Information Technology Workforce Assessment

An Interactive Qualifying Project Report

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by

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Abstract

Worcester has not fully experienced the information technology boom that has occurred just 20 miles away. By request of the Worcester InfoTech Corporation, we assessed the Worcester area workforce through interviews, archival research and existing data. We determined that a lack of skilled workers is not the determining factor of information technology businesses locating elsewhere. We recommend that Worcester needs to improve in several areas. Improvements in marketing and the regional airport are two aspects that could help to attract businesses.

Executive Summary

One of Massachusetts' greatest economic successes has been the growth of information technology cluster industries in the Boston area. Despite this huge local industrial growth, Worcester, though less than 20 miles away from these clusters, has experienced only modest growth. Perhaps surprisingly, Worcester is comparable to the Boston area in many ways. Along with its close geographic location, Worcester also offers excellent high-tech infrastructure, institutions of higher learning and available financial incentives.

The Worcester InfoTech Corporation is our sponsor for this project. This affiliate of the Worcester Regional Chamber of Commerce was created to promote the growth of the information technology economy in the Worcester area. The Worcester InfoTech Corporation is interested to see if the existing human resource skills are a deterrent to prospective information technology companies. There are no recent studies regarding the availability of a skilled workforce in the Worcester area. Our project provides information on this subject for future use by Mr. Thomas Ahern and the Worcester InfoTech Corporation.

Our main goal in this project was to determine if there are people in the Worcester area with the necessary skills to fill information technology related jobs. In order to accomplish this, we examined what types of skills companies are looking for now and also in the future. We interviewed a variety of information technology companies until we were able to gain a firm understanding of whether a skills gap exists, as well as what skills companies desire. We also looked at the region's educational facilities to see what

they are doing to help students prepare for the information technology field. In order to learn how students are being prepared for the IT industry, we interviewed a sample of personnel from the Worcester Public Schools, area private schools and institutions of higher learning. Additionally, we obtained certain demographic information from the Census 2000.

After conducting our interviews we were able to determine that there currently is not an information technology workforce skills gap in the Worcester area. Other factors appear to be a greater reason why the high-tech boom did not fully develop in Worcester. The City of Worcester has not marketed itself enough for businesses to be intrigued to locate here. Many businesses that may have located to Worcester had they known of all the advantages over the Route 128/I-495, did not locate their businesses here due to the lack of knowledge about Worcester.

There also appears to be a lack of cooperation between the city and companies. Many of the companies interviewed were not offered any tax incentives when locating here. Worcester does offer a full range of financing incentives and a Tax Incentive Financing (TIF) program. The fact that the city does offer these incentives but businesses do not know of them leads us to believe that there is a missing link with the communication of businesses and the City of Worcester. Also, the few companies that did know of these incentives stated that they were unfavorable to their business.

The Worcester Regional Airport could be a very positive selling factor for the City of Worcester. However, a lack of available flights and the high cost of these flights have forced area businesses to look towards other regional airports to fulfill their air transportation needs.

These three areas are the greatest factors that we have identified as in need of improvement. The City of Worcester now has a small idea of what needs to be done in order to attract information technology companies to the city. We concluded that there is an adequate supply of skilled workers in the area and recommended that other areas needed to be improved. When some of these needs are met, Worcester may be finally able to benefit greatly from the information technology boom of the Boston area.

Chapter I: Introduction

One of Massachusetts' greatest economic successes has been the growth of information technology cluster industries in the Boston area. Firms founded by Massachusetts Institute of Technology graduates generated over $53 billion in total sales in Massachusetts alone (MIT, 1997). This figure represents just one indication of the economic benefits that high technology industry clusters can provide to the local economy. Despite this huge local industrial growth, Worcester, though less than 20 miles away from these clusters, has experienced only modest growth. Perhaps surprisingly, Worcester is comparable to the Boston area in many ways. Along with its close geographic location, Worcester also offers excellent high-tech infrastructure, institutions of higher learning and available financial incentives.

Some of the highlights of Worcester's high-tech infrastructure include the availability of Internet2, citywide fiber optic networks, and available industrial property for lease or purchase. Worcester Polytechnic Institute heads the list of higher learning institutions in the area, which includes nine colleges and universities in Worcester alone. Financial incentives may take the form of tax breaks, government loans or grants. Property costs in the Worcester area are significantly lower than the Boston area, usually running $12-$18 per square foot in Worcester as opposed to $27-$35 per square foot in greater Boston (Metz, 2000). In spite of all these benefits, Worcester remains largely excluded from Massachusetts' recent economic success. This research is guided by the following question, "What has prevented information technology companies from locating in Worcester?" Is it a lack of human resource skills in the Worcester area? Is

there a shortage of available real estate? Perhaps it is simply the perception of Worcester. Our research is focused on the availability of a skilled workforce and determining if that is the limiting factor when companies are deciding where to locate.

The Worcester InfoTech Corporation is our sponsor for this project. This affiliate of the Worcester Regional Chamber of Commerce was created to promote the growth of the information technology economy in the Worcester area. The Worcester InfoTech Corporation is interested to see if the existing human resource skills are a deterrent to prospective information technology companies. There are no recent studies regarding the availability of a skilled workforce in the Worcester area. Our project provides information on this subject for future use by Mr. Thomas Ahern and the Worcester InfoTech Corporation.

Our main goal in this project was to determine if there are individuals in the Worcester area with the necessary skills to fill information technology related jobs. In order to accomplish this, we examined what types of skills companies are looking for now and also in the future. We interviewed a variety of information technology companies until we were able to gain a firm understanding of whether a skills gap exists, as well as what skills companies desire. We also looked at the region's educational facilities to see what they are doing to help students prepare for the information technology field. In order to learn how students are being prepared for the IT industry, we interviewed a sample of personnel from the Worcester Public Schools, area private schools and institutions of higher learning. Additionally, we obtained certain demographic information from the Census 2000. Once we gathered these statistical data

and conducted a content analysis, we used this information in addition to our earlier findings to validate our results.

The timing of our project with the Worcester InfoTech Corporation is ideal. With the present national economy, not many companies are looking to expand or relocate. Our project will be beneficial to Mr. Ahern and the InfoTech Corporation, when the economy recovers and companies might look to Worcester to locate. When the companies ask about the availability of a skilled workforce, the InfoTech Corporation can present to them our findings. It will either state that Worcester is capable of supporting additional businesses, or if not, the efforts that have been made in order to support these additional companies. Our project allowed us to present our findings to the Worcester InfoTech Corporation as well as to the educational facilities and suggest what they need to do for their students and local businesses in order to be successful.

Our report takes the form of an Interactive Qualifying Project (IQP). The IQP is a degree requirement of Worcester Polytechnic Institute (WPI) and allows students to explore how science and technology affect society. We begin with our literature review, which is a compilation of our background research. Next, we discuss the process by which we collected data to answer our question. We also included a summary of our project, its goals, and our results. Finally, we present our conclusion and recommendations for future action.

Chapter II: Literature Review

The literature review focuses on background, theoretical and conceptual information relevant to our study. First, we examine the high technology industry boom along Route 128 and Interstate 495 in Massachusetts. In this section, a history of the economic boom along these highway routes will be examined, as well as its origin. We then define information technology. Next, we will analyze the existing infrastructure in Worcester. After we examine this topic, we explore the reasons why high tech industries cluster in a particular region. We will take a look at the factors that these cluster industries considered when choosing a location to perform their business. Finally, we study the process companies go through in order to find the skilled labor they seek. We conducted our literature review by examining dozens of resources, including literature provided by the Worcester InfoTech Corporation, previous studies available online and various other library resources.

2.1. History of the high-tech boom along Route 128 and Interstate 495

> "There were once the far-flung outposts of Boston: Franklin, Hopkinton, and Stow. There, old farmhouses rose out of vast swaths of lush greenery and townsfolk moved to a slower beat. Grocery shopping was a social event, where people saw a familiar face in every aisle. Main Street knew no stoplights." [1]

[1](Rodriguez, 2001, p.1)

This was the sight that could be seen long before the emergence of the economic boom along Route 128 and Interstate 495 in eastern Massachusetts. Beginning in the early 1960s, miles and miles of concrete and asphalt began to fill the lands. Suddenly, these towns were no longer the quiet, farmland towns they used to be. What once were big lawns and quiet streets in rural towns were being transformed into sprawling Boston suburbs. During the 1990s, the decade that witnessed the largest population increase since World War II, about a quarter of the population increase in Massachusetts occurred along I-495. With research and high-tech companies developing at every turn, thousands of people migrated from the city to settle around these developing areas. The recent high technology industry growth that has taken place along Route 128 and I-495 symbolize the "new" New England; a region where people are no longer working in the factories, farms and fishing fleets that once defined communities.

Boston's high-technology boom started during the post-World War II period, when the federal government granted universities such as MIT and Harvard billions of dollars to develop war-related technologies (Kovatch, 1998). MIT performed more military research than any other university in the nation. Thus, it received the dominant share of funding from the Office of Scientific Research and Development during the 1940s and 1950s. The economic boom in Boston was a direct result of MIT's war-related research and reputation as a world leader in information technology development (Judge, 1997).

So what caused Route 128 and I-495 to evolve into desirable regions for information technology companies to locate? The three factors that provided some economic buoyancy for these areas are the highly educated students of the Boston area,

the presence of military agencies, and the availability of capital resources (Ferguson, 2000). First, it was the highly educated students of MIT and Harvard University. MIT and Harvard University contributed heavily to the Commonwealth's high technology brainpower. These universities were seen as the primary academic engines behind the high-technology industry cluster. According to a study conducted by MIT in 1997, MIT graduates and faculty have founded 4,000 companies, employing 1.1 million people and generating $232 billion in worldwide sales (Judge, 1997).

The second economic factor was the significant presence of military agencies in the area. The Department of Defense provided a major boost to the area's economy when, in 1969, it awarded the famed Advanced Research Projects Agency network contract to Bolt Beranek and Newman of Massachusetts. Their work on this network contract produced legions of network-savvy engineers who now populate the area's companies (Ferguson, 2000).

Finally, the availability of capital resources helped to attract companies to the area. The growth of high-tech companies along the Route 128 corridor around Boston reflected the amount of money and entrepreneurial spirit that was flowing into the region. As Joyce Plotkin, President of the Massachusetts Software and Internet Council (MSIC) said, "...We're number one in patents per capita, number one in federally funded research and development, number one in small-business innovative research grants, number one in per-capita college degrees, number one in per-capita venture capital" (Teuke, 2000, p.2). Venture capital investment in Massachusetts rose to $3.6 billion in 1999, a 125 % increase from 1998. In 2000, the venture flow across New England

increased an astounding 101 % to $10.5 billion. Of these venture capital funds, over $2.1 billion went to e-commerce and internet-related firms (Szechenyi, 2001).

The Route 128 high-tech community underwent another boom year in 1996 and continued to improve its economic growth in the following years. As Route 128 and Interstate 495 have become the epicenters of high technology industry clusters on the East Coast, experts say that the remarkable pace of high-tech employment growth along these highways will continue to accelerate in the near future. Hopefully, Worcester will soon become a part of this high-tech employment growth that has allowed the Boston area to prosper. The economic growth that began in Boston, and subsequently expanded into the Route 128 and I-495 region, will expand again in the future. The conditions in Worcester are similar to these other regions and the city must be prepared to accept the challenge of an expanding economy. In addition to the close geographical location to Boston, Worcester also offers an excellent high tech infrastructure and a large pool of college students. But, does Worcester have the skilled workers or infrastructure to handle a large influx of information technology companies in the area? First, we must examine what exactly is an information technology company.

2.2. What is information technology?

Information technology encompasses computers, software, telecommunications products and services, Internet and online services, systems integration, and professional services companies (http://www.itaa.org). Information technology companies can be

divided into five different classifications: bandwidth providers, service providers, application developers, support services, and knowledge-based companies.

- *Bandwidth providers* are the building block for information technology companies because they provide copper wire, fiber optic cable, or coax cable (http://www.witp.org). Bandwidth providers may also build and install the communications hardware for routing, switching, transmitting, or receiving information over wireless or fixed communications channels.

- *Service providers* activate the bandwidth channels and package voice, data, and/or multimedia services for sale to individuals and businesses (http://www.witp.org). It is the job of service providers to get these communications capacities to the customer. The greater the amount of competition by service providers, the better the variety and quality of services that will be provided and the lower the cost will be.

- *Application developers* are companies and individuals that create, adapt, install, and manage software and hardware data, voice, and multimedia applications for users of the particular information technology (http://www.witp.org).

- *Support services* are individuals and organizations that support the expansion of telecommunications applications, information technology services, and Internet-related technologies (http://www.witp.org).

- *Knowledge based companies* are those that may require access to high bandwidth, Internet application developers, and information technology support services (http://www.witp.org). The companies' use of information and Internet-related technologies for research and development, cost reduction, improved services, and market expansion may be determinants of where they locate.

The workers in the field of information technology can be defined in four different categories. Conceptualizers are those who conceive of and sketch out the basic nature of a computer system component. Developers specify, design, construct, and test

an information technology product. Modifiers and extenders are those who modify or add on to an information technology product. The final category of information technology workers is supporters and tenders, who deliver, install, operate, maintain, or repair an information technology component.

There is a distinct correlation between level of formal education and category of worker. Professions both in the conceptualizer category and the developer, modifier and extender category are commonly filled with recipients of masters or doctoral degrees. However, in the case of the modifier category, the positions may be filled with workers with an associate's degree. The information technology workers in the supporters and tenders category most commonly hold an associate's degree or, on occasion, may only have a high school diploma (Freeman, 1999).

The level of education in a community is a factor when high-tech companies are looking to locate to a certain area. Information technology companies are not looking at the workers that hold masters or doctoral degrees since these individuals can be hired and brought in from anywhere in the world. However, the community must be attractive enough to make them willing to move. The type of worker that high-tech companies look for in an area is in the supporters and tenders category. These workers are the ones that are least likely to travel a great distance for a job and also make up the majority of the information technology job market. In addition to fulfilling its need for skilled workers, a company must also assess whether the potential location is able to provide the necessary infrastructure.

2.3. What is Worcester's infrastructure?

Information technology companies are looking to locate where there is a large amount of bandwidth to handle their present and future needs. Right now, Worcester has a state-of-the-art telecommunications infrastructure with the speed and capacity to support any mission-critical telecommunications, Internet, or information technology application.

2.3.1. Bandwidth

Currently, Worcester has three completed and active carrier-neutral fiber optic networks that are available to over 500 commercial, industrial and multi-housing properties in the city. There is a no-cost sidewalk to building connection provided by NEES Communication, which is continuing to extend these networks. When completed, the network will be available to almost every commercial and industrial building and developable property in Worcester.

Also, there are at least a dozen active Points Of Presence (POP) on major regional, national, and international telecommunications carriers located in Worcester. Another advantage for Worcester is that many high speed and capacity "fat pipes," connecting to all major cities and commercial districts in New England, use Worcester as the central hub (http://www.witp.org).

2.3.2. Internet2

Worcester Polytechnic Institute has co-ventured with NEES Communications to develop an Internet2 gigapop, known as the Goddard Internet2 GigaPoP. Internet2 has been described as a high-tech test bed for the technologies that will shape the commercial Internet of the 21st century. Internet2 is a consortium being led by over 180 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet (http://www.internet2.edu).

The availability of Internet2 will allow information technology companies to complete high-tech research projects and share valuable data with colleges or other companies without encountering bandwidth traffic problems from the general public. Internet2 has guaranteed quality of service and bandwidth, which is important in such applications as the remote operation of scientific equipment, the transmission of digital video and interactive simulations. The Goddard GigaPoP consists of local "rings" within the network that reach downtown Worcester and the city's biomedical and medical communities. A third local ring serves WPI and some local businesses (The Wire, 1999). The technological infrastructure is only one aspect of a city's overall infrastructure.

2.3.3. Industrial and Commercial Property

Another need of infrastructure is available locations for growth. Worcester has an abundance of commercial and industrial space available to telecommunications, Internet,

information technology companies with access to a virtually unlimited supply of telecommunications capacity.

2.3.4. Institutions of Higher Learning

There are over 30,000 students at 11 local colleges and universities providing degree and non-degree information technology training and education with graduating students prepared to lead in the Information Age Revolution. Within a 50-mile radius of Worcester are over 100 colleges and universities with in excess of 200,000 students. There is a generous supply of students in the local area to aid in the growth of information technology businesses (http://www.witp.org). The infrastructure is an important factor when companies are choosing an area to locate their business. However, there may be other factors that play a role in their decision.

2.4. Why do firms locate where they do?

In order to attract high technology firms to Worcester, which in turn could create industry clusters, one must first examine communities that have been successful and why those cluster industries chose to settle where they did. The most well known community of this type is Silicon Valley in California. The term "Silicon Valley" can be traced back to 1971 because the heart of the region's industry is the silicon semiconductor chip. Today there are about 2000 electronics and information technology companies, along

with a large number of service and supply firms, clustered in the Silicon Valley area (Tajnai, 1985).

The roots of Silicon Valley can be traced back to the 1930s and Professor Frederick Emmons Terman of Stanford University's Department of Electrical Engineering. Professor Terman was concerned about employment opportunities for his students on the West Coast. If a recent graduate wished to be employed, especially in the radio-engineering field, that graduate would have to travel to the East Coast to find a job. Dr. Terman's solution brought together two of his former students, William Hewlett and David Packard. These two men, under the guidance of Professor Terman, founded the Hewlett-Packard Company, the leading company that initially attracted firms to Silicon Valley. This was the beginning of what would come to be known as the Stanford Industrial Park. The Stanford Industrial Park was formally established in the 1950s when Stanford University began leasing out over 8,000 acres of nearby land to high technology companies that might be beneficial to the University. As Hewlett-Packard Company, along with other high technology companies, began to expand, so did the industrial park.

2.4.1. Institutions of Higher Learning

This early history of the Silicon Valley in California illustrates one major reason why high technology industries locate in certain locations. This reason is their proximity to distinguished institutions of higher learning. Silicon Valley was settled around Stanford University and later expanded around the University of California at Berkley. Route 128 in Massachusetts, another major site of a high technology industry cluster,

expands out from the Massachusetts Institute of Technology and is close to Harvard University and several other universities. The total sales of companies founded by MIT graduates were more than $53 billion in 1997 alone (MIT, 1997). Stanford University and MIT are two world-renowned engineering institutions. This allows high technology companies to be very close to a large, well-educated labor market.

2.4.2. Location and Climate

Another major reason for the successful growth of Silicon Valley is simply its geographic location and climate. The heart of Silicon Valley is located in Palo Alto, California. William B. Shockley, co-inventor of the transistor, said that his decision to move to the Palo Alto area "was made predominantly because of the Bay Area, the fact that there are more trees in the area than there are in Southern California, and Stanford" (Tajnai, 1985). The area was once predominated by fruit orchards and thus called "Valley of the Heart's Delight." This region in California is famous for its incredible weather and beaches. This can help to attract recent college graduates when they are looking for employment.

The pleasant climate and availability of space in the research park were among other factors in attracting individuals and firms to Silicon Valley. A survey of Silicon Valley area companies in the area disclosed that more than two-thirds of the corporations rated amenities and climate as outstanding. The presence of major research universities and the concentration of high-trained workers also ranked high (Rogers and Larsen, 1984).

2.4.3. Government

The federal government is another influential factor when determining industry cluster cites. In Silicon Valley, the relocation of a major military contractor, Lockheed, brought a huge sum of federal defense dollars to the area. The close proximity of Lockheed and the companies in Silicon Valley gave those companies an advantage when bidding on defense contracts. Semiconductor procurements by the defense agencies amounted to approximately two-fifths of total semiconductor production.

The federal government played an even larger role in helping the development of the industry cluster located on Route 128 in Massachusetts. By the late 1990s, Massachusetts was one of the top five states in terms of federal research resources granted (Rosegrant and Lampe, 1992). The Department of Defense itself has accounted for over 60% of federal research and development spending in the state (Saxenian, 1991). Several of the companies in this area are very important contractors for the Department of Defense and other government agencies. Raytheon is one of the best examples of a large government contractor in the Route 128 area. These government agencies are also important in providing local universities and firms millions of dollars for research purposes.

2.4.4. Location Costs and Taxes

The cost of commercial property also plays a role when companies are deciding where to locate. In recent years, the industry cluster along I-495 has grown. Part of their

success may be attributed to their low office space rent. Office space rental cost along I-495 ranges between $5 and $12 per square foot, compared to $27 to $35 per square foot along Route 128 (Metz, 2000). Another financial incentive provided to companies is tax breaks. Communities wishing to attract cluster industries may offer significantly reduced, or altogether eliminated, tax rates. Communities find that the economic benefits generated by cluster industries outweigh certain industry taxes.

2.4.5. Clusters

Since the development of the Silicon Valley region, companies have found it very beneficial to settle in industry clusters. Michael Porter first explained the advantages of industry clusters in detail in 1985. One of the main advantages, especially prevalent in Silicon Valley, is the sharing of knowledge. Employees in Silicon Valley tended to move from one employer to another relatively often. Firms quickly found that they could develop better products by cooperating with other firms because of the rapidly changing knowledge provided by new employees. Another advantage of industry clusters is the sharing of resources. Firms that settle in the same geographic location may reduce their costs by utilizing the same technological infrastructure and transportation networks.

A seemingly endless number of communities and regions are attempting to emulate the success of Silicon Valley, California. The economic benefits of cluster industries have been well documented (Porter, 1985, Tajnai, 1985, Saxenian, 1991, MIT 1997, Joint Venture, 1999) and communities have begun to identify why these cluster industries settle where they do and what the community can do to attract these companies

to their area. While some communities may be unable to duplicate the climate, landscape or general work atmosphere present in Silicon Valley, communities may offset this with other benefits such as low rent, tax breaks, government funding or proximity to a capable workforce. Silicon Valley and the Route 128 and I-495 region are two examples of where cluster industries have settled. The Worcester InfoTech Corporation hopes that the greater Worcester area may be next on that list. Great efforts have been made in recent years to provide the Worcester area with a highly advanced technological infrastructure. In addition, the Worcester Regional Chamber of Commerce has partnered with area financial institutions to offer financial incentives to firms, in the form of reduced taxes, interest free loans or very low interest rate loans and advantageous refinancing opportunities.

Once a business has decided on its location, it must then begin the process of finding skilled workers. In order to get an understanding of this process, we must examine the human resource management of a company.

2.5. Human Resource Management

Throughout our research, we have spent a tremendous amount of time looking at newspaper advertisements to find out what types of skilled workers are in need. In order to fully understand the process of company's decision to employ a particular type of worker, we must take a look at the human resource management perspective. Often times, companies may choose to recruit certain positions when there is a need for these types of workers. This section will fully explain the process that these companies go

through, how they determine what their needs are and how they decide who the right candidates are for the job description.

When a company begins searching for personnel for a particular job, the people responsible for hiring determines exactly what they are looking for in an employee before they start the process. It is essential for them to draw the actual job description and to determine the criteria for which the hiring decision is to based (Half, 1985). Most often, the job description not only contains a list of specific duties and responsibilities for the job, but also indicates the importance of each duty and responsibility.

After the company creates the job definition for the position that they want to fill, they start determining the specific qualifications required for the job. These qualifications may include level of education, experience, skills and capabilities (Outlaw, 1998). They must also take into consideration the type of worker they need to fill the position. Their choices include full time, part time, work-at-home and temporary positions.

