north	WCB	Main	2 hr. meter	9:45	9	3	2:20	6
Thomas	south	WCB	Main	NPA					
Main	east	Thomas	School	1 hr. meter	9:45	9	1	2:20	8
Main	east	School	Belmont	2 hr. meter	10:00	27	1	2:20	11
Commercial	east	Thomas	Central	NPA					
Commercial	west	Thomas	Central	2 hr. meter	10:15	8	5	2:20	5
Commercial	east	Central	Exchange	2 hr. meter	10:15	3	3	2:20	3
Commercial	west	Central	Exchange	2 hr. meter	10:15	10	0	2:20	1
Central	N/S	Main	Commercial	NPA					
Exchange	N/S	Main	Commercial	NPA					
Main	east	Central	Thomas	2 hr. meter	10:15	1	0	2:20	0
Main	east	Central	Thomas	2 hr. handicap meters	10:15	3	3	2:20	2
Main	east	Exchange	Central	2 hr. meter	10:15	8	2	2:20	0
Central	N/S	WCB	Summer	NPA					
Thomas	N/S	WCB	Summer	NPA					
School	N/S	WCB	Summer	NPA					
						125	18		44

Worcester Central Business District

Area C Street Side Parking

Location	Side	From	To	Description	AM	# Spaces	# Empty	PM	# Empty
Lancaster	East	Cedar	Pleasant	NPA					
Irving	East	Pleasant	Chestnut	2hr Meter	9:30	9	8	1:50	8
Irving	East	Pleasant	Chestnut	Private Residential Parking	9:30	5	2	1:50	5
Chestnut	North	Irving	Aldrich	2hr Meter	9:30	12	9	1:50	7
Chestnut	South	Irving	Aldrich	2hr Meter	9:30	13	11	1:50	3
Clinton	West	Chestnut	Pleasant	64ft 1hr Unrest. 8am4pm	9:30	3	2	1:50	3
Clinton	East	Chestnut	Pleasant	NPA					
Pleasant	South	Irving	Clinton	2hr Meter	9:45	3	2	2:00	2
Pleasant	South	Clinton	Chestnut	1hr Meter	9:45	6	3	2:00	0
Pleasant	North	Irving	Chestnut	NPA					
Aldrich	E/W	Chatham	Chestnut	NPA					
Pleasant	South	Chestnut	Main	NPA					
Pleasant	North	Chestnut	Main	30 Minute Meter	9:45	14	10	2:00	4
Pleasant	North	Chestnut	Main	Handicap 38ft	9:45	2	1	2:00	0
Main	West	Pleasant	Chatham	40ft NPA 7am6pm					
Chatham	North	Main	Aldrich	1hr Meter	10:00	14	5	2:00	7
Chatham	North	Aldrich	Lancaster	Handicap 32ft	10:00	2	1	2:00	0
Aldrich	East	Chatham	Chestnut	Handicap 20ft	10:00	1	1	2:00	1
Elm	N/S	Lancaster	Main	NPA					
Elm	South	Corner of Main	Corner of Main	30 Minute Meter	10:20	5	1	2:15	0
Main	West	Elm	Pearl	NPA 7am6pm 116ft					
Main	West	Pearl	Pleasant	95ft 15 Minute Parking	10:20	5	0	2:15	2
Pearl	South	Main	Chestnut	68ft 15 Minute Parking	10:25	3	3	2:15	3
Pearl	South	Main	Chestnut	30 Minute Meter	10:30	10	6	2:15	6
Pearl	North	Main	Chestnut	30 Minute Meter	10:30	12	7	2:15	7
Chestnut	East	Pleasant	Elm	NPA					
Chestnut	West	Pleasant	Elm	2hr Meter	10:30	10	0	2:15	4
Chestnut	East	Elm	Walnut	NPA					
Chestnut	West	Elm	Cedar	2hr Meter	10:45	5	0	2:45	0
Cedar	South	Lancaster	Chestnut	1hr Meter	10:40	10	6	2:50	10
Walnut	South	Chestnut	Maple Terrace	NPA					
Walnut	South	Maple Terrace	Main	125ft 10 Minute Parking	10:45	6	0	2:40	0