In order to recruit people to fill their required positions, a company must advertise their job positions. Companies can get responses by advertising in the local newspapers and/or larger newspapers such as the Wall Street Journal. Radio and television are other sources of media that are usually successful. To get a large number of responses for the job positions desired, companies usually choose to place ads on Sundays in newspapers which contain a lot of employment advertisements. Often times, companies in need of specialists will consider trade publications that cater to the needs of specialists (Half, 1985).

The person in charge of hiring evaluates every resume they receive and selects which applicants should be interviewed and which applicants should not. The interviewing process is usually the next stage after a company has evaluated the initial responses to their job opening. The interviewing stage is where the company decides which candidate is most qualified for the job description. The interview process then begins and after careful evaluation of the information they receive from the interviews, the hiring personnel makes the final decision.

This human resource management process is repeated each time a company is need of new employees. In order to fill the positions, companies must continually make efforts to recruit new workers through newspaper advertisements, media advertisements, or simply through word of mouth. Any of these methods have allowed IT companies, now as well as in the past, to recruit the skilled workers they have searched for.

Chapter III: Methodology

Our project goal is to determine if a skills gap exists in Worcester. If there is a skills gap, we will make recommendations to the Worcester InfoTech Corporation on what needs to be done to narrow the gap between the needs of the high-tech companies and the existing human resources in the Worcester area. If there is not a skills gap, we will attempt to identify other possible factors that may deter companies from locating in Worcester. One main objective is to match the needs of high-tech companies with the resources that are already available in the Worcester region. A sub-objective of our project is to create an inventory of the human resource needs of high technology companies. Another sub-objective is to create an inventory of the available workforce skills in Worcester and the surrounding area. Our research design and methodology will assist us in carrying out these goals and objectives

3.1. Data Collection Procedures

Our data collection procedures consisted of archival research, analysis of existing data, and interviews. The archival research provided us with background information that had been documented previously. Analysis of existing data allowed us to minimize expenditure of our own resources, by examining and interpreting large amounts of data already provided by reputable sources. The interview portion of our research allowed us to collect first hand, up to date information. The rest of this section will elaborate on these procedures.

3.1.1. Archival Research

The archival research was one of our sources of data, which we used as general information for our face-to-face interviews. Information we gathered from our archival research provided us with knowledge on various subjects before conducting our interviews. The information also helped us to better understand the current human resource needs of area businesses. It is essential that we first understand what these needs are before we attempt to recommend a course of action to narrow the gap between company needs and existing human resources.

Job Advertisements

We examined the employment opportunities information technology companies are advertising in the "Worcester Works" section of the Worcester Telegram & Gazette newspaper. We also accessed the same information from the Boston Globe newspaper. We were able to determine from these advertisements what information technology companies are looking for, both in the technical and non-technical fields. We did this by examining the number of advertisements for each job position. We focused our research on these two newspapers because they are the largest general newspapers in our geographic area of interest. We looked at the "Worcester Works" advertisement section in the Worcester Telegram and Gazette over the period of the past 18 months (April 1, 2000 to October 1, 2001) to control for the effects of the weakened economy, which has hit the information technology sector especially hard.

We began the process by looking through all the ads in the "Worcester Works" section of every Sunday of each month to document information technology companies' technical and non-technical job listings. In addition, we examined the remaining ads for information technology job titles. These titles are known by their description in the ads as well as prior knowledge on job titles. Information technology companies were determined by the company description, which is most commonly described in the ad, and further research or first hand knowledge of the company.

As we progressed further along, we felt it was unnecessary to look at every week. We found that by examining a sample of the advertisements, we were still able to determine the information technology needs of the area, while allowing the time commitment to be more feasible. Instead, we shifted our focus to the second Sunday of each month. March 2001 has been identified as the official date that the nation entered into recession. We were especially interested in comparing the advertisements before and after this month. Before the recession, there were over 50 ads for information technology jobs each week. The demand for information technology jobs dropped drastically as a result of the nation's recession. Advertised listings for IT jobs eventually fell to half the number it had been before the recession.

What types of information technology jobs are most advertised for in the Worcester area and the Boston area?

The number of advertisements for a particular job reflects the company's need for that type of worker. A job that is rarely advertised indicates that that job is not in high demand. On the other hand, a job that is frequently advertised reflects a high demand.

By examining both the Worcester and Boston areas, we were able to compare and contrast the two regions to observe any similarities or differences.

Are information technology companies looking for technical or non-technical workers?

The archival research allowed us to differentiate between the technical and non-technical needs of an information technology company. If we find that IT companies are looking for non-technical personnel rather than technical personnel, there might be a skills gap but not a technical one. Furthermore, the interviews that we conducted with Worcester's high-tech companies allowed us to determine the type of worker each individual company is looking to hire.

3.1.2. Analysis of Existing Data

In our analysis of existing data, we focused on reports from the Department of Labor, Bureau of Labor Statistics and the United States Census Bureau. These documents, when carefully examined, provide extensive data on labor statistics in Worcester, the state of Massachusetts, and the nation as a whole. The analysis of these data allowed us to learn a large amount of diverse information. Some of the information we gathered explains which industries continue to grow, while other industries are stagnant. One of the best ways to determine what programs are currently offered in the Worcester region is to conduct research of available data. By examining data that already exists, we minimized our time and cost resources (Singleton, 1993). We focused on public documents and official records. We know that these records are maintained by

reputable sources under a controlled setting. We hope that this statistical information from the area will further reinforce what we have learned from our other research methods.

Department of Labor

The Department of Labor website provides general employment information, as well as links to other government agencies that may provide more detailed information. We have looked for information regarding the national economy and unemployment statistics categorized by a number of different factors, such as age, duration of unemployment and reason of unemployment. Another way that the Department of Labor organizes its data is according to the Standard Industrial Classification code, or SIC code. The government assigns a SIC code to each of the industries in the United States. It was then very convenient for us to compare and contrast the different industries. A few examples of relevant links for our project are links to the Massachusetts Department of Labor, Bureau of Labor Statistics, Department of Labor Employment and Training Association and America's Service Locator.

Bureau of Labor Statistics

The Bureau of Labor Statistics provides extensive data on international, national and regional employment trends. The Bureau publishes all of its data on its website. This allows the Bureau to keep recent figures, with their most recent figures reflecting

August 2001. There is one disadvantage, namely that while some information is only about two months old, other figures may be several months or even years out of date. The Bureau is able to publish certain estimates, such as the national unemployment rate, current to about two months ago. On the other hand, some detailed reports, such as the Metropolitan Area Occupational Employment and Wage Estimates, take about two years to compile and publish.

Using this information published by the federal government allowed us to compare employment trends in Worcester to the same trends in the nation as a whole. The Bureau of Labor Statistics also provides wage information, so that we were able to determine if area salaries played any role in the employment conditions in the Worcester area (http://www.bls.gov).

Department of Labor Employment and Training Association

The Employment and Training Association provides a great tool to employers and job seekers with their America's Labor Market Information System (ALMIS) (http://www.doleta.gov/almis). ALMIS is the information delivery infrastructure behind the service delivery system, The One-Stop Career Center System. This system combines a number of national application systems, namely, America's Job Bank (AJB), America's Talent Bank (ATB), America's Learning Exchange (ALX), and America's Career InfoNet (ACINet). When all of this information is combined into one system, it allows for much greater accessibility to those with limited resources. The main goal of ALMIS is to help labor markets function more efficiently by providing standardized and well-organized

labor statistics. We used this database to examine information on the planning of employment and training programs. This allowed us to gain detailed knowledge on human resource programs in Worcester and the surrounding area that are available to local businesses.

Massachusetts Department of Labor

The Massachusetts Department of Labor publishes annual employment reports. The most recent employment statement available is the 2000 report. It also provides monthly estimates covering the state's wage and salary employment. The Massachusetts Department of Labor classifies all of this information by city, county, labor market area, industry code and a number of other factors (http://www.detma.org). We used this information to gain specific employment data on Massachusetts and the Worcester area.

The Massachusetts Department of Labor also provides a variety of educational resources and employment opportunity information. We have examined each of these in order to determine if any of these sources were able to provide us with relevant information.

How does the job market in Worcester compare to other job markets in the surrounding area?

The Massachusetts Department of Labor compiles statistics on almost every Massachusetts city and town. Worcester's surrounding communities may also have an impact on Worcester being able to attract information technology companies. Perhaps

these surrounding communities do not have the support industries or pool of information technology workers that is needed.

United States Census Bureau

The United States Census Bureau provides detailed demographic information about the United States. The Census Bureau conducts a full nation-wide census every 10 years. We mostly used information from the 2000 Census data, but other information is currently available. These include extensive reports conducted in the past few years; the 1997 Economic Census is one example. Some of the information that is provided by the Census Bureau includes detailed statistics on the number of workers employed in each industrial sector and breakdown, by town, of where the workers are located. The majority of this information is presented in Adobe Acrobat Reader format. The website also provides a number of graphs, charts and other tables. We used this information to assess the economic condition of the city of Worcester and the surrounding area.

The website of the Census Bureau allows quick and relatively easy access to a wide range of information. Due to our time and resource constraints, this website is a huge asset. Once again, this information was used to confirm what we have already gathered, primarily through our face-to-face interviews with businesses and educational facilities in the area. If there is, indeed, a lack of a qualified workforce in the Worcester area, it will show up in statistics provided by the census and categorized by region and industry. For instance, an extremely low unemployment rate in Worcester for information technology workers would be a good indicator that the vast majority of these

workers are already gainfully employed. This would mean that an information technology related company relocating to Worcester might have a difficult time in finding other qualified workers in a tight labor market.

United States Bureau of Economic Analysis

The United States Bureau of Economic Analysis provides information on personal income by major source and earnings by major industry. It then provides convenient state-to-state comparisons. It also provides a wealth of information broken down by each community within Massachusetts. The Bureau of Economic Analysis will allow us to assess Massachusetts' and Worcester's economic standing compared to that of the nation, other states and even other communities.

3.1.3. Face-to-face Interviews

Face-to-face interviews allowed us to obtain personal information from area companies regarding their employment needs. These qualitative data provided us with much more information than we would be able to obtain from surveys and questionnaires. In addition, since every company has different needs, conducting surveys was not the best way to obtain our data. We used a semi-structured interview plan as opposed to a structured interview plan. The flexibility of this type of interview plan provided the companies the opportunity to tell us what specific skills they are looking for in an employee, without having to choose from a list of options. The educational facilities had

a chance to tell us exactly how they are preparing students for the information technology field. The semi-structured interview plan that we used outlined a general plan for the interview to ensure that we recorded only relevant data. Utilizing personal interviews allowed us to receive a response from only the companies that we were interested in for our research. Furthermore, this research method compelled companies to devote sufficient time to our research in order to provide us with more accurate and detailed information.

Educational Facilities

To better understand how the educational facilities in the Worcester area help students become better prepared for the information technology workforce, we conducted face-to-face interviews with various personnel who are familiar with the IT programs of their facilities. Interviewing these people was useful because we were able to get a sense of how these educational facilities are preparing students for the information technology workforce. An advantage to interviewing these people in person was that we were able to obtain up to date information about the types of information technology courses that are offered at their facilities. In addition, we were able to get a chance to clarify or restate any questions that the respondent did not understand. Conducting face-to-face interviews also gave us a higher response rate than if we were to conduct surveys or questionnaires (Singleton, 1993). This high response rate was especially important since it will help to reduce the chance of non-response bias in the data.

We sampled the Worcester Public School System along with a random sample of private schools, area colleges and universities and other continuing education programs that are offered. After generating a list of educational facilities in the area, we randomly selected a representative sample. This sampling technique allowed us to gain extensive and representative data on the education facilities in the Worcester area.

Before we began the process of interviewing personnel from educational facilities, we developed and pre-tested our instrument to ensure clarity and to avoid bias. We formulated interview questions for schools that were different from our questions for companies. First, we discussed these questions amongst ourselves, then with our liaison, advisors and other groups. Some of the changes that we made as a result of this pre-test included more detailed questions regarding the school's IT programs and the percentage of students who take these courses. After successful completion of this pre-test, we developed a final semi-structured interview plan. This semi-structured interview plan was used throughout each interview so that we were able to gain a better understanding of the type of curriculum being offered at the schools, as well as the courses that are required. This information is useful for us when we begin to determine how we can help to improve upon the preparation of a student's success in the job market. The scope of the semi-structured interview plan was limited to certain topics that relate to the school's curriculum and the key questions were planned in advanced (Singleton, 1993). The interview questions consisted of questions that relate to the types of the IT classes that are offered, whether or not they are required, and the approximate number of students who choose to take these courses if they are offered as electives. The data of these interviews aided us in our analysis of what educational facilities in the area need to do in order to

prepare students for the future. The semi-structured interview plan may be found in Appendix B.

How can the educational facilities play a role in improving the City of Worcester?

The Worcester Public Schools along with the vocational schools and colleges in the area can help local businesses by preparing their students for the information technology workforce. We have examined each school's curriculum to determine if there are enough information technology related courses offered, whether or not they are part of the school's requirements or if they are just offered as electives. We will then make recommendations to the Worcester InfoTech Corporation on how local schools might better prepare the students to become successful in the future.

What are the workforce demands of Worcester's IT industry?

To answer this question, face-to-face interviews were conducted with a random sample of information technology company representatives in the Worcester area. This type of interview allowed us to obtain the most up to date information. We started the interview process with a stratified random sample based on the list of companies that our liaison, Mr. Ahern, provided us. We interviewed companies until a clear conclusion could be drawn. In order to interview enough companies, we continually made new contacts through snowball sampling and our own efforts.

Stratified Random Sampling

The stratified random sample is a sample that is obtained by dividing a population into categories that represents distinctive characteristics (Singleton, 1993). This type of sample enabled us to categorize the high-tech industries and to divide them into subgroups. Since our main concern is the information technology field, a stratified random sample ensured that we interviewed only the types of companies that we were interested in for our research. An advantage to using this method is that it ensures that one subgroup is not represented more than another subgroup. The stratified random sample guarantees that all variable categories, large or small, will be sufficiently represented (Singleton, 1993). Given that there are a large number of firms in the region, taking into account our time constraints, we decided which companies would be most useful to our analysis. At the same time, we wanted to be able to give each company an equal chance of being included. The random sample allowed us to randomly select companies without fear of bias. We started the stratified random sampling with the list of IT companies that Mr. Ahern randomly picked from his database of companies that he has available from the Massachusetts Software and Internet Council. This list only provided a limited number of information technology companies in the area. In order to interview a sufficient number of companies, we utilized snowball sampling as well.

Snowball Sampling

We selected companies based on the sample drawn from each stratum of the stratified random sample to initiate the interview process. After successful completion of the interview, we asked these companies to provide us with the names and addresses of other companies in our target population. A basic assumption and advantage to this technique is that these companies might already know each other, thus giving us direct contact with their companions. The snowball sample continued to expand, with companies referring us to other companies. This was extremely helpful in gathering our data, as it was used as our sampling frame. The sample that we ended with included 20 companies, 16 of which were IT companies, two staffing agencies, a venture capital firm and a non-profit consortium. These companies vary in size from seven employees to approximately 40 employees all within a 25-mile radius of Worcester. The majority of these companies were located in the City of Worcester.

Semi-Structured Interview Plan

A semi-structured interview plan is a type of interview that allowed us to have some freedom in meeting the specific goals that we had identified (Singleton, 1993). Since we wanted to know what type of workers high-tech companies are looking for, a semi-structured interview plan helped us to ask limited questions that achieved the goals we sought. Similar to the semi-structured interview plan used for the educational facilities, we also pre-tested our instrument of questions for these high-tech companies.

As mentioned earlier, the basic purpose for conducting a pre-test was to determine whether or not the prepared interview questions would serve the purpose of helping us to analyze our data (Singleton, 1993). This pre-test was conducted along the same period, and by the same people, as the pre-test interviews for the educational facilities. Some of the changes that we made as a result of this pre-test included creating more in depth questions regarding recruitment of jobs in and out of the Worcester area, the benefits of training programs to the company and the utilization of partnerships with colleges. The semi-structured interview plan may be found in Appendix C. These questions were helpful in determining why these companies settled in Worcester and the type of skilled workers they require.

Over the course of our interviews, we continued to change and refine our interview plan. The biggest advantage of the semi-structured interview plan is that it allows us this great flexibility. If a company representative mentioned the airport as something that needed improvement, we would then follow up with questions that provided specific details about their thoughts on the airport. The semi-structured interview plan provided us with many more details than any other method could have done.

3.1.4. Special Considerations

One of the special considerations we took into account was the availability of the people we were going to interview. We worked with these people to negotiate the best possible times. This meant that interviews might have had to be conducted during

particular times of the day, whenever they were most available. Secondly, some of the representatives of the companies were CEO's and/or presidents of their company. This meant that with their busy schedules, they often had very limited time to meet with us. With this in mind, we decided to make contact early and often with these people to set up a meeting time. We made the initial contact via email followed by subsequent emails and/or phone calls. We received a high overall response rate (78.5%) of participants who were willing to take time out of their busy schedules to take part in our research. Of the 25 companies that we contacted, only two indicated that they could not assist us and three companies did not reply, giving us a response rate of 88%. We contacted 26 educational facilities, of which eight contacts did not respond, giving us a response rate of 69%.

3.2. Data Analysis

Once we gathered all of the data and statistics, we needed a method of analyzing the information. We did this through content analysis. The information we gathered from our archival research was analyzed in a number of ways. First, we created definable categories and classified the advertisements into these categories, accordingly. These categories included Engineering, Computer/Software, Computer/Hardware and Internet/New Media. After we generated the separate databases, we compared the different industries by documenting the number of advertisements each month.

We conducted interviews, as opposed to surveys, because we could not anticipate the needs of the different companies. We used a fairly standardized interview plan so that we were able to compare the information. We continued to interview companies and

educational facilities until we felt we were able to draw a clear conclusion. Once an interview was completed, we wrote up an interview summary so that our respondent could revise and verify our information. The interview summaries were formulated by reviewing all of our handwritten notes from the interview. The interview summaries were then sent out via email to our respondents. We asked them to review our summary and respond to us with any revisions that they felt were necessary.

Using Microsoft Excel, we categorized the quantitative information collected from the interviews and displayed the comparative results using charts and graphs. This quantitative information included what needed to be improved in the City of Worcester and what factors they found most important when locating to a city. The visual displays of information allowed us to easily draw conclusions from the information gathered. In addition to examining the quantitative data, we also studied the qualitative responses to interpret each individual's opinion. We noticed a trend from the responses, which allowed us to draw conclusions for our analysis.

The information we gathered from the existing data provided by the government publications and official documents were already organized into databases. We interpreted this information and drew conclusions based on our research questions.

Chapter IV: Results

Over the past seven weeks, we have researched and investigated the questions our project hoped to answer. Our main guiding question is if there are people with the needed skills in the Worcester area that are able to fill information technology jobs. The results of our research are displayed here.

4.1. Face-to-Face Interviews

Face-to-face interviews proved to be a very valuable asset to our project by allowing us to learn the opinions of the many businesses and educational facilities that we interviewed.

4.1.1. Educational Facilities

We interviewed representatives from a number of colleges, universities and public and private high schools in Worcester. Appendix D shows a breakdown of these numbers according to higher education, private and public schools. The interview summaries for these schools may be found in Appendix E.

Worcester Public Schools

The public schools are guided by state frameworks, which determines which courses the school must offer and require their students to take. Schools can individually add courses to their curriculum after satisfying the state frameworks. The process for adding new courses to the curriculum is very time consuming because the subjects, textbooks, and evaluations must first be approved by the school committee. The public schools are offering many IT preparation courses such as C++, A+ Certification, computer repair and general computer training. In addition, Worcester Vocational High School offers A+ and Cisco certification.

Private Schools

The private schools have a very high rate of 95% to 100% college bound graduates. Two out of the three private schools we interviewed are currently offering IT courses. St. Peter Marian High School offers an extensive number of IT courses, including C++ programming, java/HTML and desktop publishing, to name a few. On the other hand, Notre Dame Academy focuses on the Humanities and Sciences and does not offer any IT courses at all. St. Mary's High School offers one IT course to seventh, eighth and ninth graders and one optional computer course for seniors.

Higher Education

The colleges have not noticed a high demand for IT courses. Some have offered courses based on the companies' suggestion that people will take these courses to prepare themselves for the IT industry. However, several IT courses have been removed from the curriculum due to a lack of interest. All of the colleges in the area that we spoke with are offering IT courses and/or continuing education for the working individual. These courses are offered at night and on weekends to accommodate their schedules. The colleges will tailor training programs to the needs of companies and always looks to the input of industry on what is important for students to learn. Many of the colleges consult with personnel in the industry to determine which courses students should be taking and which now are becoming outdated.

Colleges and universities frequently review and examine their curriculum to ensure their courses are up to date. When new credit courses must be added, the universities typically must go through an approval process in order to accept these new credit courses and materials. All of the colleges will offer non-credit courses, which do not need to go through the same approval process as credit courses. They may use them as pilots for new credit courses to determine the desire for such a course.

4.1.2. Companies

We interviewed a sample of information technology companies, staffing agencies and a venture capital firm in the Worcester area. We learned first hand from those who would know the best if there were a skills gap in Worcester.

Information Technology Companies

All but one of the IT companies interviewed agreed that there was not a skills gap in the Worcester area (Figure 4.1). They have encountered only slight problems finding workers in the past when the demand was higher, but the economic situation has changed significantly in the past two years. Hiring is typically completed by word of mouth, advertising in the local newspaper or by the use of a staffing agency. Generally, all the workers that companies were searching for were found within the Worcester area.

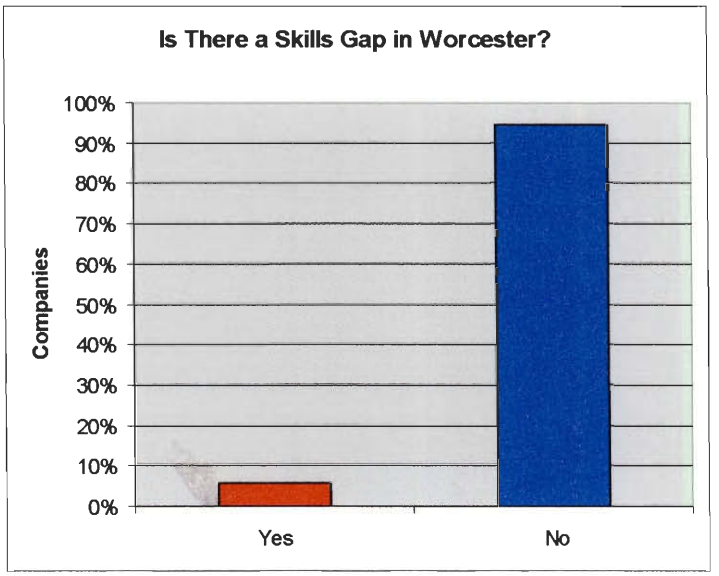

Figure 4.1

The desired skill level that employers looked for was often a BS or MS degree or a particular certification backed by a few years of experience. Companies do not often limit themselves to just the candidates with a college degree or certification but look favorably upon the individual's work experience and previous projects.

We also explored the companies' opinions of how important certain factors are in making a decision to locate to an area (see Figure 4.2). The top three factors were quality of life, cost of real estate and the availability of skilled workers. Weather/climate, availability of capital and regulatory climate were the factors at the bottom of the list.

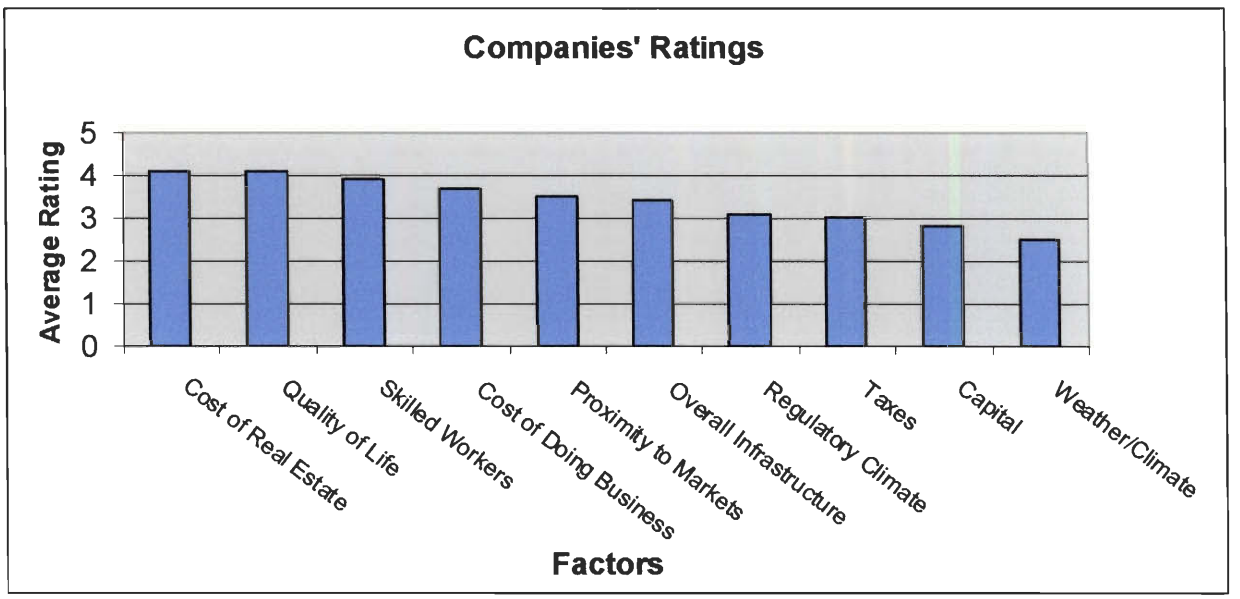

Figure 4.2

We also learned other opinions of Worcester through our interviews. Appendix F provides detailed interview summaries. In addition, Figure 4.3 illustrates the IT company representatives' response to the open-ended question: "What needs to be done to improve

the opportunities for your company?" Some of the areas that were mentioned that Worcester could improve upon were:

- *Marketing of Worcester* – Seven representatives from the IT companies stated that the City needed to market itself better in order to successfully encourage companies to locate in Worcester. As stated by Mr. John Merrill of The Worcester Capital Partners, the biggest thing that Worcester needs to do is market itself. With a $400 million annual budget, the City only spends less than $400,000 on marketing. This amount is not nearly enough to promote the offerings of the City.

- *Worcester Regional Airport* - Four of the IT company representatives stated that the Worcester Regional Airport was an issue that needed to be improved upon. Many companies rely on air travel to conduct business. Despite the fact that there is an airport in the City, there is not much activity going through this facility. This requires most business people to utilize nearby city airports for air travel. Mr. Ron Ranauro of Blackstone Computing named airport improvement as the single factor that would be most beneficial to his company. Currently, Blackstone is only able to use the Worcester Airport for about 5% of its air transportation needs.

- *Access to venture capital* – Access to venture capital is also another concern that was also brought to our attention during our interviews. Since there is a lack of competition between venture capitalists in the area, there is simply not enough money for information technology companies. Mr. Thomas McGovern of Lightband Communications Inc. believes that more access to venture capital will help the growth of new businesses. However, being that Worcester is a non-traditional venture capital market, it is difficult for companies to connect with venture capitalists. This makes it even more difficult for start-up companies to raise the necessary funds for their business.

- *Downtown area* – Mr. Marc Bellora of Optasite Inc. believes that the downtown area needs some form of improvement. He mentioned that Main Street is in terrible shape and needs some re-routing to be done. Mr. Bellora states that the street is simply not attractive for companies looking at Worcester. Housing and more restaurants in the area would be a great improvement.

- *School System* – Mr. Nannapaneni of Sigma Systems Inc. suggested that Worcester should offer itself as a safe city, with a good school system. As some companies choose to locate in an area close to their home, he notes that

with a good school system and an easy place of commute, more companies will choose to locate in the area.

- *Tax rate* – A majority of the companies stated that they would have found lower tax rates to be attractive. Many note that the tax rate in Worcester is simply too high and believes the city needs to reduce their taxes in order to attract more companies into the City.

- *Cooperation of city government* – Mr. Olen Bielski III of The Center for Advanced Fiber Optic Applications (CAFA) believes that in order to attract companies, the City needs to work in a collaborative manner with the local and state government to show the diverse opportunities that exist in the area. Mr. Peter Brady of IMS, Inc. also noted that he has found the city to be "...unfriendly and uncooperative..." (Appendix F) when trying to improve property.

- *Funding for training programs* – A few company representatives have noted that Worcester needed to offer funding for training programs in order to become successful in attracting information technology companies to the area. Mr. Craig Smith of GeekStaff Inc. stated that Worcester must be willing to put together targeted training programs and provide subsidized funding to make these programs happen. He noted the success of Albany in creating funding for similar programs and thinks that Worcester can be successful as well if it also offers funding for these programs.

- *Infrastructure* – According to a couple of company representatives, Worcester's infrastructure can use some improvement. Ms. Shari Worthington of Telesian Technology mentioned that the city has a potential but does not make an effort to do anything about it. Mr. Wallace Andrews of Interglobal Services Inc. also mentioned that he would like to see improvement in the world-class technological infrastructure.

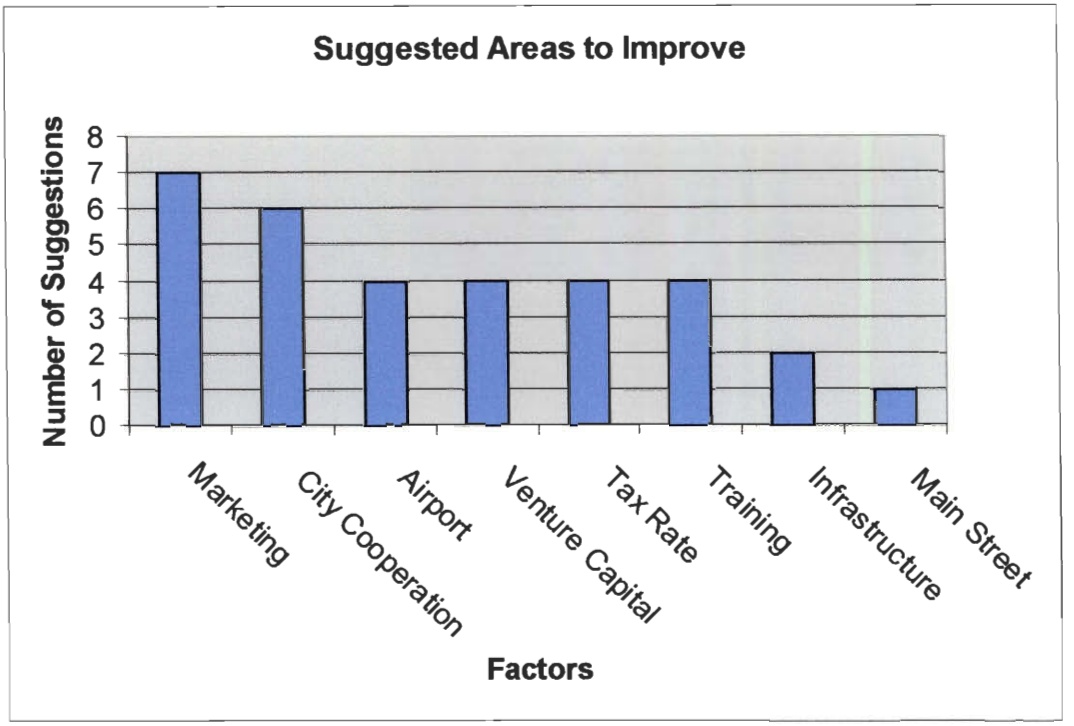

Figure 4.3

Staffing Agencies

We interviewed staffing agencies in order to learn their opinions on the employment situation in Worcester (see Appendix G). The staffing agency that we spoke to, which is located in Worcester, has not had difficulty in finding workers in the area. The staffing agency foresees that customer service individuals will be most needed in the future.

Venture Capital Firm

The Worcester Capital Partners is the only venture capital firm located in Worcester, a "non-traditional" venture capital market. From this interview, we learned

that 77% of venture capital goes to only 17% of the population. This makes it difficult for companies in Worcester to find people willing to invest in start-up companies. However, through cooperation and efforts to improve the community, colleges such as WPI, Clark University and Holy Cross have each invested $1 million in the venture capital market. We knew that venture capital firms had a direct impact on information technology companies, but also hoped to learn if the educational facilities had any impact.

How do the educational facilities play a role in improving the City of Worcester?

The interviews that were conducted with the colleges and universities, public schools and private schools have shown that each facility is doing its best to teach students the skills necessary for the information technology field. By offering courses that are necessary for the growing IT industry, educational facilities are preparing their students for success in the future. One example that we have already mentioned is that some of the higher institutions of learning have even committed a fair amount of money to the venture capitalist firm in efforts to improve the community.

Information technology companies are also taking advantage of the colleges in the area. Artis Corporation, IMS, Inc., and Vitel Software are just three good examples. Artis Corporation primarily employs Worcester Polytechnic Institute (WPI) computer science graduates, while IMS, Inc. has hired students from WPI. The major factor in Vitel Software's settlement in Worcester was to take advantage of the opportunities that existed with WPI students.

What are the workforce demands of Worcester's information technology industry?

Currently, most likely due to the economic situation, there is not a high demand for workers of any type by information technology companies. However, there is still a small demand for workers, but the needed amount is not that significant. Only a few of the companies that we have interviewed expressed a need to fill a position.

4.2. Archival Research

The archival research, which is meant to support our interviews, has provided us with valuable information. We learned from our interviews that IT company representatives did not think there was a lack of skilled workers in the area. The data we collected from job advertisements showed relatively few advertisements, indicating that our findings from our interviews were accurate.

4.2.1. Job Advertisements

We have looked at the Worcester Telegram & Gazette over the past 18 months and also looked at current information provided by the database at BostonWorks. After examining the "Worcester Works" section and the Boston Globe, we were able to reflect the information gathered back to our guiding question, "Is there a skills gap in the Worcester area?" Figure 4.4 displays the information technology related jobs advertised in the Worcester Telegram & Gazette over the past 18 months (see Appendix J). There

was a very significant change in the number of advertisements for information technology related jobs between April 2000 and October 2001.

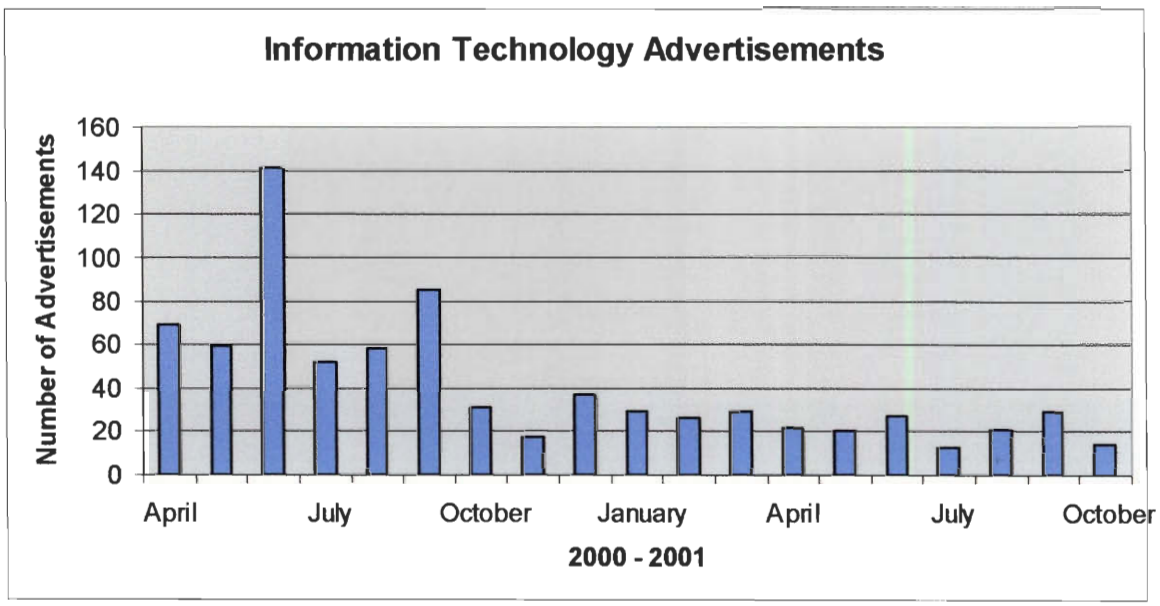

Figure 4.4

What types of information technology jobs are most advertised for in the Worcester area and the Boston area?

The BostonWorks database currently has approximately 12,000 listings. Of all listings for information technology related skills, the largest number was for computer/software skills (see Figure 4.5). The Worcester Telegram & Gazette also showed similar results. Engineering followed by computer/software, were the most frequent listing in the "Works" section (see Figure 4.6). Though the sample size from the Worcester Telegram & Gazette is much smaller, this still illustrates a large demand for these types of skills in both the Boston and Worcester area.

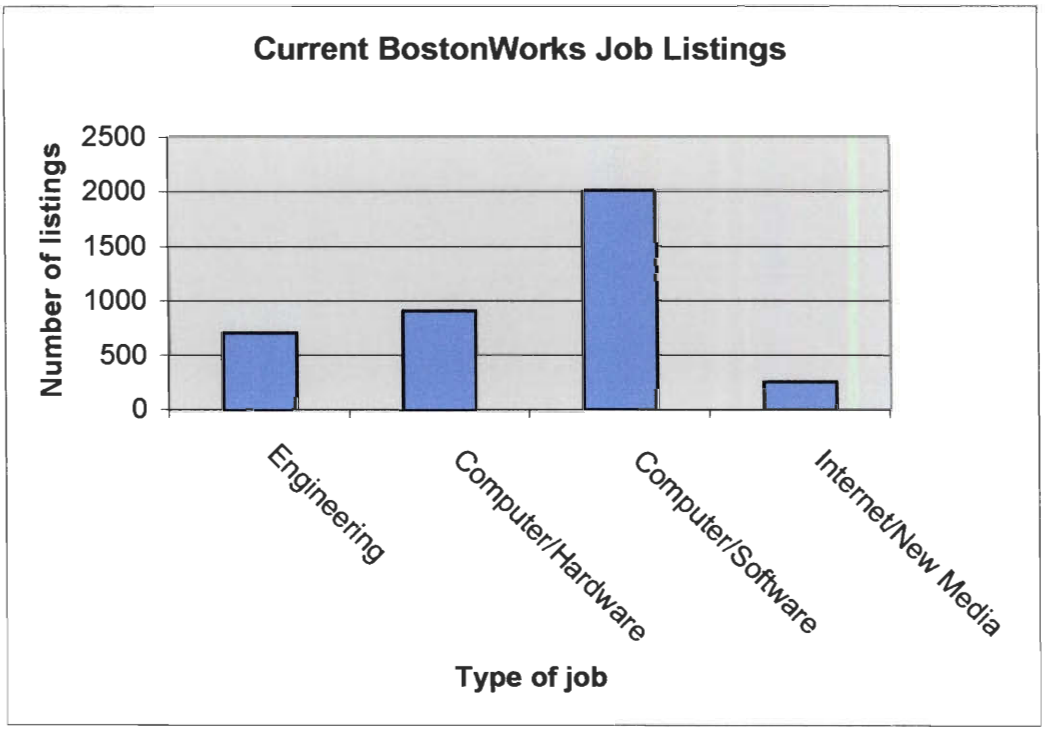

Figure 4.5

Source: BostonWorks

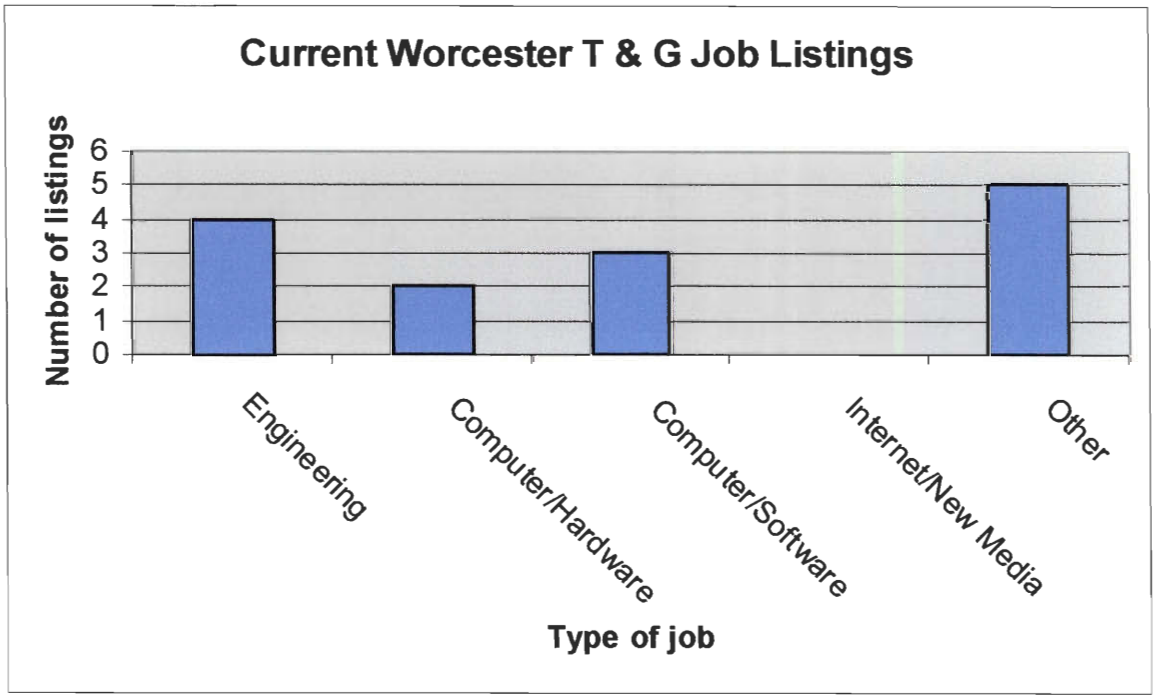

Figure 4.6

Are information technology companies looking for technical or non-technical workers?

We have also been able to examine the difference between the numbers of technical versus non-technical job titles advertised. This graph shows that the need for technical workers has drastically changed over the past 18 months. During this same time period, the need for non-technical workers remained largely the same (Figure 4.7).

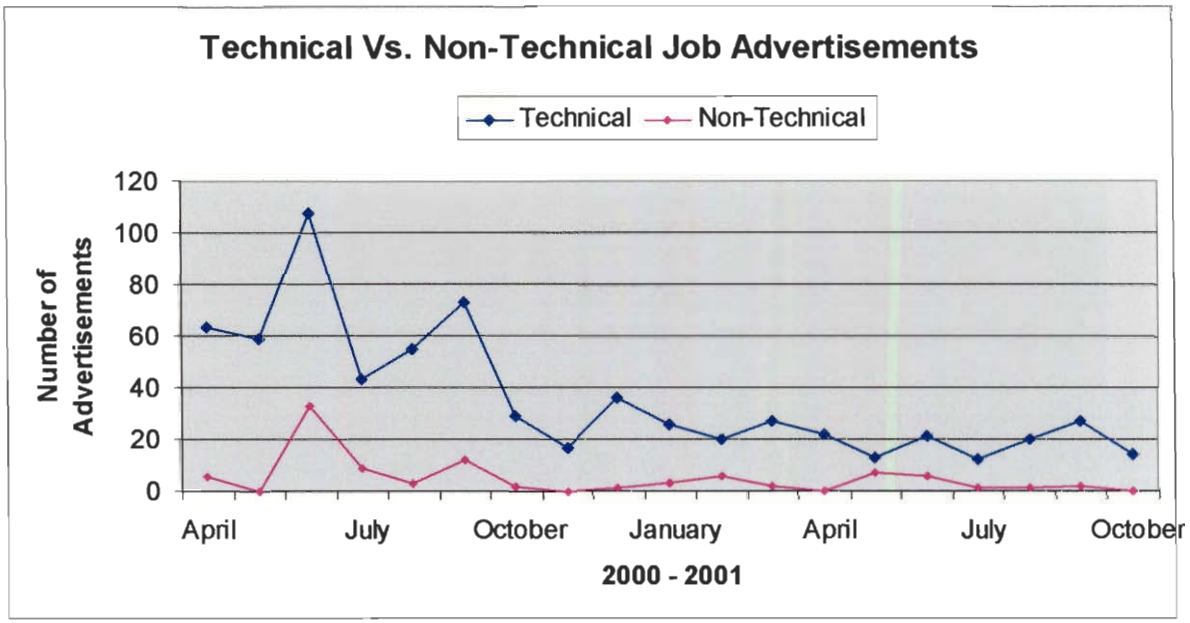

Figure 4.7

4.3. Existing Data

The statistics that we have found in the Census and other government information have provided us with a lot of valuable information as to why Worcester has not seen the benefits of the high tech boom that the Route 128 / I-495 area has seen.

4.3.1. Labor Force

The population of a city is misleading because it does not display the size of the actual work force. The population accounts for children, handicapped, retired, unemployed, and the employed. Of this population, only the labor force statistic is important when contrasting cities.

As shown in Figure 4.5, the size of Worcester's labor force is currently approximately 75,000 people (Figure 4.8). With the exception of Boston, Worcester's labor force is the largest in Massachusetts (Figure 4.9).