Main	West	Walnut	Maple Street	30 Minute Meter	10:45	3	0	2:40	0
Main	West	Maple Street	Elm	NPA					
Maple Street	North	Main	Elm	1hr Meter	10:45	9	0	2:45	1
Maple Street	south	Main	Elm	NPA					
Maple Terrace	West	Maple Street	Walnut	NPA					
Maple Terrace	East	Maple Street	Walnut	60ft Handicap	10:50	3	0	2:40	0
Maple Terrace	East	Maple Street	Walnut	1hr Meter	10:50	1	0	2:40	0
Maple Terrace	East	Maple Street	Walnut	NPA 7am6pm 128ft					
						166	78		73

Worcester Central Business District

Area D Street Side Parking

Location	Side	From	To	Description	AM	# Spaces	# Empty	PM	# Empty
Norwich	east	Mechanic	Foster	1 hr meter	9:40	7	0	3:00	1
Norwich	east	Mechanic	Foster	20 ft handicap	9:40	1	0	3:00	0
Norwich	west	Mechanic	Foster	1 hr meter	9:40	5	2	3:00	1
Foster	south	Main	Norwich	NPA					
Foster	north	Main	Norwich	NPA					
Main	east	Foster	Exchange	NPA					
Waldo	east	Exchange	Foster	30 min meter	9:40	5	3	3:00	4
Waldo	west	Exchange	Foster	30 min meter	9:40	3	3	3:00	3
Waldo	west	Exchange	Foster	1 hr meter	9:40	5	5	3:00	4
Waldo	west	Exchange	Foster	17 ft handicap	9:40	1	1	3:00	0
Foster	north	Main	Waldo	NPA					
Foster	north	Waldo	Commercial	1 hr meter	9:50	4	4	3:00	0
Commercial	west	Foster	Exchange	30 min meter	9:50	2	1	3:00	0
Commercial	west	Foster	Exchange	2 hr meter	9:50	9	5	3:00	7
Commercial	west	Foster	Exchange	22 ft handicap zone	9:50	1	1	3:00	1
Commercial	east	Exchange	Foster	2 hr meter	10:00	14	12	3:00	10
Foster	north	Commercial	WCB	1 hr meter	10:00	3	3	3:00	0
Foster	south	Commercial	WCB	294 ft handicap	10:10	15	9	3:00	5
Foster	south	Commercial	Norwich	1 hr meter	10:10	5	2	3:00	3
Commercial	west	Foster	Mechanic	156 ft15 min 6am7pm M-F	10:10	8	2	3:00	7
Commercial	west	Foster	Mechanic	70 ft handicap	10:10	7	0	3:00	0
Commercial	east	Foster	Front	NPA					
Commercial	west	Mechanic	Front	152 ft of 15 min 6am7pm M-F	10:15	8	4	3:00	7
Front	north	Commercial	Main	30 min meter	10:20	13	2	3:00	12
Front	south	Commercial	Main	40 ft handicap	10:15	2	0	3:00	0
Main	east	Front	Mechanic	111 ft NP 7am6pm M-F					
Main	east	Mechanic	Foster	180 ft NP M-F					
Mechanic	north	Main	Norwich	1 hr meter	10:20	6	0	3:00	0
Mechanic	north	Norwich	Commercial	1 hr meter	10:20	8	0	3:00	0
Mechanic	south	Main	Commercial	80 ft handicap	10:20	4	0	3:00	2
Mechanic	south	Main	Commercial	30 min meter	10:20	8	0	3:00	2
Franklin	north	WCB	Front	NPA					

Franklin	north	Front	Main	2 hr meter	10:30	6	0	2:50	0
Front	north	Commercial	Franklin	NPA					
Front	south	Commercial	Franklin	NPA					
						150	59		69