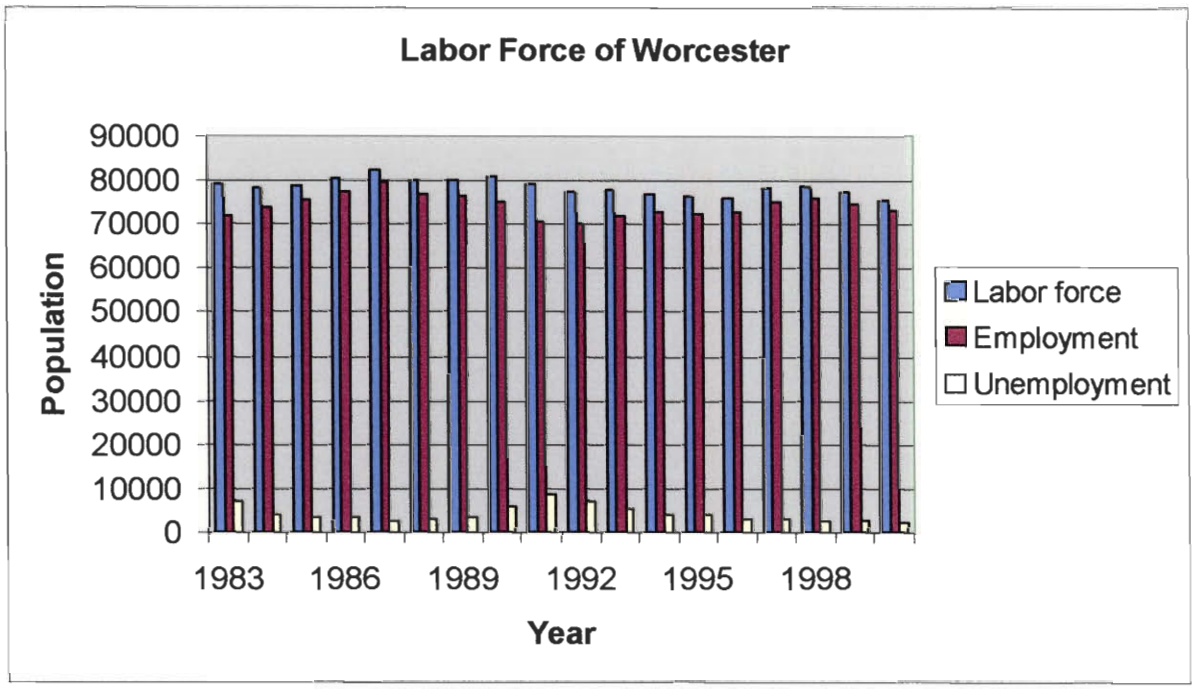

Figure 4.8

Source: United States Census Bureau

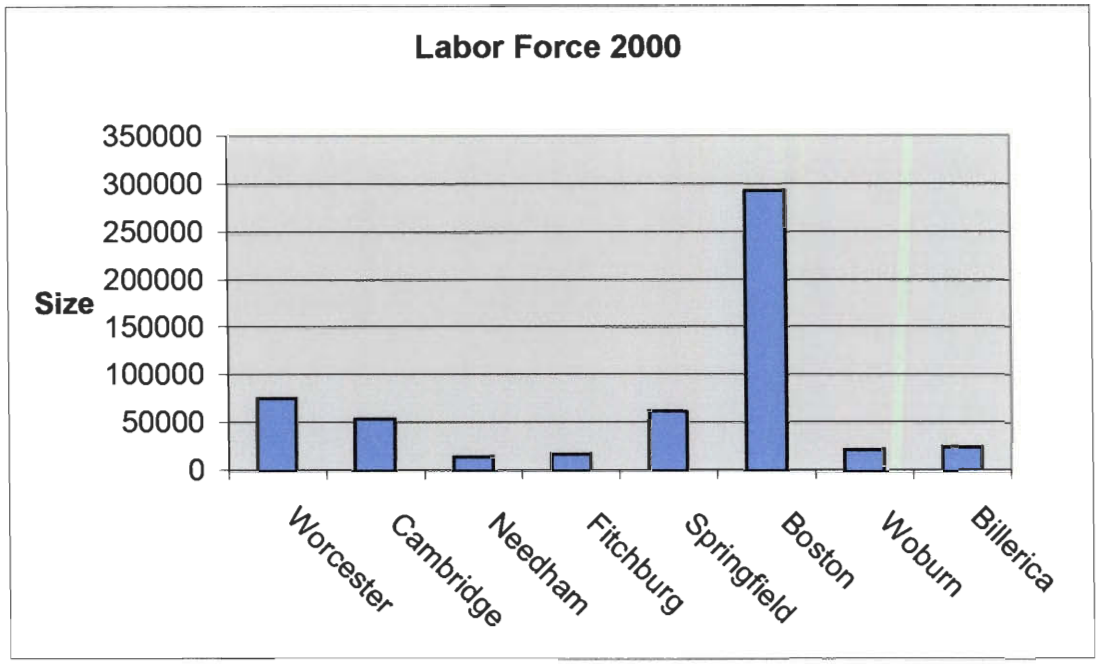

Figure 4.9

Source: United States Census Bureau

The unemployment rate is also an important statistic to compare. The unemployment rate in Worcester has typically been slightly higher than the state of Massachusetts as a whole (Figure 4.10). Currently, the low unemployment rate of 3.3% indicates that the economy in Worcester remains strong (Figure 4.11). It is interesting to note that Cambridge, Needham and Woburn all have unemployment rates under the state average. These three communities also had the highest number of IT companies for their population sizes. This may indicate that finding workers in these communities is extremely difficult.

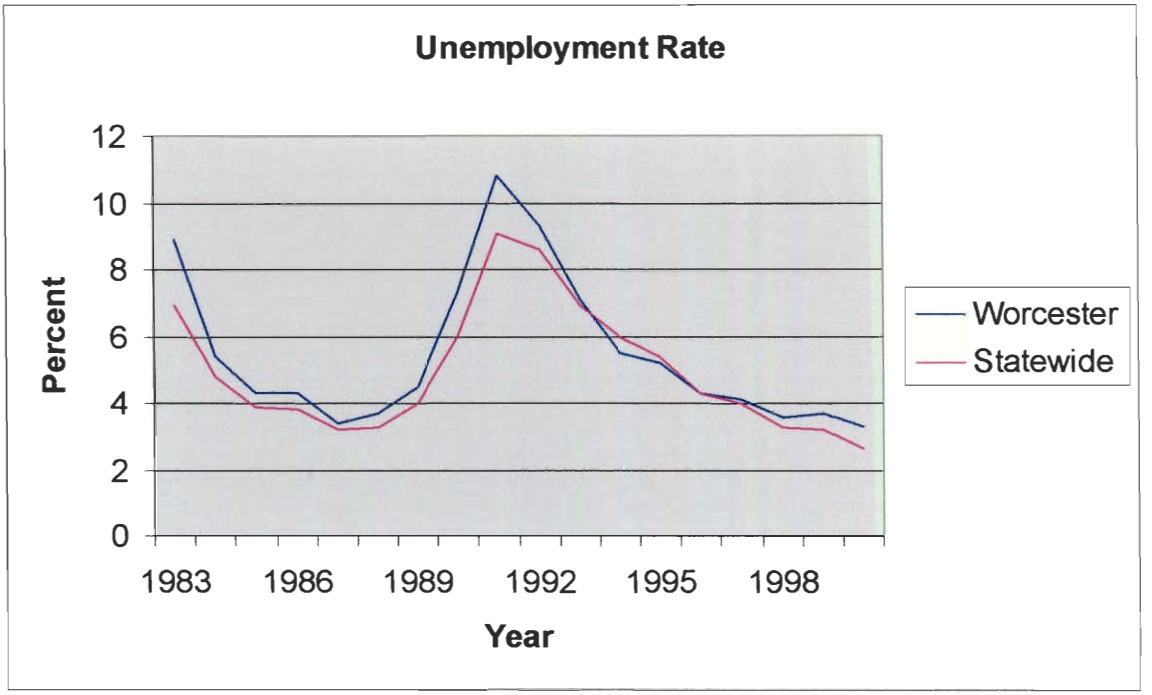

Figure 4.10

Source: United States Census Bureau

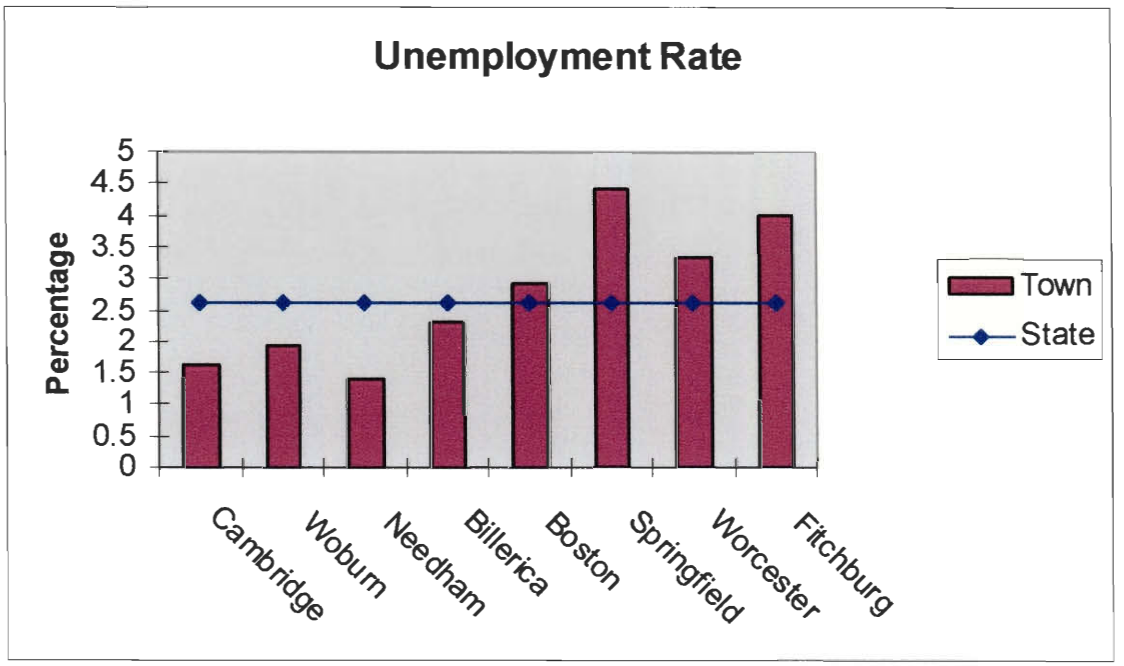

Figure 4.11

Source: United States Bureau of Labor Statistics

4.3.2. Information Technology Presence

The number of IT companies in Worcester is about average for the state of Massachusetts. There are 24 IT companies in Worcester, as listed by the Massachusetts Software and Internet Council (Figure 4.12). At the same time, there are 311 companies in Cambridge and 81 in Woburn. We conducted a random sample of other communities in Massachusetts, the results of which may also be found in Figure 4.12.

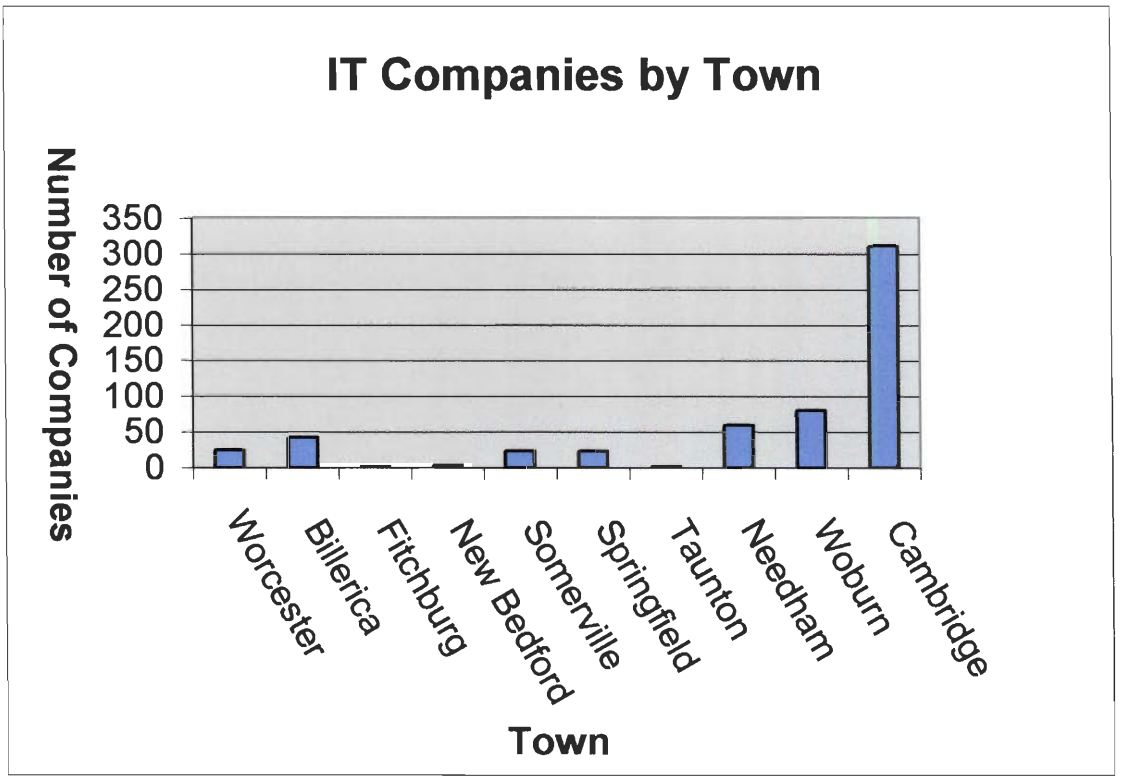

Figure 4.12

Source: Massachusetts Software and Internet Council

The number of information technology companies is important, but the population of the community must also be taken into account. Figure 4.13 shows the same sample of communities as before, only this time the graph reflects the number of IT companies for every 1000 residents in the community. Cambridge continues to lead the way, while Worcester falls more towards the bottom. The data provided by the Massachusetts Software and Internet Council only provided the size of the company within the state of Massachusetts. This means that if a company was listed as being in Worcester, it could have 1,000 of its employees located in Fitchburg. This would be greatly misleading, therefore, only the number of companies per community is listed.

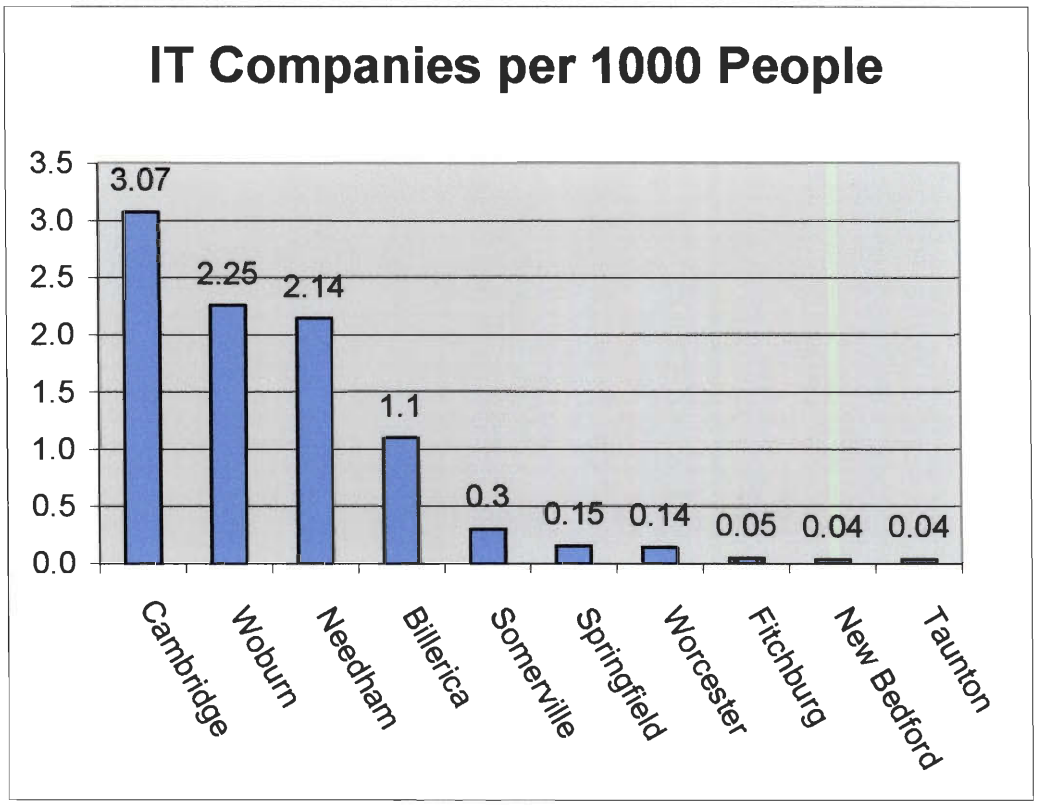

Figure 4.13

Source: Massachusetts Software and Internet Council

4.3.3. Airport Findings

The other airports, all within an hour's drive from Worcester, have all seen growth in the number of enplanements and deplanements (see Appendix H). On the other hand, the Worcester Regional Airport has seen its number of passengers decrease at the time that other airports have had increased passenger traffic. The number of passengers increased in 2000, after two consecutive years of declining traffic (Figure 4.14).

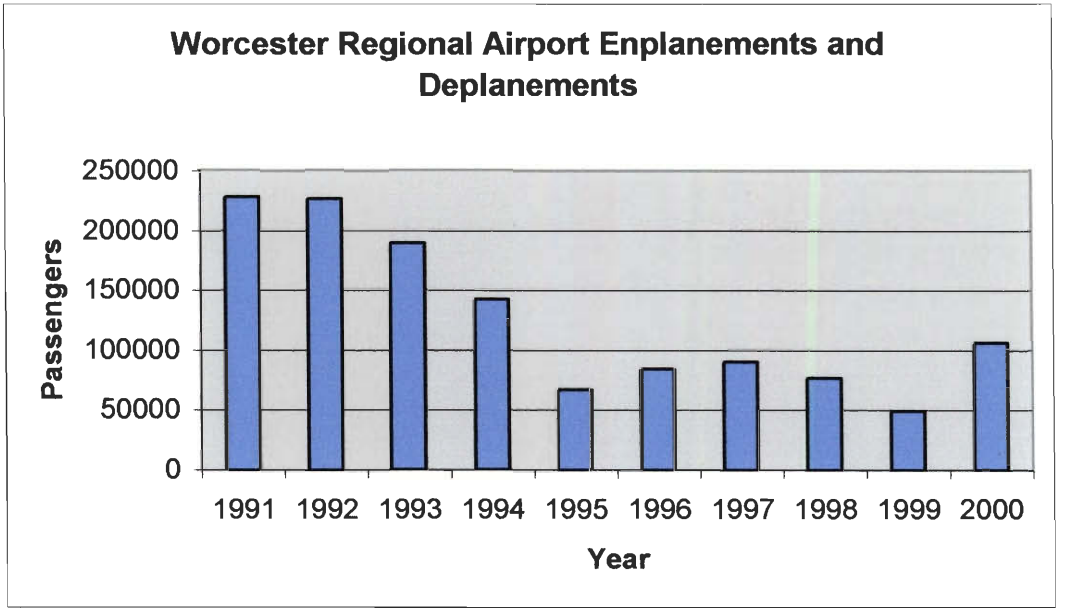

Figure 4.14

Source: Worcester Regional Airport

4.3.4. Real Estate

The cost and availability of real estate play an important role when companies are looking to locate in a certain area. The average rent in the Boston area is about $38 per

square foot, compared to approximately $14 per square foot in Worcester (Figure 4.15). Several IT company representatives mentioned the low real estate cost as one of the biggest advantages of locating in Worcester. Mr. Peter Brady, of IMS, Inc., specifically mentioned that the low rent in Worcester, while being able to compete in the Boston market, was very influential in his decision to locate in Worcester. The information provided by CoStar Realty also showed that although Boston has more total existing rentable building area, the vacancy rate in Worcester is higher (Figure 4.16). This would indicate that finding available property might be easier in Worcester.

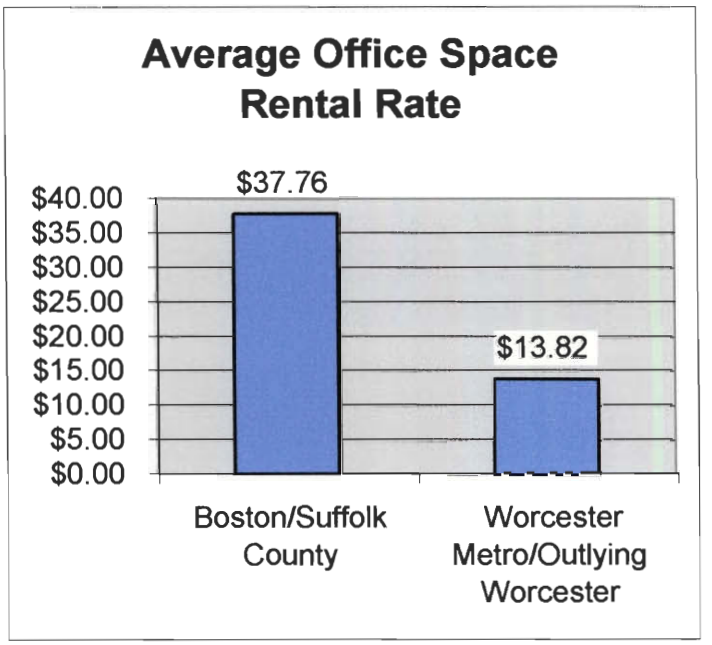

Figure 4.15

Source: CoStar Realty Information, Inc.

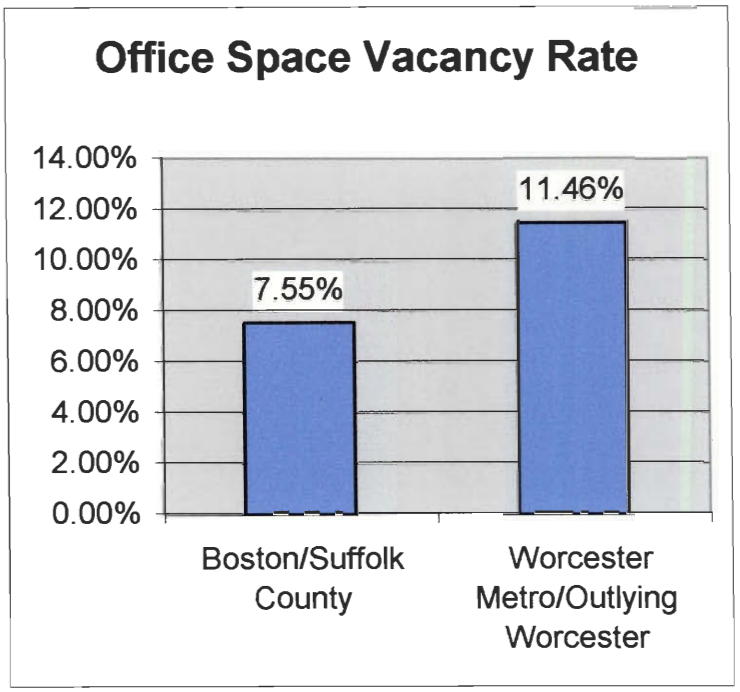

Figure 4.16

Source: CoStar Realty Information, Inc.

4.3.5. Labor Statistics

We found that there were 13,590 employees in Worcester working in education, training and library occupations. There were also 3,460 employees involved in computer or mathematical occupations. These are the employees that are most involved with our research project. A complete breakdown of Worcester employees by occupation, provided by the United States Bureau of Labor Statistics (http://www.bls.gov) may be found in Appendix I.

Chapter V: Analysis

Based on our results, we can further analyze the data and begin to interpret what it really means. It appears quite obvious that there is not currently a skills gap in Worcester. However, data can often be skewed or misinterpreted. There could be several factors that might prove our initial findings to be wrong.

Is there a skills gap in Worcester?

In order to formulate an accurate analysis, every angle of our research and results must be identified. Perhaps there really is a skills gap in Worcester and our research does not accurately reflect this. One of the possibilities could be that we did not interview a representative sample. It is possible that our research only allowed us to examine small, relatively new companies and since our focus was not shifted to larger companies, the results were biased or skewed. Looking into these possible errors, we carefully examined each and every data that we have obtained to figure out why information technology companies have not settled in Worcester and what needs to be done to make Worcester a more attractive place for companies to locate.

5.1. Face-to-Face Interviews

The analysis of our face-to-face interviews is where we gained the most first-hand knowledge. We were able to learn what people involved in business and education in Worcester thought about our research topic.

5.1.1. Educational Facilities

We were able to gain a lot of useful knowledge from our meetings with personnel from Worcester's educational facilities. We learned that there is a surprising number of opportunities in Worcester to gain knowledge in the IT industry. Even Assumption College, a liberal arts college, began offering information technology programs in the spring of 2000.

Worcester Public Schools

Beginning at the high school level, significant effort has been made over the past few years to improve information technology related courses and programs. Worcester Vocational High School has begun an IT department that offers A+ and Microsoft Certified Software Engineer (MCSE) certification programs. The Worcester Public School System has outlined a technological guideline program, where it has already met its goal of providing computer access to students. This technological guideline program explains, in detail, the school system's plan for the implementation and use of computers

in the schools. In addition, several IT and pre-engineering courses have recently been added to the curriculum. Advanced Placement Statistics has been added at Doherty High School with the hopes of expanding the class to other high schools in the near future. Burncoat High School has also recently added a computer repair class.