Worcester Central Business District

Area E Street Side Parking

Location	Side	From	To	Description	AM	# Spaces	# Empty	PM	# Empty
Portland	East	Myrtle	Federal	2hr Meter	9:15	15	3	2:40	0
Portland	East	Myrtle	Federal	Handicap 19ft	9:15	1	1	2:40	0
Portland	West	Myrtle	Franklin	15min 8am-6pm 150ft	9:15	8	2	2:40	1
Portland	East	Federal	Franklin	1hr Meter	9:15	13	2	2:40	1
Federal	North	Portland	Main	2hr Meter	9:20	6	2	2:45	0
Federal	North	Portland	Main	Handicap 20ft	9:20	1	1	2:45	0
Federal	North	Portland	Main	15min 8am-6pm 39ft	9:20	2	0	2:45	0
Federal	South	Portland	Main	2hr Meter	9:20	10	0	2:45	0
Federal	South	Portland	Main	15min 8am-6pm 75ft	9:20	3	0	2:45	0
Main	East	Federal	Franklin	30min 8am-4pm 158ft	9:20	8	2	2:45	1
Franklin	South	Main	Portland	15min 8am-6pm 45ft	9:30	2	0	2:45	0
Franklin	South	Main	Portland	1hr Meter	9:30	9	1	2:45	0
Franklin	South	Main	Portland	Handicap 20ft	9:30	1	1	2:45	1
Franklin	South	Portland	Salem	1hr Meter	9:30	5	2	2:45	1
Southbridge	East	Main	Myrtle	15min 8am-6pm 260ft	9:40	13	2	2:45	0
Library Ln	North	Salem	YWCA Way	30min Meter	10:00	9	8	2:40	8
Austin	North	Irving	High	NPA					
Austin	North	High	Main	30min 8am-6pm 59ft	10:10	3	0	2:45	0
Main	West	Austin	Chatham	30min Meter	10:10	7	4	2:45	0
Chatham	South	High	Irving	1hr Meter	10:15	3	2	2:45	2
Chatham	South	High	Irving	NPA 7am-6pm					
Chatham	South	Main	High	NPA					
Irving	West	Chatham	Austin	NPA					
YWCA way	N/S	Franklin	FJM	NPA					
Myrtle	N/S	Main	FJM	NPA					
Salem	E/W	Franklin	Myrtle	NPA					
Main	East	Federal	Madison	NPA					
Madison	North	Main	FJM	NPA					
Southbridge	E/W	Myrtle	Madison	NPA					
Southbridge	West	Main	Myrtle	U.S. Marshall Parking Only					
Southbridge	West	Madison	FJM	2hr Meter	9:10	14	13	2:15	13
Southbridge	East	Madison	FJM	2hr Meter	9:10	10	10	2:15	8

Southbridge	East	Madison	FJM	15min 8am-6pm 75ft	9:10	3	2	2:15	3
Wellington	East	Murray	Main	NPA					
Chandler	north	Murray	Irving	1hr meter	9:20	8	4	2:15	3
Murray	East	Austin	Chandler	1 hr meter	9:30	3	0	2:15	0
Murray	West	Austin	Chandler	1 hr meter	9:30	4	0	2:20	0
Murray	SE	Wellington	Madison	unrest (cut meters)	9:30	21	4	2:25	11
Main	NW	Wellington	Madison	135ft 15 min 8am6pm	9:30	7	0	2:30	5
Main	NW	Wellington	Madison	490ft NP 7am6pm xpt Sun/Hol	9:30	24			
Main	SE	Sycamore	Ionic	100 ft15 min 8am6pm	9:30	5	0	2:30	3
Main	SE	Ionic	Madison	92ft 15 min 8am6pm	9:30	5	0	2:30	1
Sycamore	NE	Main	Beacon	NPA					
Ionic	both	Main	Beacon	NPA					
Madison	south	Main	Beacon	NPA					
Austin	south	Irving	Murray	NPA					
Austin	south	Murray	Main	60ft 15min 8am6pm	9:30	4	0	2:15	0
Main	west	Chandler	Austin	NPA					
Irving	east	Austin	Chandler	NPA					
Chandler	north	Irving	Murray	NPA					
Beacon	east	Sycamore	Madison	NPA					
Madison	south	Beacon	McGrath	NPA					
						227	66		62

A.3 COMPUTER FILES

AutoCAD

Area A Blocks – drawing of Area A with blocks labeled
Area B Blocks – drawing of Area A with blocks labeled
Area C Blocks – drawing of Area A with blocks labeled
Area D Blocks – drawing of Area A with blocks labeled
Area E Blocks – drawing of Area A with blocks labeled
CBD Blocks – drawing of CBD with blocks labeled
CBD Parking Lots – drawing of CBD with off street parking labeled

Documents

Appendix – appendix cover page
Draft – main body of report
List of Tables – list of tables for report
Table of Contents – table of contents for report

Excel Files

Demand – calculations of parking demand in CBD
District Lots – supply and occupancy numbers for parking lots
District Street Parking – supply and occupancy numbers for on street parking
Figures – list of figures for report
Pie Charts – pie charts used in report
Assessors – building areas of CBD given by assessors office
Total Occupancy – calculated total parking in CBD

GIS

CBD – windows metafile exported from ArcView