Private Schools

The private schools typically offer information technology programs as well. While their focus may be on religious study or college preparation, students at least have the chance to become familiar with computers. St. Peter Marian is an outstanding example of a private school that offers excellent opportunities in the information technology field. The students are required to take a keyboarding course and an introduction to computers course. In addition, St. Peter Marian offers everything from basic programming to desktop publishing to java/HTML programming.

Institutions of Higher Education

At the college and university level, there are extensive opportunities for students in the IT field. Quinsigamond Community College offers a huge variety of courses and programs and, as are many others, are willing to offer additional programs should the need arise. Worcester Polytechnic Institute offers several innovative programs, such as the Collaborative for Entrepreneurship and Innovation and the WPI Venture Forum, aimed to foster entrepreneurial business in the community. Overall, all of the institutions

of higher education in Worcester that we spoke with have an IT program in place and say they are willing and capable of adding other courses and programs should a sudden influx of companies move into the area.

5.1.2. Companies

The IT companies, staffing agencies and venture capital firm all have strong interests in our research project. The information technology companies would like to see certain aspects of Worcester improved to benefit their business. Along that same line, staffing agencies depend on an available workforce in Worcester in order for their company to be successful in Worcester. The Worcester Capital Partners are continually looking to raise money and then invest that money in local businesses that are in the beginning stages.

Information Technology Companies

Our interviews, typically of CEOs and company founders, dramatically illustrate that the IT companies in the Worcester area do not find that there is a skills gap in Worcester in their opinion. In addition, companies that do business here in Worcester believe they know exactly what the city can improve in order to increase business opportunities. From this information, it would appear that there are three main aspects that need to be improved in the City of Worcester. The three issues are the city's marketing, airport and venture capital. These issues were identified as a bigger concern

for their company than the availability of finding a skilled workforce. We will provide a detailed explanation of these issues in the Conclusion section.

Staffing Companies

The staffing companies expressed that they felt Worcester was a strong market for them to do business. They would be able to offer one of the best opinions on the availability of a skilled workforce and mentioned that there is no shortage of workers in the city. This further illustrates our opinion that there is not a skills gap in Worcester.

Venture Capital Firm

The Worcester Capital Partners offered great insight on what is currently being done to improve business opportunities in Worcester. Venture capital is essential for many companies to get started. If companies are able to find venture capital in Worcester, they are more likely to locate to the area. This also illustrates the community support for start-up companies by the investments that are made in venture capital. This is one area that Worcester could improve on and they could do this by attracting at least one more venture capital firm to the city in order to increase the opportunities for area businesses.

5.2. Archival Research

Archival research was one of the methods that we looked into when we attempted to find out what types of skilled labor force was being sought by information technology companies over the past 18 months. The microfiche data that we collected allowed us to compile and categorize the numerous listings into sub-categories. Once again, these categories were engineering, computer/hardware, computer/software, internet/new media and other. We were able to learn that engineering and computer/software personnel were especially in demand. Perhaps information technology companies were having a lot more trouble finding non-technical staff. The microfiche data enabled us to determine whether technical or non-technical jobs were more in demand during certain time periods. We found that neither type of job currently seemed to be in high demand.

5.3. Existing Data

We thoroughly examined a number of reports and surveys that have already been completed. The United States Census Bureau provided one of the most extensive and well-respected sources of data. In addition, we also consulted sources such as the Worcester Business Journal "Fact Book of 2001", online information provided by CoStar Realty Information Inc. and Massachusetts Software and Internet Council, Worcester Regional Research Bureau's "Benchmarking Economic Development in Worcester" and the "Mass Broadband Initiative: A Broadband Roadmap for Massachusetts." These publications provided us with extensive data to analyze.

5.3.1. Labor Force

The U.S. Census Bureau provided us with the majority of our data on the labor force in Worcester. We were able to determine that Worcester had a labor force of 75,368 in the year 2000. This number is second only to Boston, and considerably ahead of the third highest labor force, Springfield. In addition, we were able to analyze the unemployment rate of Worcester as it compared to other Massachusetts' communities. It is interesting to note that communities that had the largest number of IT companies, such as Cambridge and Woburn, also had very low unemployment rates. This suggests that finding workers, of any kind, would be considerably more difficult in these communities. Information technology companies in these communities would have to aggressively recruit outside of their community much more so than cities such as Worcester or Springfield.

5.3.2. IT Companies by Town & Population

A city with a greater population should have a greater number of companies located there, so the shear number of companies illustrates very little. When analyzed as a ratio of IT companies to population size, we are able to gain a more accurate picture. Our sample of communities in Massachusetts reflects the westward expanding information technology boom. Cambridge, Woburn and Needham have a significantly higher ratio, as that is where the boom started. The other communities that we sampled continue to attempt to realize the same success in their community.

5.3.3. Airports

As we do not believe that the skills gap is an issue in Worcester, we began to explore other possible factors. The Worcester Airport came up four times in our conversations with IT company personnel. Mr. Ron Ranauro, of Blackstone Computing was most straightforward when discussing the need for more and cheaper flights in and out of Worcester. We then began to analyze not only the Worcester Airport, but also several other airports in the area. It was very interesting to note that the Manchester and Providence area airports all saw significantly more business than the Worcester Airport. This is due to a lack of flights going in and out of the Worcester Airport. It makes scheduling flights at the Worcester Airport more of a hassle than a benefit to area companies.

5.3.4. Available Real Estate

The availability of real estate is always a factor when a company is deciding to locate. Our analysis of the available office space and cost of that space shows that Worcester is more favorable than Boston in several aspects. The cost of rent is 64% cheaper in the Worcester area when compared to the Boston area. There is more available space in Boston, but it is also a much larger city. The percent vacancy shows that Worcester has a higher percentage of office space available. Since they are at a lower capacity, this would suggest that Worcester would be more capable of handling additional information technology companies.

Chapter VI: Conclusion

Our project was designed to clearly state if there was a skills gap in Worcester. We used interviews, archival data and other existing data to gain extensive knowledge on this subject. We hoped that these three methods would reinforce one another and lead us to the same conclusion; which is exactly what it did.

Before we can draw conclusions from our analysis, it is important to acknowledge the limitations of our research. First, our research was limited to small information technology companies. These companies may have no problem acquiring skilled employees because they only require a few employees at once. A larger company may encounter problems in Worcester when trying to fill a large number of job openings.

Our sample size was limited to companies that were provided by the InfoTech Corporation, along with companies that this initial list of companies referred us to. The majority, 16 out of 20, were located in the City of Worcester. Companies located in nearby towns may have trouble finding qualified employees.

The time constraints on our project also presented significant limitations. We only had a few weeks to gather all of our information. This forced us to limit the number of companies and educational facilities that we interviewed. In addition, the limited time allowed us to focus on only a few of the areas that were mentioned needing improvement in Worcester.

After taking into account our results and analysis, we are able to draw some conclusions that will be beneficial to our sponsor, as well as the City of Worcester. The conclusions that we have made are detailed in the following section.

Is there a skills gap in Worcester?

The main question that our research project hoped to answer was if there is currently a skills gap in Worcester that may be hindering efforts to bring information technology companies to the area. One of the most dramatic findings that we have been able to present was that the overwhelming majority of information technology companies that we talked to did not believe that there was a skills gap in Worcester.

Furthermore, this was illustrated by several other findings. Our research into the advertisements for IT opportunities in the Boston and Worcester area shows that there is a much larger need for skilled workers in the Boston area. The analysis of existing data illustrated the higher concentration of IT companies in the Boston area and the below average unemployment rate. In addition, the advertisements for IT jobs are much greater in the Boston Globe, when compared to the Worcester Telegram & Gazette. This would suggest that companies in Worcester are more able to find skilled workers without having to advertise for them in the local paper. All of this information shows that the information technology boom that started in the Boston area is looking to expand into untapped markets.

We also showed that Worcester is an excellent place for this expansion with its strong economy with a large available labor force. The unemployment rate in Worcester tended to be slightly above the state average, while still remaining low. This would indicate that there might be slightly more workers in Worcester that are looking for work. In addition, the large student population base and large number of training programs in the area would suggest that there is at least a significant potential for highly skilled

workers. When we interviewed educational facilities in Worcester, they informed us that a majority of their IT programs and classes are not filled. All of them also added that they are capable of responding to demand and could offer additional courses or programs to meet the needs of businesses in Worcester.

Once again, we do not believe there is currently a skills gap in Worcester. The information technology companies that we talked to have all been able to find skilled workers to fill job openings. The City of Worcester also appears poised to handle an influx of IT companies by being able to train and educate people at the high schools, colleges, universities and other training programs.

If not the workforce, why does Worcester have difficulty attracting information technology companies to the area?

As we moved forward in our research, we began to focus on other potential reasons that may explain why the information technology boom in Massachusetts has yet to find its way to Worcester. We have identified a few key factors that may explain where Worcester needs to improve.

The single largest factor that we found was the marketing of Worcester. The information technology companies that we spoke with typically found Worcester a nice place to do business. They also mentioned that it was a good alternative to the Boston area. However, they believed that people and other businesses simply did not know that Worcester existed and what the city had to offer. The companies believed that if people were informed of the great things in Worcester, such as the technological infrastructure, low cost of doing business and the available skilled workforce, those people might have

initially located in Worcester. A problem that the city has is that it does not currently market itself effectively. As was shown earlier, the City of Worcester has an annual budget of $400,000,000, but spends less than $400,000 on marketing. The marketing budget for the city is less than 1% of the overall budget. This small amount would be unheard of by a typical company that competes for customers, which is essentially what Worcester is doing. In New England, the geographical proximity of many cities makes this competition extremely heated and Worcester needs to do something to remain competitive.

Another problem that we have identified deals with the Worcester Airport. Many of the companies that we spoke with mentioned this specific factor when we asked them what could be improved in Worcester. They found that the airport hindered their business. The extremely limited number and destinations of flights forced them to drive to other nearby airports in order to travel for business. Companies often had to take the extra time and hassle to drive to airports located in Boston, Providence, Manchester or other communities.

When we further examined several airports in the area, we noticed several interesting things. T.F. Green Airport located near Providence, which has a population of less than a 1,000 more people than Worcester, saw over 3,000,000 passengers as compared to 100,000 passengers in Worcester. Manchester Airport located in Manchester, New Hampshire saw over 2,000,000 passengers. Manchester has approximately half of the population of Worcester and is located about 45 miles away from Boston. Worcester is also located about 45 miles away from Boston, but is much closer to other cities such as New York, Providence and Springfield. If the time and

money were put into the Worcester Airport, we believe that the airport could see the same success as the other nearby airports and has the potential to be the largest in New England. Worcester's central location and the fact that people want to avoid the hassle of driving into Boston to go to Logan Airport would greatly benefit their status.

Venture capital also appears to be hard to find in Worcester. Village Ventures, a larger venture capital firm, notes that 77% of venture capital goes to traditional markets representing 17% of the population (http://www.villageventures.com). Worcester is a "non-traditional" venture capital market, which makes it difficult to attract investors. We believe that this is the area that Worcester has improved the most on in the last couple of years.

The Worcester Capital Partners, a venture capital firm in Worcester, was established in 1999. It is interesting to note that three colleges and universities in Worcester made a significant investment in this venture capital firm. This illustrates that these institutions are interested in helping to attract high technology companies to the area. The majority of the companies that mentioned access to venture capital as a problem in Worcester, located to the city before this firm was established. It was also mentioned that it is difficult to get other venture capital firms to invest outside of the Route 128 / I-495 area. However, some companies in the Worcester area were able to find funding from outside the area.

What is the story we are trying to tell?

We believe that there are several other aspects that the City of Worcester needs to focus on in order to be more successful in attracting companies to Worcester. Three major areas for improvement are the marketing of the city, airport improvements and availability of venture capital. In addition, it was often mentioned that the ease of doing business with the city and the overall attitude that people in the city had when dealing with information technology companies could be much improved. We will present detailed recommendations in the following section. The skilled workforce in Worcester is not an issue for the city when attracting information technology companies. In fact, it should be used as a selling point. The number of colleges and universities in Worcester is often mentioned, but this is only one aspect. The entire city, from high schools to colleges and universities to other non-degree programs, appears to be in excellent shape to handle the addition of information technology companies to Worcester.

Chapter VII: Recommendations

It is important to gain something valuable from this report and use it as the beginning of the process to better recruit businesses to Worcester. Our report has outlined that the workforce in Worcester is not the most pressing need at this time. We have presented our conclusions on other areas that need attention. It also important to understand that our research plan is just the beginning and significant additional effort will have to be made in order to ensure the City of Worcester's success in attracting information technology companies to the city.

Marketing of Worcester

We have determined that the City of Worcester is severely lacking in the marketing area. Seven companies specifically mentioned this factor as one of the most important. Worcester has many strong selling points and it is important that people outside of the city are aware of these strengths.

The first step that must be taken is to increase the marketing budget. The resources must be made available to advertise the City of Worcester as an attractive place to locate an information technology company. This increased budget would also include the Worcester InfoTech Corporation. Additional money for the InfoTech Corporation would allow for more incentives and assistance to be provided to IT companies either currently in the city, or looking to move to the city.

City Cooperation

The cooperation of the city was the second most often mentioned area for improvement. Six representatives of information technology companies in the area stated that they hoped that their dealing with the city could be made easier.

There are several factors that need to be considered when discussing this area of improvement. First, the permit and license process needs to be streamlined and be made simpler. Mr. Peter Brady of IMS, Inc. stated that the process he had to go through to renovate his building was so difficult that some other property owners would simply not improve their buildings in order to avoid this hassle.

The communication between businesses and the city government must also improve. This would entail the Chamber of Commerce and City Council to invite local businesses to any meetings where matters concerning them in any way may be discussed. Mr. Peter Green of Artis Corporation stated that he did not know that the city was planning on tearing down the building where he is located until he read about it in the Worcester Telegram & Gazette. Another idea would be for the city to publish information presented at meetings on their web page in order to make this information more accessible to the community. Information that needs to be made available includes the details on what incentives and assistance the city offers, and how a business might go about attaining those incentives or assistance.

The city should also host a semi-annual meeting with local businesses. At these meetings, the city can gauge what is needed from them and the progress of their efforts.

This would allow the city to maintain a current and accurate perception of the needs of information technology businesses.

Worcester Regional Airport

The Worcester Regional Airport was mentioned four times in our interviews with IT companies. When it was mentioned, the company representatives had a lot to say about the topic. The lack of flights and cost of these flights appear to be the major problems. Worcester needs to better compete with other airports in the area, such as T.F. Green and Bradley International Airports, in order to provide better opportunities to local businesses.

The first step in this process would be to attract another major air carrier to offer flights from the Worcester Regional Airport. Southwest Airlines would an ideal carrier for the airport. This added carrier would not only increase the number of flights offered, but the increased competition would lead to cheaper flights.

It would also be important that businesses in and around Worcester are aware of the opportunities offered by the airport. This could be done by simply adding an update on the airport at City Council meetings, Worcester Regional Chamber of Commerce meetings and other publications released by the city.

Venture Capital

The recent addition of the Worcester Capital Partners (WCP) to Worcester has greatly increased the opportunity for businesses to find funding. However, with only $16.4 million to invest, the Worcester Capital Partners cannot provide nearly enough venture capital.

The attraction of an additional venture capital firm, most likely from the Boston area, would increase the amount of capital that is available for start-up companies. Fostering the growth of companies that start in Worcester might be more beneficial, since incentives or other assistance would not be needed to entice the company to move to Worcester.

Tax Rate

Four business representatives mentioned the tax rate in Worcester as being unfavorable for their business. This relates back to the communication between the city and local businesses, because the city does offer tax breaks as an incentive. However, many companies we spoke with were simply not aware of this. The few companies that were aware of the tax rate in Worcester stated that it was too high for what the city had to offer. A combination of a lower tax rate and making tax breaks more accessible would greatly improve this area.

Further Research

As previously mentioned, our research is just the beginning of solving this complex problem. Further research is needed in many areas. First, it would be beneficial to do a similar study in the Boston area. This would provide insight on what these communities have to offer and why they have been able to be more successful with IT companies. The perceptions of Worcester that businesses in the Boston area have would also be beneficial. This would illustrate if companies outside the Worcester area were even aware of the City of Worcester and what it has to offer.

In addition, the expansion of our project to include a greater sample of companies and programs offered would provide more extensive knowledge. We have previously mentioned the limitations of our research and, had we the time and resources, these limitations could have been greatly reduced.

The City of Worcester now has a small idea of what needs to be done in order to attract information technology companies to the city. We concluded that there is an adequate supply of skilled workers in the area and recommended that other areas needed to be improved. When some of these needs are met, Worcester may be finally able to benefit greatly from the information technology boom of the Boston area.

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Appendix A:

Organizational Background

The Worcester InfoTech Corporation has been established to promote the growth of the information technology economy in the Worcester region. Worcester InfoTech hopes to take advantage of the tremendous growth of technology-related companies in the greater Boston area by attracting these companies to the Worcester region.

The origins of this corporation can be traced back two and a half years ago when a public/private initiative for information technology called the Worcester InfoTech Project began. Everett Shaw, Director of Economic Development, was the driving force behind this initiative. The Worcester InfoTech Project hoped to expand on the technological infrastructure in Worcester that began when NEES Communications installed a large fiber optic network in the city. The main goal of this initiative was to determine if the city's information technology needs were being served. This initiative provided the background and research for what would become the Worcester InfoTech Corporation.

The Worcester InfoTech Corporation officially began when the Worcester Regional Chamber of Commerce took the Worcester InfoTech Project out of the public sector and privatized this initiative in March of 2001. The Worcester InfoTech Corporation is a privately funded, non-profit economic development organization. Our liaison, Mr. Thomas P. Ahern took over as President of InfoTech Corporation on March 12, 2001. Thomas Ahern reports to Worcester InfoTech's twelve members of the Executive Committee.

This committee is comprised of Worcester Regional Chamber of Commerce personnel, as well as other personnel from organizations that have an interest in the Worcester InfoTech Corporation. The people, and their organization, are: Tom Ahern, Worcester InfoTech Corporation; John Nelson, TJX Corporation; Mark Love, Worcester Regional Chamber of Commerce; David Forsberg, Worcester Business Development Corporation; Craig Blais, Worcester Business Development Corporation; John Merrill, Worcester Capital Partners; John DeStefano, NEES Communications; Tony Pini, NEES Communications; Linda Mahoney, Verizon; Mark Donahue, Fletcher, Tilton & Whipple; Susan Rayne, Bowditch & Dewey; and a representative from Fleet Bank.

Private companies that have an interest in working with the companies that the Worcester InfoTech Corporation hopes to attract provide the funding for this private initiative. InfoTech is mainly focused on the human resource issues rather than the infrastructure of Worcester.

The number one mission of the Worcester InfoTech Corporation is to increase the number of technology related companies in Worcester and to help the existing companies prosper. In addition, Worcester InfoTech has identified four primary initiatives. The four initiatives are: high-tech business development, recruitment and placement; workforce development and skills training for the technology sector; capital availability for existing Worcester technology businesses; and competition and broad access in the high-speed Internet market. To accomplish these goals, InfoTech is able to provide assistance to these technology-related companies by providing access to capital or

financial assistance. This may be in the form of negotiating loans, contacting venture capitalists, establishing credit, or other forms of financial incentives. The Worcester InfoTech Corporation will also provide real estate assistance. They will help to locate available property and resources and also negotiate for a better price of that property or resources.

InfoTech will also work to develop the skills of the workforce in the area. It will allow people to inform others about the information technology opportunities in Worcester. Finally, the Worcester InfoTech Corporation wants to find out about the educational facilities and whether or not they are on track in terms of teaching the skills needed by students in order to be successful in the information technology field in the future.

Appendix B:

Semi-Structured Interview Plans for Educational Facilities

Colleges & Universities:

1. How would you classify your educational facility?

2. What is your student body population?

3. What are the educational goals of your institution?

4. Are there any information technology related courses offered?

    4a. If yes, how many?
    4b. If no, why not?

5. How many students are involved in the program?

6. Do you think your school can afford to create more information technology related courses into the curriculum?

7. What will you foresee in the future as needed skills for your students to have?

8. Is this college partnered with any businesses to expand information technology?

9. Some colleges have created courses that businesses suggest are needed in the IT workforce. Has this college done anything similar?

    9a. If so, what were the results? Was it successful?

10. How would you advise businesses to train their workforce?

11. Are there any other efforts that your school is making to prepare your students for the information technology field?

12. Any other additional information?

Public & Private Schools:

1. What is your student body population?

2. What are the educational goals of your institution?

3. What general courses does your curriculum require?

4. Are there any information technology related courses offered?

    4a. If yes, how many?

    4b. If no, why not?

5. Are these information technology courses classified as a required class or are they an elective?

    5a. If they are electives, what is the percentage of students that actually take these courses?

6. Do you think your school can afford to create more information technology related courses into the curriculum?

7. How many of your high school students go on to higher education?

8. What will you foresee in the future as needed skills for your students to have?

10. How much space or time in your curriculum does the national and state frameworks allow for additional courses?

11. What are you preparing your students for? (higher education, workforce, etc.)

12. Are there any other efforts that your school is making to prepare your students for the information technology field?

13. Any other additional information?

Appendix C:

Semi-Structured Interview Plans for IT Companies

How would you classify your company?

How long ago did your company locate in the Worcester area?

Are there specific aspects that your company was looking for when deciding to locate in the Worcester area?

Was there an adequate supply of skilled workers in the area?

4a. If not, what are you doing to find skilled workers?

4b. How do you go about finding them?

4c. Where do you look in terms of geography, institutions, and agencies?

5. What type of skilled worker does your company primarily employ?

6. What specific types of skills is your company looking for in an employee?

7. What level of education is needed by these workers?

8. What type of skilled workers do you foresee as most needed in the future?

9. Were the area colleges and universities a factor to your settlement in Worcester since there is a constant supply of graduates each year?

10. How would you classify Worcester's existing facilities, services and installations that are needed for your company to function?

11. How would you rate Worcester's technology infrastructure? (1-5, with 5 being excellent)

12. How would you rate Worcester's physical infrastructure? (1-5, with 5 being excellent)

13. Since your location to the Worcester area, have you found that the cost of bandwidth has decreased with the increased supply of bandwidth?

14. Please rate the importance of the following factors that your company considered when locating to the Worcester area. (1-5, with 5 being most important)

Overall Infrastructure
Weather/climate
Availability of skilled workers
Availability of capital
Quality of life
Taxes
Proximity to markets
Regulatory climate
Cost of real estate
Cost of doing business

15. Has your company encountered problems trying to fill skilled labor positions now or in the past?

16. What category of skilled workers have you had the most difficulty finding?

17. Are you willing to train your employees?

    17a. If so, what types of training programs do you offer?

    17b. If not, how do you utilize any outside training programs?

18. Have you ever worked with any area colleges to develop training programs?

    18a. If so, have these partnerships been beneficial?

    18b. If not, are you aware that these opportunities exist?

19. Do you recruit for certain positions outside of the Worcester area?

20. Do you aggressively recruit for certain positions in the Worcester area?

21. Were you provided with any financial incentives to settle in this area?

    21a. If so, what types of incentives? (grants, tax breaks, low interest loans, etc.)

22. Are there other possible types of incentives that you would have found attractive?

23. Taking into account all these things, infrastructure, educational facilities, financial incentives, etc., what needs to be done to improve opportunities for your company?

24. What can Worcester do to close the skills gap if one exists in the area?

Appendix D:

Our Interview List

Companies Interviewed:

1. Thomas McGovern – Lightband Communications Inc.
2. Mohan Nannapaneni – Sigma Systems, Inc.
3. Ron Ranauro & Graeme Boyle – Blackstone Computing
4. Arthur Butler – Electromagnetic Solutions Inc.
5. Ian Rossi – eSourceMortgage.com
6. Peter Brady – Internet Marketing Services Inc. (IMS)
7. Wallace Andrews – InterGlobal Services Inc.
8. Michael Matthews & Marc Bellora – Optasite Inc.
9. Tony Lista – Vista Information Technologies
10. Tana Scouras – Vitel Software Inc.
11. Olen Bielski III – Center for Applied Fiberoptic Applications (CAFA)
12. Francesca D'Angelo & Ken Amidon – Blue Cod Technologies
13. Peter Green – Artis Corporation
14. Shari Worthington – Telesian Technology
15. Gary Gomes – Allegro MicroSystems Inc.
16. Matt Roy – Medicalis Corporation
17. Debbie Somma – Rainier
18. John Merrill – The Worcester Capital Partners
19. Kevin Wilson – Manpower Inc.
20. Craig Smith – Geek Staff Inc.

Colleges Interviewed:

1. Andrea Aiello – Becker College
2. Arlene Lowenstein – Worcester Polytechnic Institute (WPI)
3. McRae Banks – Worcester Polytechnic Institute (WPI)
4. William White & Aparna Mahadev – Worcester State College
5. Charlene Martin – Assumption College
6. Tom Massey – Clark University
7. Noreen McAuley – Quinsigamond Community College

Private Schools Interviewed:

Mary Anne Gormley – Notre Dame Academy

Patricia Aubertine – St. Peter Marian High School

Paul DiDomenico – St. Mary's Jr. & Sr. High School

Public Schools Interviewed:

1. Joe Buckley – Worcester Public Schools - Science Liaison
2. William Daigle – Worcester Public Schools - Math Liaison
3. Janet Ginkus Allen – Worcester Public Schools - Elementary Math Liaison
4. Charles Campbell – Worcester Public Schools - Technology Liaison
5. Janice Johnson – Worcester Public Schools - South Quadrant Manager
6. Frank Mann – Worcester Vocational High School – Department Head of Telecommunciations
7. William Cousins – Worcester Vocational High School – Director of Recruiting

Appendix E:

Interview Summaries for Educational Facilities

Colleges:

1. **Assumption College**: Ms. Charlene Martin, Dean of Continuing Education

On Thursday, November 15, 2001, we met with Ms. Charlene Martin of Assumption College. Ms. Martin is the Dean of Continuing Education at Assumption. Assumption College is a four-year liberal arts college for daytime students with a graduate studies and continuing education department. The following is a summary of our interview.

Assumption College began offering information technology programs in the spring of 2000. Prior to that time, there were no IT-related courses offered at Assumption. Assumption partnered with a certified training company in order to offer A+ and MCSE certification programs. They offered these courses, taught by instructors from the training company, at the Assumption College campus. It wasn't until the spring of 2001 that there was enough interest to have both the A+ and MCSE programs. This was not a surprise to Ms. Martin, as Assumption is not known for their information technology department. She estimated that there were between seven and 14 students in a class when it was offered. The A+ certification class would have more students than the MCSE class.

Assumption decided to start offering IT courses because, at the time, there were no such programs available in the area. At almost the exact same time that Assumption began to offer these courses, Becker College also offered IT courses through its New Horizons program. Assumption attempted to garner interest by blanket advertisements to company training directors.

The IT programs at Assumption suffered a major setback when the company that Assumption College had partnered with declared bankruptcy. This occurred in October of this year and forced Assumption to cancel the IT courses for the year. Ms. Martin believed that these programs were just beginning to gain more interest and could have kept going had it not been for the company's bankruptcy.

The training company that partnered with Assumption did identify that Worcester had been a tougher market to sell. The company had similar partnerships in the Springfield, Bridgewater and Fairfield area. Ms. Martin believed that this tougher sell was largely due to the typical personality of Worcester residents. Traditionally, Worcester residents are very bargain conscious. Another obstacle that potential students had to overcome was finding a way to pay for the courses. A couple of individuals had their training paid for by their employer, but Ms. Martin believed that many people might have had trouble getting approval on loans. This may have been because many people were in low-income jobs, or even unemployed, and the banks were unwilling to take a risk by giving them a loan. Assumption College was also somewhat restricted by the available space on campus and their limited computer facilities.

Assumption College did try offering a web master certification program, but was forced to cancel due to a lack of interest. Assumption offered the IT courses part-time at night. If a student wished to complete both the A+ and MCSE program, he/she would have to commit to four nights a week for seven months. This is a huge commitment for anyone, especially someone who is typically working full-time during the day. This is why Assumption attempted to offer a more concentrated track during the day. They were unable to do this due to a lack of interest.

Ms. Martin believed that their IT courses could be successful in the future with a fresh start next year. She mentioned that the need for IT skills is still there, even with the current economy. Convenience is very important when offering continuing education and Assumption College hopes that its on-campus training program can provide that in a shorter time frame than before.

2. **Becker College**: Ms. Andrea Aiello, Associate Dean of Centers for Learning and Career Advancement

On Tuesday, November 6, 2001, we conducted a personal interview with Ms. Andrea Aiello. Andrea Aiello is the Associate Dean of Centers for Learning and Career Advancement at Becker College. A summary of the interview is provided below.

Ms. Aiello stated that Becker College was the first in the area to offer non-degree information technology programs. Over one year ago, New Horizons Computer Training Centers partnered with Becker College to expand the offerings of non-credit based courses. The non-credit courses that Becker offers now are the MCSE certification, Certified Internet Webmaster (CIW), and A+ computer technician courses. Becker maintains many computer labs for students to use while other colleges sway more to require the students to have their own computers.

The enrollment of fulltime students at Becker is around 1000 and the part-time enrollment is also around 1000. At least one third of the enrolled students are going through the computer related courses. There was not as much interest in the New Horizon programs as expected. The programs' enrollment was good initially but soon dropped off as additional colleges and companies started to offer similar programs in the area.

The Centers for Learning and Career Advancement have the ability to pilot new courses that may later be approved by a committee and added to the regularly scheduled curriculum offerings. The flexibility of Becker also allows them to tailor a course, credit or non-credit, for the needs of a company. If companies do come into the area, the school will offer courses for them to offer to their employees. It has been the College's

experience that a perceived demand for certain courses does not always translate to students registering and courses populating. Becker College is poised to meet the demands of information technology companies should the needs arise. Currently, there are only a few companies that have expressed needs.

3. **Clark University**: Mr. Thomas Massey, Dean of College of Professional and Continuing Education

On Tuesday, November 6, 2001, we conducted an interview with Mr. Tom Massey via telephone. Tom Massey is the Dean of College of Professional and Continuing Education at Clark University. A summary of this interview is provided below.

Mr. Massey classified Clark University as a complex, multi-tiered educational facility with multiple campuses both in the state and around the world. Clark University is a liberal arts university that also offers select graduate courses. Clark University has around 700-100 students in Worcester, 2000-3000 students in Boston and 400-500 students in Israel. The continuing education department focuses in adult education, with the average student age somewhere around 35 years old.

As far as the information technology area, Clark offers a M.S. in Science and Technology at its Framingham campus. This program was started this year with about 25 students. Mr. Massey feels that this program will expand in the future, as the demand for these skills is present. Mr. Massey feels that there is a strong need for this program in Framingham. However, that need does not exist here in Worcester. Clark University uses focus sessions and input from graduates currently at information technology related companies when they are determining the need for adding IT courses.

Mr. Massey does see a potential for expanding its information technology courses in the area. Currently, Clark University has four Computer Career Institutes in the Boston area. Mr. Massey stated that there was probably a need for a Computer Career Institute in the Worcester area.

Mr. Massey finds that the greatest demand from his department is equipping students with the communication skills that are necessary in the business world. Clark University has found a demand for both information technology and communication skills.

4. **Quinsigamond Community College**: Ms. Noreen McAuley, Dean of the Center for Continuing Education.

On Thursday, November 29, 2001, we met with Ms. Noreen McAuley of Quinsigamond Community College. Ms. McAuley is the Dean of the Center for Continuing Education at Quinsigamond Community College. The following is a summary of our interview.

The Continuing Education department at Quinsigamond is different from most other continuing education departments because they focus on non-credit programming and are also a profit center. This enables Ms. McAuley to function basically as an entrepreneur. The Continuing Education department is driven by industry needs and requirements not by academic programming and regulation. This allows the department to continually change and update its course offering to accommodate the needs of area businesses. The department contracts with employers in order to train their employees. It also conducts public programming to support individuals' career and personal development needs.

The Continuing Education department has nothing to do with offering degrees. In the technology field, vendor credential certifications may hold more value than a college degree. Individuals with these certifications are in high demand; not only at information technology companies, but at almost any other company that has an information technology infrastructure need.

Quinsigamond offers a huge array of information technology related courses. A majority of these courses are offered online. The target audience of Quinsigamond is working adults and online courses offer the flexible schedule that appeals to so many in

the target audience. Most of the online courses start the second Wednesday of every month and then are available 24 hours a day, seven days a week. This flexibility allows the student to work at their own pace when they want to work. The online courses are cheaper for both the student and, in most cases, the employer. Quinsigamond definitely has a lot more online students than students on campus or at their facility in the mall.

Two years ago, Quinsigamond was looking to get into the high-end technological certifications, which included among others Oracle, Linux and MCSE certifications. The Continuing Education department has no instructional space on campus that is dedicated solely to them. The only space on campus that the department is able to get is the space available after credit programming is scheduled. So, the department had to go looking for space and found that the mall was a good match for them. The Worcester mall may be transitioning right now from a high-end retail space, but there was available space and a good infrastructure already in place. It will take some time to change some people's lingering perceptions of the area, but as successful programming takes hold, new perceptions are created as well. In September training programs were transitioned from the Worcester campus to the mall site. In October the first vendor certification class, Microsoft Certified Systems Engineer (MCSE) was launched with 7 students. Ms. McAuley believes that programming at the mall is already successful. Plans are already in place to bring on line additional space across the hall from the current site. Currently, Quinsigamond has a lab for vendor certification training, a computer lab and some traditional classroom space at the mall.

When asked if Ms. McAuley believed there was a skills gap in Worcester, she replied that she thought there was an "enormous" skills gap. One of the reasons she

listed for this was that many Worcester natives do not explore career opportunities beyond the greater Worcester area. It's very difficult to convince people to travel to worksites inside Route 495 and to Boston. Many Worcester residents tend to rely on the experience of friends and family in exploring career options.

One thing that Worcester and Quinsigamond Community College need to do is to offer information sessions to open people's eyes to the vast opportunities available. The average person has no idea of the opportunities in information technology. People simply do not know what's out there. Quinsigamond has had trouble recruiting students into the technical field. Part of the reason for that is that people in Worcester do not fully understand the breadth and depth of career choices in the technology field.

Another aspect is the issue of who comes first, the companies or the employees? This is where economic development and educational facilities need to work better together. Large information technology companies do not suddenly locate/relocate in Worcester; there is always someone who knows that they might be thinking of moving to Worcester. If a little notice could be give to the educational/training facilities, they could prepare enough workers before the company moves to Worcester. The colleges of the Worcester area must also do a better job of working together.

Ms. McAuley believes that the training companies and the Worcester Public Schools provide major solutions to the skills gap problem. The training companies and public schools will be able to provide the type of skilled worker that in the future is most in demand from information technology companies.

5. **Worcester Polytechnic Institute**: Ms. Arlene Lowenstein, Dean of Continuing and Professional Education.

On Wednesday, November 14, 2001, we met with Ms. Arlene Lowenstein of WPI. Ms. Lowenstein is the Dean of Continuing and Professional Education. A summary of the interview is written below.

When the goal of our project was summarized for Ms. Lowenstein, she informed us that across the nation information technology training groups are saying that there is a gap in skilled workers.

Last year WPI taught over 450 non-credit programs to over 8000 students at all the WPI campuses. In-house training is also offered by WPI. Ms. Lowenstein provided us with a copy of the Continuing and Professional Education course catalog. The catalog provided us with answers to the majority of all our questions. In this catalog, the companies that WPI has worked with are listed along with full descriptions of the many courses offered. Ms. Lowenstein expects that 20% of the students taking courses this year will be in the information technology courses.

Ms. Lowenstein conducts focus groups with individuals of industry at various times to make sure that WPI is offering the courses that individuals will need to succeed in the workforce. She is also thinking of the idea of an industry board to help advise course offerings, but has stated that even meeting two times a year might be tough for the board.

6. **Worcester Polytechnic Institute**: Dr. McRae Banks, Director of the Collaborative for Entrepreneurship and Innovation Program & Management Department Head.

On Tuesday, November 27, 2001, we met with Dr. McRae Banks of Worcester Polytechnic Institute. Dr. Banks is the Director of the Collaborative for Entrepreneurship and Innovation program and Management Department Head at WPI. The following is a summary of our interview.

The Collaborative for Entrepreneurship & Innovation (CEI) at WPI offers a number of programs designed to foster entrepreneurial opportunities at WPI. The Collegiate Entrepreneurs' Organization (CEO) is one of these programs. The CEO is a student organization for both undergraduate and graduate students interested in entrepreneurial business. Currently, there are about 100-150 students involved in this program. The CEO brings in speakers relevant to entrepreneurial business, offers business tours, offers seminars or workshops and provides students the opportunity to compete in national competitions in order to foster a student's interest in entrepreneurial business. This program also creates a networking venue for the students at WPI. A number of students already run a small start-up company and encounter problems along the way. They might think that these problems are unique to them and their business, but they come to find out that many others face similar problems. The network provided by CEO allows students to work together to solve common problems.

Earlier this year, it was announced that WPI, along with the College of the Holy Cross and Clark University, would be investing $1 million in the Worcester Capital Partners (WCP). This decision was made for a couple of reasons. First, the endowment fund at WPI tries to diversify their investments. An investment in venture capital is a

high-risk investment with the opportunity for high rewards. WPI had invested in incubators and venture capital funds before and decided to invest in the WCP after John Merrill, Managing Director of the WCP, made a presentation to the WPI investment committee.

In addition to the monetary investment, WPI continues to make a social investment in the city of Worcester. Worcester Polytechnic Institute certainly wants to improve the community because building a stronger community helps WPI to attract both faculty and students. Dr. Banks and WPI do not want to see the information technology expansion to skip over Worcester.

Another opportunity that WPI offers is the CEI@WPI ALL-OUT Business Plan Challenge. This year, CEI will award $50,000, as compared to $10,000 last year. This may be awarded as cash, a loan or staggered increments of cash. The $50,000 prize money places WPI among the front of the pack when compared to other college business awards. One thing that is unique to the WPI contest is that it is restricted to WPI students. All students in the group must be enrolled at WPI; at other colleges only one student in the team is required to be enrolled at the school.

Worcester Polytechnic Institute is also home to the WPI Venture Forum. This forum allows students, alumni, and others community members to meet with entrepreneurs, venture capital angels and other venture capital funds. The Venture Forum also awards a $10,000 prize. Dr. Banks hopes that WPI will be able to increase this prize from $10,000 to $50,000 in the near future. He also hopes that WPI will eventually establish three separate $50,000 awards. The three awards would allow separate awards for undergraduate students, graduate students and other members in the community.

The New England Collegiate Entrepreneurial Award is another opportunity that WPI offers its undergraduate students who already operate their own business. WPI awards $3,000 to the winner of the regional contest. The winner at WPI then goes on to compete at the national level for a chance to win $10,000.

WPI also offers the opportunity to have dinner with entrepreneurs. A grant awarded to this school currently allows WPI to provide dinner to 18 college students, six high school students and three entrepreneurs five times per year. This dinner opportunity allows people to share stories and fan the fires in entrepreneurship. Dr. Banks hopes that this program can be expanded to once a month and accommodate 15 tables, as opposed to the current three tables.

Dr. Banks believes that the efforts that WPI has made to support entrepreneurial efforts are helping to make a name for WPI as one of the premier institutions for young entrepreneurs. WPI also has a number of ideas for the future. Dr. Banks mentioned that WPI recently purchased the Burnside building on Boynton Street. A possible use for this building would be to renovate the building and make it a dormitory for student entrepreneurs. This building would have completely separate hardware and software from WPI. The entrepreneurs' dorm would allow 50-75 students to run their business while attending WPI. Another program that WPI hopes to get started is the virtual incubator program. This program was approved, but never launched due to the recent dot com meltdown. The Bioengineering Institute at Gateway Park on Prescott Street is another unique opportunity available to WPI students. The infrastructure available at this building would allow bio-related students to perform labs that they would not be able to do in the entrepreneurial dorm, or anywhere else.

Worcester Polytechnic Institute also offers an entrepreneurial boot camp. This boot camp has a strong emphasis on the finance aspect of starting a business. It allows people to learn about venture capital, what it is, and how to get it. The day long program is open to anyone in the start-up phase of their company and allows people to travel to Worcester to see the opportunities that are present in the city.

All the facilities that WPI currently offers, and hopes to offer in the future, will be used to attract more high school students to WPI that are interested in entrepreneurship or bio-related fields. The more students that are here in Worcester, the more likely that some aspect of that talent will remain here in Worcester.

WPI offers an extensive Management Information Systems program in undergraduate and graduate degrees. Currently, there are approximately 150 students in the undergraduate program and an additional 40 students completing their master's degree. Both of these programs have grown substantially in recent years. The master's program was started in the fall of 1997 with five students and has grown every year since. When Dr. Banks came to WPI in 1995, the undergraduate program had five students. Since then, it has grown to become the largest degree program in the management department.

When asked his opinion on the possible skills gap in Worcester, Dr. Banks explained that it was a complicated, multi-variable problem. He stated that Worcester probably doesn't have the skills to meet a big influx of IT companies. However, Worcester draws its workforce from a 50 mile radius which provides sufficient skills if the people are willing to commute to Worcester. So part of the problem now becomes how to attract people to Worcester. The single largest factor for most people is

education, on all levels. In Worcester, the college and graduate level educational opportunities are very good. Worcester could improve its public education and skills-based education. Another problem that in Worcester is that nobody knows how to market. This includes both WPI and the city itself. WPI and Worcester are both great in many aspects; people simply don't know that they exist.

The city of Worcester must show that the strengths of the city outweigh other factors that are not so favorable. They must convince that factors such as an available highly-skilled workforce and superior technological infrastructure are worth putting up with the downsides of Worcester. People in Worcester must also try to see the long term outlook here in Worcester. It typically takes 12-15 years to fully realize the benefits of a company locating in here.

7. **Worcester State College**: Dr. William White, Dean of Continuing Education, and Dr. Aparna Mahadev, Chairperson for the Department of Computer Science

On Thursday, November 8, 2001, we met with Dr. William White and Dr. Aparna Mahadev of Worcester State College. Dr. White is the Dean of Continuing Education at Worcester State and Dr. Mahadev is a Professor and Chairperson for the Department of Computer Science. The following is a summary of this interview.

Worcester State College offers a bachelor's degree in computer science and a minor in web design. There are approximately 270 students in the major. This number has grown within the last two years and is expected to continue to grow. The courses offered that are required for this major includes two semesters of calculus, two semesters of discrete mathematics, and two semesters of physics or two semesters of analog/digital electron. Pertaining to the major, courses include computer science 1 and 2 designing with assembly language programs, data structures algorithms, and operating system database design.

Worcester State also offers non-credit courses in word, excel, and PhotoShop. Up until recently, these classes have been taught face-to-face but in the coming future, these classes will be offered only. Currently, there are about 25 students taking these courses but the number is expected to increase once it is offered online, as it will be cheaper.

A fairly good amount of computer science majors do internships. According to Dr. White, when the major was designed, they looked at the industry for the needed entry-level skills.

Web design dealing with HTML is one of the new classes that is being offered. The computer science department has reconfigured some of the courses offered as a

result of changing. Since the change, visual basics has been dropped and C++ has not been taught in the last two years with the exception of C under Unix. The computer science department has gone to teaching Java Script.

Some of the non-credit courses offered in computer science include CGI & pearl programming, Visual Basics 6.0, and Cisco Certification Network Administration. A+ certification, MCSE certification, and Red Hat Linux are also non-credit courses but are offered online. These classes are not foreseen as future credit classes.

Computer Science is one of the fastest growing majors at Worcester State. It has really grown since the last two years and is very strong based upon a 5-year program evaluation. The non-credit courses tend to be easier to add, as they are able to respond to needs faster than the credit courses. The credit courses are more difficult, as it needs to go through a process to be approved.

According to Dr. Mahadev, Worcester State only focuses on computer science, not computer engineering nor MIS. The majority are software developers and software engineers. Worcester State also has a national advisor, whom they meet with twice a year, to discuss its curriculum.

Public Schools:

1. **Worcester Public Schools**: Ms. Janet Ginkus Allen, Math Facilitator for grades K-8

On Monday, November 5, 2001, we met with Ms. Janet Ginkus Allen at the WPI library. Ms. Allen is the Math Facilitator for grades K-8 for the Worcester Public Schools. The following is a summary of this interview.

Ms. Allen is the math facilitator for all of the 45 elementary and middle schools in the school district area. Her task as the math facilitator is to go to the schools that students have the largest weakness in math and help them improve. While she is making sure that these schools are teaching their students the material that needs to be learned, she also thinks that teachers should promote the district to create a group of teachers at each school to be designated as a "math specialist" or a "science specialist". These "specialists" will be able to put more emphasis on the mathematical and science aspects of technology. Although this may seem like a good idea, certain issues may arise such as a teacher's interest or the extra pay that is needed.

Basic math is the type of math that is taught in the elementary schools. In addition, the school district provides professional development courses for teachers, as described in the Professional Development Brochure, to teach them more knowledge of mathematics.

The only types of technology that the Worcester Public Schools has in the elementary schools are the use of calculators and computers. The high schools, however, offer courses that deal with designs and technology. In addition, the school district has been using technology as a means to organize itself. They have computer programs that

analyze a student's math skills. In each school, there is a "CCC" lab for each student to take in addition to their basic courses that will help them practice and improve upon their math skills.

Ms. Allen believes that problem solving and making sense of problems are the main skills that students need to have in the future. Students need to know how to make sense of the problems that they are faced with and be able to tackle the solutions to those problems.

2. **Worcester Public Schools**: Mr. Joseph Buckley, Science Curriculum Liaison

On Friday, November 2, 2001, we met with Mr. Joseph Buckley at South High Community School. Mr. Buckley is the Science Curriculum Liaison for the Worcester Public Schools. The following is a summary of this interview.

At South High School, two years of science is required. More than half of the students take four years of science. Students at South High are also required to take one technology program. The students looking at college often take AP Biology, AP Physics, and/or AP Environmental Science. Applied biochemistry, physics, and electronics are also offered.

Worcester's school district is divided into four quadrants. Each quadrant has a different focus. South High has a biology & math focus with emphasis also on business and environmental issues. A student can select a magnet school depending on what they wish to study. Doherty High School focuses on design engineering, North High School focuses on biomedical, and Burncoat High School focuses on the arts.

In the last year the Worcester Public School System has taken over the curriculum of Worcester Vocational High School. They will implement a full set of science and math courses this year. In addition, they are looking at setting up an engineering program at the high school. The school system has received a substantial grant to develop this curriculum. The school committee must approve the courses of study and course materials for this new curriculum.

There is a continual need for change in the curriculum of the Worcester Public Schools. The school system adjusts according to the needs of businesses and colleges.

However, it must also ensure that its students pass the MCAS, so there is a strict curriculum up until the 10th grade. Three years ago the curriculum only offered AP Biology to students at South High. In the last two years they have added AP Physics and AP Environmental Science. South High is also looking to add earth and space science into the curriculum.

Mr. Buckley estimated that 60% of the students at South High School went on to four-year institutions. In addition, another 15-20% went on to other means of formal training.

Every year the state of Massachusetts provides a set of frameworks for the public schools. These frameworks can be classified into four strands: earth and space science, life science, physical sciences, and technology/engineering. In the next year there will be a new set of state frameworks in which the school will have to realign their present curriculum. Frameworks continue to be revised when the need or national focus seems to be significant.

Students are required to take the MCAS test at the end of their sophomore year. They are required to pass this test in order to graduate. However, in the near future students will be required to also pass a two year integrated science exam or two one year field specific exams (biology, physics, chemistry, etc.).

The top priority of South High School is to have their students graduate. They must pass the MCAS test to graduate, so it is very important for the curriculum to prepare them for this test. Another goal is to prepare students for some type of higher education, such as college or trade school.

3. **Worcester Public Schools**: Mr. Charles Campbell, Technology Facilitator & Ms. Janice Johnson, South Quadrant Manager

On Monday, November 19, 2001, we interviewed Mr. Charles Campbell and Ms. Janice Johnson. Ms. Johnson is the South Quadrant Manager of the Worcester Public Schools and Mr. Campbell is the Technology Facilitator of the Worcester Public Schools.

On a previous visit to see Mr. Campbell, he provided us with the Tech Plan for the WPS. The plan is a rough draft stating the technological goals of the school system for the next six years. Massachusetts has required in the past a tech plan for the previous five years. Mr. Campbell mentioned that the plan was very helpful for the public school system and gave the school system goals to achieve. The state does not require a formal plan, like the one Mr. Campbell provided us with, but does ask for a progress report to verify that the school system is proceeding in the right direction.

Worcester Public Schools, when hiring, place an ad in the Worcester Telegram & Gazette and also the Boston Globe. Although, the school system tends to hire outside of the schools, last year they hired two new repair technicians, one of which is a recent Worcester Voke graduate. There has been difficulty in the past hiring for information technology positions because schools cannot compete with the salary being offered at companies. Even though the school system has had difficulty filling positions they did eventually find the needed workers. This difficulty in finding workers has passed with the falling economy and currently the school system has a much greater pool of possible workers to choose from. Still, the workers that the school hires for information technology positions tend to be young. If the school system happens to be understaffed

these new workers get the chance to gain experience in all parts of the information technology field, unlike they would at a company.

There are six online courses currently being created for teacher training in the information technology field. The courses are in the designing stage right now and will be completed by March. The next stage is testing it with individuals who already know the course that is being taught and can provide feedback. The novice courses for the teachers will still be taught face-to-face. It is hard for many teachers to take a course from three to five in the afternoon, after they have already completed a day of teaching. The school system will be offering the course online so that the teachers may complete it at the most convenient times for them. Workshops will still be conducted when there is a new product or procedure that teachers will be using.

Students have the ability to use computers in labs and also in the classrooms. The state offers a course designed by Princeton to help students pass the MCAS test. The name of the course is called MCAS 2003. Doherty and Burncoat High Schools have just recently received new computers from Intel and IBM. The donations from companies are not just handed out; the schools must actually seek them. Some of the donations that the schools receive are outdated and occasionally cause more problems than they are worth. Soon, Mr. Campbell said he would be talking with Intel and the Voke School about filtering the donations from Intel through Voke so that the students there can gain experience in computer repair. Also, Burncoat has a computer repair class and they too can help fix the donated computers for the school system. The Youth Tech Entrepreneurs (YTE) have developed a curriculum for information technology and Mr. Campbell hopes that the Worcester Public Schools may work more with this program in the future.

The Worcester Public Schools still offer the basic computer science class in each high school. They also continue to explore new classes to offer and continue to update their curriculum. Any new course that is designed, along with the materials and texts must be approved by the school committee. This process can be rather quick or lengthy, depending on the class.

4. **Worcester Public Schools**: Mr. William Daigle, Math Curriculum Liaison

On Monday, November 5, 2001, we met with Mr. William Daigle. Mr. Daigle is the Math Curriculum Liaison for the Worcester Public School System. The following is a summary of this interview.

Mr. Daigle began by stating that a set of national and state frameworks guide the math curriculum in the Worcester Public Schools. The national frameworks were developed in the early 1990s and the state frameworks were completed in 1995, with revision in 2000. The National Council of Teachers of Mathematics (NCTM) formed a group of educators and industry personnel to determine a set of standards of what kids should know by a certain age. The state frameworks have been broken down into five strands. These five strands are number sense and operations, patterns, relations and algebra, geometry, measurement, and data analysis, statistics and probability. These frameworks help vertical articulation between teachers. For instance, a 9^{th} grade teacher knows what the kids should know by 8^{th} grade, so at the beginning of the year the teacher can pick up where the students left off.

The Worcester Public Schools offer Algebra, Geometry, Advanced Algebra and Pre-calculus as their basic math courses. Students do have the opportunity to double up on math classes, as well as take more advanced courses. There is no general track, per say, in the Worcester Public Schools because the students have a wide variety of options in math courses. Students are required to take three years of math in order to graduate high school. This was changed from only requiring two years of math before 1996. Mr. Daigle guessed that about 40% of the students take four years of math classes.

The math curriculum at the Worcester Public Schools is constantly evolving. The school system eliminated a lot of courses in the mid 1990s. Every student is expected to perform at a higher level, so more honors and college level courses are currently being offered. The school systems added Advanced Placement Statistics at Doherty High School, with hopes of adding the class to more high schools in the near future. In the future, some things will change in the math curriculum, while some things will stay the same. The math curriculum will continue to change and evolve with the times.

5. **Worcester Vocational High School**: Mr. Frank Mann, Department Head of Telecommunications & Mr. William Cousins, Director of Recruiting

On Friday, November 9, 2001, we met with Mr. Frank Mann and Mr. William Cousins of Worcester Vocational High School. Mr. Mann is the Department Head of Telecommunications at Worcester Vocational High School. He is also a teacher who runs the IT shop. Mr. Cousins is the Director of Recruiting at Voke. A summary of the interview is provided below.

Mr. Mann teaches A+ certification classes. There are currently ten sophomores and ten freshmen students taking this course. By December of sophomore year, a student is required to take the certification test. Next, a student takes the Cisco certification network administration course for the next two and a half years. The focus is on designing and maintaining a network of a 200 to 300 persons company. At Voke, students are also taught how to be field service technicians. Students are given trouble tickets and must solve the problem. Also, students learn valuable customer service skills that are essential for their careers. By graduation, students have at least three months of work experience. The school has industry advisors from many large corporations that help design the curriculum. Most of the computers that the school maintains are donated and virtually all run a Windows operating system with Intel infrastructure.

The Cisco certification is a fairly new program and there is a lot of interest in the middle school. Voke toured over 8000 eighth graders this year. The next students to start the Cisco certification will start in January.

Recently, Alden Trust has provided a grant to develop a pre-engineering curriculum. The program will concentrate on engineering more than the general course

load of a regular high school. This program will employ dedicated teachers who only teach this set of courses. Teachers and students are already being recruited for this new curriculum. This program would have the small school concept with flexible hours, narrow focus, and a tailored curriculum. Worcester is hoping to build a new school and already has secured Bill Gates Funding and Kennedy Funding. This new school is part of a proposed 80 million dollar campus.

The curriculum is constantly being changed to meet the desires of the advisory board. Frank Mann meets twice a year with the operations manager and discusses which courses should be added, dropped or modified. A new course that could be offered would be in partnership with MCI. MCI has a lab that students would have the privilege to use fiber optic splicing.

Currently, it is estimated that 30% of the students go on to higher education. Of this 30%, most students go to a community college to further their education. A new program AVID, Advancement Via Individual Determination, is currently being used to increase the amount of students coming out of the school district, that are going on to higher education.

Worcester Vocational High School has an association with Intel. The program funnels decommissioned computers from Intel to the school. Currently the school has 350 – 400 computers. This is a sufficient amount for the entire school. When the school receives these old computers, they are broken down by the students and pieced back together to make working computers. Voke can then send extra computers out to the rest of the school system.

Private Schools:

1. **Notre Dame Academy**: Ms. Mary Anne Gormley, Curriculum Director

On Wednesday, November 14, 2001, we met with Ms. Mary Ann Gormley of Notre Dame Academy. Ms. Gormley is the Curriculum Director for the school. A summary of this interview is provided below.

Notre Dame Academy is the only private all girls school in the area. Currently, there are 315 students at Notre Dame. Notre Dame is a college prep school, of which all of the graduating students go on to higher education. All of the girls at Notre Dame Academy go on to four-year colleges. It is very rare that a student would attend a two-year college.

The goal of Notre Dame Academy is stated as follows from their mission statement: "Notre Dame Academy's philosophy of education is built on the belief that education should prepare students for their role as Christian women. We wish to provide our students with the opportunity to become more aware of what is happening in their lives and to assume responsibility for themselves and their community. In order to learn to make responsible choices, Notre Dame students have the freedom to learn in a school dedicated to high academic standards and to involve themselves in the community, both utilizing its resources and serving its people."

At Notre Dame, there is a solid core curriculum that every student must follow. All students must complete six full-credit courses successfully each year, as well as required partial credit courses. All courses are college preparatory courses and a broad range of advanced level courses are offered. Students in grades 11-12 may carry seven

full-credit courses with the approval of the guidance department. The requirements for graduation from NDA are four years of English, four years of Religious Studies, three years of Math, two years of Language, three years of Science, and three years of History. However, students are always reminded to be mindful of college requirements as they choose their courses and electives. Most students complete four years of Math, History, and Science and at least three years of Language. In addition, there is a keyboarding/computer applications course that is required for all freshman year students to take.

Notre Dame has a very demanding academic program grounded in the Humanities and Sciences. Every course offered utilizes technology and expects students to use and apply their knowledge of computer technology in their research, class presentations, and projects. Notre Dame offers its students a graphics design course, which heavily uses computers as a necessary tool. Students also have the ability to be taught additional computer technology skills by the Technology Director and a computer teacher. This is accomplished by tutorials, interdisciplinary endeavors, and also through the school's computer club.

Every year departments meet to review their course offerings. The offerings are evaluated on the basis of the school's mission statement, the needs of students, and the entrance requirements of institutions of higher learning. The focus areas of this year's professional development efforts (workshops, group investigation, etc.) are three-fold: rubrics and assessment; curriculum development and mapping; and infusing technology into the curriculum. Approximately a third of the faculty are working in each of these areas.

2. **St. Mary's Jr. & Sr. High School**: Mr. Paul DiDomenico, Principal

On Monday, November 19, 2001, we met with Mr. Paul DiDomenico of St. Mary's Jr. & Sr. High School. Mr. DiDomenico is the principal of St. Mary's. The following is a summary of our interview.

St. Mary's Junior and Senior High School is a private, Catholic school that prepares their students for higher education. The student body population for grades seven through twelve is about 150 students. As it is a parochial school, its goal is not only to prepare the students for college, but also to teach them to live their life in Christ.

Prior to graduation, students must have already taken four years of English and religion, three years of math and science and two years of history and foreign language, although three years of foreign language is offered. The only information technology related courses that are required are for grades seven, eight, and nine. In addition, there is an optional computer course for seniors. Approximately 40% of the students choose to take this elective.

When asked whether he thinks St. Mary's can afford to create more information technology related courses into the curriculum, Mr. DiDomenico answers that he is not sure how much emphasis the school wants to put on information technology. Their main focus is to work on the fundamentals such as reading and writing. He notes that the best resources are not focused on information technology training.

Within the last two years, there has been a 100 percentile of students going on to higher education at St. Mary's High School. A majority of these students go on to four-year colleges while some go to a two-year college.

When asked what he foresees as future needed skills for students to have, Mr. DiDomenico notes that students should be able to think critically and "think on their feet." Students should also be able to express themselves well. The availability of computers is there to provide more information for students.

In terms of other efforts that the school is making to prepare their students for the information technology field, Mr. DiDomenico states that in the past, there have been field trips to colleges and special guest visits to their school to talk about opportunities in higher education. This will allow the students to be aware of the opportunities that are out there. If a student has an interest in the information technology area and the school cannot provide enough information for them, the school will at least refer them to someone that can provide this information.

3. **St. Peter Marian High School**: Ms. Patricia Aubertine, Principal

On Thursday, November 15, 2001, we met with Ms. Patricia Aubertine. Ms. Aubertine is the principal at St. Peter Marian High School. The following is a summary of our interview.

St. Peter Marian High School currently has 1166 students. Their goal is to provide students with the education necessary to prepare for all areas of college and life. They do this through the curriculum that they offer. As a catholic school, they have religion classes to teach the students the value system of life. Prior to graduation, a student must have taken four courses in religion, English, math, science, and social studies. Students are also required to have three courses of a foreign language, half a year of physical education, and a minimum of half a year of computer science. Ms. Aubertine notes that this school has the highest number of credits in the area. St. Peter Marian also offers 12 Advanced Placement courses.

The computer science programs that are offered at St. Peters include logo and keyboarding for grades 7 and 8. In high school, the courses that are offered include introduction to computers, basic programming 1 and 2, advanced applications, desktop publishing, C++ programming, visual basics, and for honor students, java/HTML. For graduation, students need to take at a minimum, the keyboarding course and the introduction to computers course. Some students have chosen to take more than the required courses while others prefer not to. A few have even completed all the computer science courses offered. It is estimated that about 150 students take these computer science courses.

Ms. Aubertine states that approximately 88% - 89% of her students go on to four year colleges while the remaining number goes to community and junior colleges. This means that approximately 98% of the students at St. Peter Marian to go to some form of higher education. The remaining 2% go to the armed services.

Ms. Aubertine believes that computer skills are obviously a needed skill in the future as students grow in the very high-tech world. She also believes that it would be good to be fluent in a foreign language, especially in Spanish since many jobs involve some Spanish speaking activity. In addition, Ms. Aubertine thinks that math, reading, writing, and public speaking skills would be most helpful.

Besides the computer courses offered at St. Peter Marian, the school provides guidance to students. The students are given career choices with a program software that they can work on. St. Peter Marian is a school that provides a lot of emphasis on writing and analytical and critical thinking. Ms. Aubertine notes that these skills are needed to advance in any form of technology or anything else, for the matter.

Finally, Ms. Aubertine mentions that students at St. Peter Marian High School are taught to be good citizens. Seniors focus on American Studies and takes modern history for half a year and American government for the other half of the year. Along with that, they perform community service to show good citizenship.

Appendix F:

Interview Summaries for IT Companies

1. **InterGlobal Services, Incorporated**: Mr. Wallace Andrews, CEO

On Friday, November 16, 2001, we met with Mr. Wallace Andrews of InterGlobal Services, Incorporated. Mr. Andrews is the Chief Executive Officer at InterGlobal. InterGlobal Services is both a service and ASP provider to small, medium and large enterprises. The following is a summary of our interview.

InterGlobal Services located in Worcester in September 2000. The main reason that they located in Worcester was because of the business support infrastructure provided by the city of Worcester, the Chamber of Commerce and others. InterGlobal was provided with financial incentives, in the form of low interest loans, to move to Worcester.

InterGlobal has found an abundance of skilled workers in the Worcester area. They have never had problems filling available positions now, or in the past. They tend to be able to hire all of their employees from the greater Worcester area. The only exception being upper level management, which they find within the state of Massachusetts. The required skills of the employees range from semi-professional to professional. InterGlobal requires most of their employees to possess a minimum of an associate's degree. If they do not have this degree, they need at least a GED and a trade certification such as Microsoft certification.

Mr. Andrews stated that InterGlobal has worked with colleges and universities in the area. InterGlobal has programs to recruit students from the area and have them fill part-time positions. Mr. Andrews has found these programs beneficial to the company.

InterGlobal Services is located in the Worcester Business Center on Millbrook Street in Worcester. The existing facilities, services and installations needed for business have been great at that location for InterGlobal. As far as the city of Worcester in general, those same aspects would receive a C letter grade. Mr. Andrews rated Worcester's physical and technological infrastructure a three, on a scale from one to five. When asked to rate the importance, on a scale from one to five, with five being the most important, of some factors when considering a location for business, Mr. Andrews gave the following information:

Overall infrastructure: 4
Weather/climate: 3
Availability of skilled workers: 4
Availability of capital: 2
Quality of life: 3
Taxes: 1
Proximity to markets: 2
Regulatory climate: 3
Cost of real estate: 3
Cost of doing business: 3

InterGlobal does offer its employees a number of training programs. All employees have two weeks of orientation training in order to familiarize them with the company. In addition, InterGlobal offers at-work training on topics ranging from budgeting money to help with certification tests.

Mr. Andrews identified a few areas that Worcester could improve in order to be more successful attracting companies to the area. The three things that he mentioned were a lower tax rate, more availability of capital and a world-class technological infrastructure. Mr. Andrews also mentioned that local colleges and universities should

offer more professional development and continuing education programs, at all skill levels.

2. **Blackstone Computing**: Mr. Ron Ranauro, Founder/ Vice President of Business Development & Mr. Graeme Boyle, Director of Customer Support and Information Technology

On Wednesday, November 14, 2001, we met with Ron Ranauro and Graeme Boyle of Blackstone Computing. Blackstone Computing optimizes the computing infrastructure of companies by providing the necessary software and services. Mr. Ranauro is the Founder and Vice President of Business Development of Blackstone. Mr. Boyle is the Director of Customer Support and Information Technology. The following is a summary of our interview.

Blackstone Computing was founded in 1996 in Worcester. The company has been in the same building since its founding, although they have moved workspaces. The primary reason for their location in Worcester was that Mr. Ranauro lived nearby. The low cost of rent was also beneficial for Blackstone. Blackstone Computing received no financial incentives from the city of Worcester for locating in Worcester.

As typical of most information technology companies, Blackstone sees an abundance of qualified workers with the current economy. In the past, Blackstone Computing has used staffing agencies in order to fill open positions. They were able to eventually fill all of these available positions. Some of the skills that Blackstone requires in employees are in the areas of UNIX, Linux, networking, Java, Oracle, and hardware. Blackstone Computing does not require their employees to possess a college degree. Although it is usually beneficial to possess a degree, the ability to do the job is most important. The workers' skills and experience are one of the first things Blackstone looks at, while the education and certifications may be one of the last things. The level of

education, skills or experience depends on what specific job Blackstone is looking to fill. A compatible personality is also an important quality.

Blackstone Computing offers limited in-house training to its employees. The training that they do offer deals with company-specific product training. If an employee needs additional training, such as Java or Oracle, Blackstone will send them out for this training. Blackstone Computing does pay for this additional training. A company like Blackstone Computing tends to hire people who already possess a majority of the required skills. This is because a small start-up company cannot afford the time needed to train the employees. However, if students are trained in contemporary tools, a start-up company can hire them because they can immediately apply their skills. This is one reason why the curriculum of an educational facility must continually be revised in order to keep up to date with industry.

Mr. Boyle did mention that the colleges and universities in the Worcester area is definitely an asset for the city of Worcester. Blackstone Computing has employed students over the summer and currently do have one co-op student working part-time. Blackstone utilizes a number of training programs, depending on who is offering the training. Mr. Boyle also mentioned that they have not specifically utilized WPI for their training programs.

Blackstone Computing is very satisfied by the technological infrastructure in the city of Worcester. The city installed a T1 line shortly after Blackstone located on Grove Street in 1996. The T1 line, which Blackstone shares with others in the building, is more than adequate for their current needs. There is also a point of presence, or POP, in the building, with a connection to the Internet. On a scale from one to five, with five being

the highest, the two gentlemen rated the technological infrastructure a four or a five. They believed that the available technology in the area was largely due to WPI and other campuses. The only problem that they have encountered deals with the last mile of connection. This is the connection from the street to the building provided by Verizon.

As far as the other aspects of Worcester, both of the gentlemen agreed that it was a relatively easy commute (Mr. Ranauro commutes from Auburn; Mr. Boyle from Shrewsbury). Finding funding for the company was one problem that Mr. Ranauro encountered. Initially, the banks in Worcester were very good. However, once Blackstone really started growing, Mr. Ranauro had to go Boston to find financing. Venture capital was also very hard to find. Blackstone was eventually successful in finding venture capital from Ampersand Ventures, out of Wesley, Massachusetts. It should be noted that Blackstone located in Worcester before the Worcester Capital Partners, a venture capital firm based in Worcester. Mr. Ranauro believed that current financing alternatives were geared to either small or large businesses (like SBA loans or asset backed credit lines). A high-tech start-up company does not really fall into either of these categories. A company such as Blackstone Computing initially appears as a small company. However, their high-growth status hopes to transition them into the large company category as quickly as possible. Mr. Ranauro understands that Worcester is a non-traditional venture capital market and that the lack of venture capital firms is due to supply and demand.

When asked to rate the following factors of Worcester, on a scale from 1-5, with 5 being the highest, Mr. Ranauro and Mr. Boyle responded:

Overall infrastructure: 4
Weather/Climate: 3

Availability of skilled workers: 4
Availability of capital: 2
Quality of life: 5
Taxes: N/A
Proximity to markets: 3
Regulatory climate: N/A
Cost of real estate/rent: 4
Cost of doing business: 3

Blackstone Computing currently employees about 40 employees. All of these employees are from Worcester County. This means that Blackstone has not had to recruit outside of the greater Worcester area.

Any improvements to the Worcester Airport would be the biggest help for Blackstone. Blackstone Computing requires a lot of traveling, and that traveling is usually done via airplane. Mr. Ranauro estimated that they use the Worcester airport one out of every twenty times they fly. On the other occasions, they must travel to Boston or Providence in order to use the airports there. It would save a lot of time if they could simply fly out of Worcester. The frequency of flights and the price of flights out of Worcester are the main reasons Blackstone does not often utilize the Worcester airport. Mr. Ranauro also believed that many people, and businesses, might simply not be aware of what opportunities exist at the Worcester airport. If the city, or someone else, could provide this knowledge to local businesses, it would be a big help.

3. **Blue Cod Technologies**: Ms. Francesca D'Angelo, CFO and Founder, & Mr. Amidon, Director of Sales and Marketing

On Tuesday, November 13, 2001, we met with Ms. Francesca D'Angelo and Mr. Ken Amidon of Blue Cod Technologies. Ms. D'Angelo is the Chief Financial Officer and Founder. Mr. Amidon is the Director of Sales and Marketing. A summary of the interview is provided below.

Ms. D'Angelo started out by telling us a brief history of how Blue Cod Technologies started. Many members of the Blue Cod group worked together at Allmerica in Worcester. Later, many of them followed on to an insurance start-up where they represented a large part of the IT department, working there for five to six years. The group split into various places for about a year. Two members of the group went on to higher education. They decided that they wanted to build their own company. Eventually, Blue Cod was formed and as of April 16, 2001, Blue Cod Technologies has been entirely on their own.

Blue Cod Technologies is a software company that writes software that hits three areas: higher education, insurance industry, and general work for the private/public sector. There are two concentrations. The first is product sales. The products developed deal with customer service relationships with the clients. The clients might use this as a tool to access hubs, for example. These clients range from students to parents to teachers and advisors. The second concentration is the servicing and consulting. Employees working in this concentration must have great experience in insurance and programming. They must also have worked in an IT background, such that they must have strong application development backgrounds, strong network and communications background,

and a strong web development background. Ms. D'Angelo states that if the person is engaged in understanding the customer's needs, then there is a constant focus on the needs of the client. They also deal with work management, which meant keeping track of interrelationships between departments and how they work on common tasks.

Ms. D'Angelo noted that they wanted to be located in Worcester because most of their employees were from around the area. The Chamber of Commerce also made their move back to Worcester much easier. In terms of financial incentives, they were given a bridge loan. Ms. D'Angelo and Mr. Amidon thought that if there were more small, technical oriented companies like Blue Cod Technologies around the area, Worcester would be more attractive as a city.

Blue Cod Technologies currently employees 11 employees. These employees must have at least a bachelor's degree or equivalent. Blue Cod Technologies is willing to train employees from a certain skill point. Although they are not likely to teach a person the basic skills that they should already have, Blue Cod Technologies will train their employees the knowledge they need for their job.

The local colleges and universities were a definite factor to their settlement in Worcester because it was an avenue to get interns or entry level staffing. They also hoped to partner with the schools and to get their products put into use in the schools. In the next few months, Blue Cod Technologies hope to obtain a few interns to work with them. Blue Cod Technologies is focused on recruiting positions in the area and does not recruit aggressively outside of Worcester.

When asked to rate the importance of the factors that Blue Cod Technologies considered when locating in Worcester, Ms. D'Angelo and Mr. Amidon gave the following ratings:

Technology infrastructure	4
Physical infrastructure	3.5 - 4
Overall infrastructure:	4
Weather/Climate	3
Availability of skilled workers	4
Availability of capital	N/A
Quality of life	5
Taxes	N/A
Proximity to markets	N/A
Regulatory climate	N/A
Cost of real estate	5
Cost of doing business	4

Finally, when asked what they think Worcester can do to close the skills gap if one exists, Ms. D'Angelo and Mr. Amidon answered that the skills gap is not going to be one course. In fact, students need to deal with more hands-on learning and students should start doing internships as early as possible so that they may get experience on real life work.

4. **Internet Marketing Services, Inc. (IMS):** Mr. Peter Brady, CEO

On Monday, November 19, 2001, we met with Mr. Peter Brady of Internet Marketing Services, Incorporated. Mr. Brady is the Chief Executive Officer of Internet Marketing Services (IMS). IMS provides Internet and e-business solutions to a wide variety of high technology clients. The following is a summary of our interview.

Internet Marketing Services has been located in Worcester since 1995, and at its present location since 1997. The primary reason for being at their current location is that Mr. Brady owns the building. IMS was not provided with any financial incentives by the city of Worcester for locating his business in Worcester. He added that the logic of not paying top dollar rent was also a factor in his location decision. IMS needs good communication abilities, not a flashy office.

Mr. Brady stated that IMS has not had any problems finding skilled workers in the area. IMS is a small company, with just ten employees. IMS utilizes targeted training and uses the location of Worcester as a selling point. The location of Worcester allows people to avoid the hassles of working in eastern Massachusetts and Boston in particular. IMS tends to require its employees to possess a college degree. There is one exception of an employee who did not have a college degree, but did have extensive computer skills. Internet Marketing Services hires both information technology and sales and marketing individuals.

IMS, Inc. does offer some training for its employees. The company has a conscious procedure of developing skills in its workers. For example, one employee

started at the business with a bachelor's degree in business. He has since been taught HTML and is currently learning ASP at Internet Marketing Services.

IMS has established a working relationship with colleges and universities in the area. Mr. Brady explained that in the past, IMS has hired students from Worcester Polytechnic Institute. These students would be set up with an account, log their hours, and work from their own dormitory room.

The technological infrastructure in Worcester is very good for IMS. Initially, in 1995, IMS had problems with their ISDN service. Since then, Worcester has continued to improve its technological infrastructure and IMS in now serviced with a T1 cable. This cable now provides all the service that the company requires.

Mr. Brady stated that one problem with information technology companies is that when the whole dot com mania took place, too many companies wasted money on elaborate office. IT companies were spending too much money for an office, when they should be able to compete from anywhere. The biggest problem for companies in the Worcester area is the Worcester Regional Airport. The access to the airport isn't the problem; it's simply the limited flight schedule. Not only is it difficult to fly out of Worcester to conduct business, it's also difficult to have individuals fly into Worcester for business purposes. Another problem that IMS has encountered with the city of Worcester is the difficulty to improve property. Mr. Brady has found the city to be unfriendly or uncooperative. In addition, the city of Worcester makes renovations and improvements more costly for property owners. As a result, some property owners will not find it worth their time to improve the property and actually do less for the city of Worcester.

Mr. Brady stated that the one thing that Worcester could do to improve the opportunities of local businesses would be to improve the airport. Worcester has a very good central location and there is no reason why it cannot be more like T.F. Green Airport in Warwick, Rhode Island. This would make business travel in and out of Worcester much easier.

5. **ElectroMagnetic Solutions, Incorporated**: Mr. Arthur Butler, CTO

On Tuesday, November 20, 2001, we spoke with Mr. Arthur Butler of ElectroMagnetic Solutions Incorporated. Mr. Butler is the Chief Technical Officer of ElectroMagnetic Solutions, a consulting company located in Worcester. A summary of the interview is provided below.

ElectroMagnetic Solutions was created in Wisconsin in 1990 and later that year, relocated to Worcester. Mr. Butler did not receive any financial incentives to locate his business in Worcester. Family is the reason Mr. Butler located back to Worcester. When ElectroMagnetic Solutions first arrived in Worcester, there was an adequate supply of skilled workers in the area. Mr. Butler said that ElectroMagnetic Solutions has not had a problem, past or present, finding skilled workers in the area.

Currently, ElectroMagnetic Solutions is hiring to fill a software engineer position. When looking at individuals for hire the company looks for experience and knowledge of Linux and also Windows device drivers. Mr. Butler stated that workers who hold a bachelors or masters degree is looked highly upon, but the company does not limit itself on who they hire by just educational background. ElectroMagnetic Solutions does provide training for its employees. They do this by paying for courses at local universities. Also, they look for experience and past accomplishments of individuals for hire.

When ElectroMagnetic Solutions located to Worcester, the local area colleges were a factor in the decision to move because of the constant supply of graduates. Mr. Butler classified Worcester's facilities and services as satisfactory. He also said that

these services and facilities have become significantly better since he moved here in 1990. On a scale of one to five, five being excellent, he rated the technology infrastructure of Worcester a four. Also, on the same scale, Mr. Butler rated the physical infrastructure a three. He mentioned that the airport still remains an issue for businesses. The cost of bandwidth has decreased since locating to Worcester.

We asked Mr. Butler to rate factors that the company considered when locating to Worcester on a scale from one to five, with five being most important.

	Rating
Overall infrastructure	3
Weather/Climate	4
Availability of skilled workers	4
Availability of capital	3
Quality of life	3
Taxes	2
Proximity to markets	3
Regulatory climate	3
Cost of real estate	2
Cost of doing business	2

ElectroMagnetic Solutions has had difficulty filling the Project Manager position and occasionally has to recruit outside of Worcester to fill this position. Most of the hiring is done by word of mouth. Mr. Butler does not believe that Worcester has a skills gap.

When asked what Worcester could do to improve opportunities for ElectroMagnetic Solutions, Mr. Butler stated that Worcester needs to market itself better. Also, Worcester needs to promote its transportation and increase the availability of the flights in and out of the airport.

6. **Rainier**: Ms. Debbie Somma, Director of Human Resources

On Wednesday, November 14, 2001, we talked to Debbie Somma of Rainier via telephone. Rainier is an international public relations and marketing services agency for technology companies. Ms. Somma is the Director of Human Resources at Rainier. The following is a brief summary of our interview.

Rainier is located in Princeton, Massachusetts, and also has a location in London, UK, that handles European operations. Rainier mainly hires people with marketing, advertising or a public relations background. A part of Rainier's marketing services include web development. As far as web design capabilities, Rainier works with a client on the artistic direction, site map and site design, then they partner for html programming of the site. Often Rainier finds this partner through professional contacts. This area has potential to grow at Rainier, as they hope to expand these services in the future.

Currently, Rainier is not looking to hire new employees. Ms. Somma believed that it would be very easy to find employees now, if they were needed. In the past, when the economy was much stronger, Rainier did have problems hiring personnel. Rainier used headhunters (staffing agencies), attended college fairs (specifically at Clark University) and aggressively advertised in order to find qualified personnel in the public relations and marketing area.

The primary reason that Rainier located in Princeton is that the founder, Steve Schuster, originally lived in Princeton and it was very convenient for him. In addition, Princeton's location allows Rainier to recruit from nearby communities such as Leominster, Fitchburg and Worcester. Ms. Somma believed that an advantage when

recruiting workers was that the commute to Princeton was shorter and easier than the commute to Boston. Although Rainier does currently have a T1 line, one disadvantage of the Princeton location was that there were not easy options for this line.

7. **Allegro Microsystems, Incorporated**: Mr. Gary Gomes, Network Manager

On Wednesday, November 14, 2001, we spoke with Gary Gomes of Allegro Microsystems, Incorporated. Allegro is a worldwide supplier of analog integrated circuits to a variety of different industries. Mr. Gomes is the Network Manager at Allegro. The following is a summary of our interview.

Allegro Microsystems requires a wide range of skills among their employees. Oracle, database administrators (DBA) and Microsoft Certified Systems Engineer (MCSE) are some basic areas of knowledge required by information technology employees. The skills required are always changing, along with the introduction of new products. If someone is hired and he/she does not possess one of these skills, or another needed skill, Allegro will send them to an outside source for the additional training. Allegro may send that employee to a college or another facility that offers the required training. Allegro Microsystems does not do any in-house training.

Allegro always looks for employees who possess a college degree. An employee new out of college can provide some new, out-of-the-box thinking for the company. However, a college degree is not necessary for an employee. Often, an employee with an associate's degree, or even high school education, may perform better on the job. This is almost always due to experience in the industry.

Mr. Gomes stated that Allegro Microsystems have been successful in locating qualified information technology workers. A while ago, there was an abundance of qualified workers. Now, it's even easier to find qualified personnel because of the current state of the economy. A year ago, the potential employee had all of the leverage.

He/she could pretty much name their price and then pick the job that they wanted. Now, the information technology related companies have the leverage. People are willing to take whatever they can get.

Overall, Mr. Gomes had a very good opinion of Worcester. He noted that the education facilities are a definite asset of the city of Worcester. Allegro Microsystems often take advantage of this by hiring co-ops and interns from area colleges. One minor aspect of Worcester that could be better is the traffic on Interstate 290. Allegro Microsystems have been very satisfied with their Worcester location.

8. **Artis Corporation**: Mr. Peter Green, President

On Wednesday, November 21, 2001, we interviewed Mr. Peter Green of Artis Corporation. Mr. Peter Green is the President of Artis Corporation. A summary of the interview follows below.

Artis Corporation is a software development company, which started as a spin-off of WPI in 1989. Early in the company's history they were located in Westborough. Artis was located in Westborough in order to be closer to an Air Force base. Later the company moved back to Worcester with the idea of being closer to the student labor that is replenished each year by a new graduating class.

Currently, Artis primarily employs WPI computer science graduates. Artis is now looking for experience when hiring new employees; for example, Artis is looking to hire a manufacturing engineer with programming experience. Mr. Green believes in functional hiring. That is, Artis is hiring to fill a specific position with an experienced individual requiring a minimal amount of training.

Mr. Green does not think highly of Worcester's existing facilities, services, etc. When asked to rate Worcester's technology infrastructure he gave it a two, saying that the company is able to get what they need. Mr. Green rated the physical infrastructure between a two and three. The office space is cheap here in Worcester but the treatment that his company has received from the City of Worcester has been very poor.

Artis Corporation does train in company specific software but does send workers out to trained professionals for the required sales personnel training. Colleges are not staffed to do the training that Artis needs. Mr. Green also mentioned that the courses on

Microsoft programs need to be updated at the colleges. When hiring, most employees are found inside of Worcester County.

As a result of Worcester being unfriendly to businesses, Artis Corporation is looking to locate out of Worcester. The City of Worcester did not speak to any tenants of the building that Artis is currently located in, even though the city published articles in the Worcester Telegram & Gazette, saying that the building is going to be torn down for the Worcester Baseball Team.

9. **Vista Technologies Incorporated:** Mr. Tony Lista, Vice President of the Northeast Division

On Thursday, November 8, 2001, we conducted a phone interview with Mr. Tony Lista. Tony Lista is the Vice President of the North-East Division of Vista Information Technologies. Vista Information Technologies is an information technology professional services company. A summary of the interview is provided below.

Vista Information Technologies had been previously located in Worcester for about five years prior to the company recently relocating to Framingham. When originally locating in Worcester, Vista acquired their local branch but was not offered any sort of financial incentives. The skills of the possible workforce were not a reason for the company to locate to Worcester. Prior to the location of Vista Information Technologies in Worcester, there was an adequate supply of skilled workers in the area that the company would need. After locating in Worcester, Vista required a different level of staff than the city could offer. The company looked outside of Worcester to find skilled workers to fill their positions. Also, the local area colleges were not a factor in Vista's settlement.

Mr. Lista mentioned some of the primary types of positions that Vista employs. Such examples include Cisco technicians, professional consultants and sales representatives. Almost all of the skilled workers that are employed by Vista hold either a four-year degree in a certain major or have received a MCSE certification in a particular field along with two to three years experience.

A couple reasons why Vista relocated to Framingham was that Worcester's proximity to business partners was not good. Also, the transportation infrastructure was

undesirable. Since relocating to Framingham, the company now has the opposite situation compared to when they were in Worcester.

Vista trains their employees via in-house training or with certified partners. Mr. Lista has not worked with any area colleges on developing training programs but he does know that they exist and are readily available for Vista to utilize. The recruitment for positions within Vista is conducted throughout the entire New England region.

Mr. Tony Lista did not believe that there was a skills gap between employers or employees in the area. However, he did mention that a good public relations program would benefit Worcester and its businesses. As stated by Mr. Lista, "perception is everything." When asked to rate Worcester's infrastructure on a scale of 1-5, with 5 being excellent, Mr. Lista replied with:

	Rating
Technology infrastructure	4
Physical infrastructure	2

When asked to rate a variety of factors that Vista considered when locating to Worcester on a scale of 1-5, with 5 being most important, Mr. Lista replied with:

	Rating
Overall Infrastructure	3
Weather/climate	1
Availability of skilled workers	3
Availability of capital	4
Quality of life	5
Taxes	1
Proximity to markets	2
Regulatory climate	2
Cost of real estate	4
Cost of doing business	4

10. **Medicalis Corporation**: Mr. Matthew Roy, Vice President

On Tuesday, November 20, 2001, we conducted a phone interview with Mr. Matthew Roy of Medicalis Corporation. Mr. Roy is the Vice President of Medicalis Corporation. The following is a summary of our interview.

Medicalis Corporation is a small healthcare information technology start up company located in Chestnut Hill, MA. This company was started approximately one and a half years ago. When they decided to locate in Chestnut Hill, Medicalis Corporation was primarily looking for people in the information technology department at large hospitals and medical research facilities.

According to Mr. Roy, there was an adequate supply of workers in the area because they were close to Harvard University. The company was founded partly by doctors who knew where to find the people who worked in the IT department.

There are currently three categories of skilled workers that Medicalis Corporation employs. The first category is the information technology people. These people are familiar with large IT needs of the hospital. They deal with digital equipment and systems such as the CAT scan. The next category of employees are the medical and clinical people. These people are mainly the doctors and physicians. Finally, the last category consists of the business people, who manage high-tech business and who have worked in the biotechnology or healthcare technology field.

Due to the fact that Medicalis Corporation is a small start up company, they are mainly looking for people who are capable and flexible of doing a broad set of skills. These people need to be experienced in the IT field. They need to know how to deal with

software development and technological software. In addition, they also need to be well rounded with a presentable image. They need to be good, sensible people who also know how to talk to customers, as well as be educated in the medical field.

When asked what type of skilled workers he thinks will be most needed in the future, Mr. Roy stated that software developers will be most needed. Mr. Roy thinks that there needs to be more people who can take medical information needs and apply them into useful software applications.

The area colleges and universities were an indirect factor to their settlement in Chestnut Hill as the company is a joint venture of Brigham and Women's Hospital, which was also a major teaching affiliate of Harvard Medical School.

When asked how Mr. Roy would classify Chestnut Hill's existing facilities, services and installations, he notes that it is an expensive place to do business, with high rent. Next, Mr. Roy was asked to rate the importance of the following factors that their company considered when deciding to locate in the Chestnut Hill area. Mr. Roy gave the following ratings:

Technology infrastructure	4
Physical infrastructure	3
Overall infrastructure:	4
Weather/Climate	N/A
Availability of skilled workers	5
Availability of capital	5
Quality of life	2
Taxes	1
Proximity to markets	3
Regulatory climate	1
Cost of real estate	1
Cost of doing business	1

Mr. Roy mentioned that Medicalis Corporation has had problems trying to fill skilled labor positions in the past because the skills needed were so specific. However, as Chestnut Hill is close to the Boston area, he notes that they are more likely to find these types of workers in the area than they would anywhere else. The type of workers that they have the most difficulty finding are the ones that have cross over knowledge of both medical and software development. Mr. Roy mentions that they do not train their employees nor have they worked with colleges to develop training programs because they only hire experienced personnel. Medicalis Corporation has aggressively recruited for positions in Chestnut Hill but has not yet begun to recruit for positions outside out of the area.

Medicalis Corporation was not provided with any financial incentives to settle in the area. Mr. Roy mentioned that the type of incentives that he would have found attractive would have been access to venture capital and access to the skills needed, especially a hub between medical and information technology.

Finally, when asked what he thinks need to be done to improve opportunities for Medicalis Corporation, Mr. Roy mentions that they would greatly appreciate access to venture capital as they expand. The cost of office space, the cost of doing business and the ability to tap into the pool of medical personnel and software developers will be especially important. Mr. Roy doesn't believe that there is a skills gap in the Chestnut Hill area. He mentions that this area is filled with bad traffic, crowded areas, and a place where it is very hard to get the attention of ventured capitalists as there is numerous small start up companies in the area who want the same attention.

11. **Lightband Communications, Incorporated**: Mr. Thomas McGovern, President and CEO

On Tuesday, November 13, 2001, we met with Mr. Thomas McGovern of Lightband Communications, Incorporated. Mr. McGovern is the President and CEO of Lightband Communications. Lightband is a worldwide, facilities-based Internet service provider. The following is a summary of our interview.

Lightband Communications, Inc. is an ISP company with an actual hook-up to the Internet. Lightband is classified as a tier 1A, which means that they have multiple connections to the Internet at speeds greater than a T1 but are not a national service provider.

Lightband was started in 1995 in Milford and later moved to Manchaug, MA in 1998. With the company in its new location, it was only a mile and a half from the founder's home; a strong reason for moving. Also, Lightband currently rents 13,000 square feet of space, of which they only use about half. The 13,000 square feet of space in Manchaug costs less to rent than 6,500 square feet of space in Worcester. Lightband is non-competitive with their distance reliant products, in particular, the lease line business. Colleges were not a factor in the locating to the area.

There are two customer bases that Lightband targets. They offer Internet service to local customers in Eastern Massachusetts, who are strictly business and not residential customers. Mr. McGovern said that Lightband was previously engaged providing service to the public but has pulled out of that market. The service that Lightband provides to business is predominately DSL. Lightband provides Internet connectivity to third world countries via satellites as their second customer base. There are only four other

companies that offer Internet to these countries, all of which are big telecommunication businesses. Lightband Communications is able to compete with the competition because of their excellent customer service. Currently, most of the international market for Lightband is concentrated in sub-Sahara Africa and the Mideast. Soon, Mr. McGovern said they hope to expand into India and China.

When Mr. McGovern started with Lightband, they were a public and private service provider. The company was receiving about 40% of its revenue from residential business but had to maintain a staff of seven technicians. Mr. McGovern sold the residential market to North Attleboro Electric, cutting the required staff from seven technicians to three, and three administration personnel to only one. Residential service is a source of numerous problems, while business service is profitable with fewer complications.

Lightband has not had any problems attracting skilled workers and Mr. McGovern doesn't foresee it ever being a problem for them. The company is located only 12 miles from Worcester, offering them access to a vast amount of workers. If the business doubled, Lightband would only need one additional technician in order to man the business 24 hours a day, seven days a week. Currently, the three technicians work 24 hours a day, five days a week and rotate being on call over the weekends. Lightband Communications does not require applicants to possess a four-year college degree when they are hiring personnel for available job openings. Lightband is more attracted to a technical school graduate or someone who holds an Associate's degree with experience. The company looks for a worker with experience in UNIX/Linux system administration, who must understand different operating system environments and firewalls. Mr.

McGovern stated that Lightband does not currently train its employees, nor will they in the future. Mr. McGovern stated that the growth of his company is not dependent on information technology personnel.

Lightband does not compete for labor inside of I-495, where there is a premium for workers because of the demand in the area. When needed, Lightband will put sales personnel on the street to recruit for new positions. The sales positions themselves are recruited outside of the Worcester area.

When asked why his company did not locate to Worcester, Mr. McGovern stated that their location depends on high quality communications links. Situated in Manchaug, Lightband has everything that they need. There is an Asynchronized Transfer Mode (ATM) connection, a communications protocol used for high speed connections, access to the switch in Worcester, which is one of seven in Eastern Massachusetts and are located in the Local Access Transport Area (LATA). The ATM connection is very vital and Lightband would not be able to function without it. Lightband also has a channelized DS3 connection, which is used for the leased lines. The connection is physically located in Worcester. This is one disadvantage of not being within the City of Worcester - the premium charged for access to the ATM and DS3 connections. The premium which Lightband pays for this connection is a disadvantage, however, when compared to the advantage of a much lower cost of rent, the location in Manchaug is more sensible for the company.

Mr. McGovern believes that Worcester needs more access to venture capital to help the growth of new businesses. Currently, The Worcester Capital Partners does not have enough competitors in the area. Also, because of the lack of competition between

venture capitalists, there is not enough money for information technology companies. Worcester is a non-traditional venture capital market, which makes it difficult for companies to connect with venture capital firms. This, in turn, makes it difficult for information technology start-up companies to raise the necessary funds. Mr. McGovern believes that in the future, the majority of the money from venture capital firms in Worcester will go into the biotech industry. Worcester needs secondary market venture capitalists in order to become more attractive to businesses.

12. **Sigma Systems, Incorporated**: Mr. Mohan Nannapaneni, President/CEO, Founder

On Monday, November 12, 2001, we met with Mr. Mohan Nannapaneni of Sigma Systems, Incorporated. Sigma Systems Inc. is an IT and software consulting company. Mr. Nannapaneni is the President, Chief Executive Officer and founder of the company. A summary of the interview is provided below.

Sigma Systems Inc. was founded six years ago. As an IT solutions and staffing company, Sigma Systems performs a lot of IT projects for their clients. In October of 2000, Sigma Systems Inc. was ranked # 24 on the list of The Inc. 500 Magazine as one of America's fastest-growing private companies.

When he decided to locate his company in Shrewsbury, Mr. Nannapaneni took into account the low cost of the area, as well as the proximity to his home, making it easier to commute. According to Mr. Nannapaneni, there was an adequate supply of skilled workers in the area. He went about finding these workers through the use of networks, Internet sites and Internet advertising. He has also called up companies in the past, looking for the talents and skills of workers that exist.

There are two types of workers that Sigma Systems Inc. primarily employs. The first type is the administrative staff, where they take care of the office duties. The second types of workers are the software engineers. These employees must have at least a bachelor's degree. In the past, Sigma Systems had provided specialized training for their employees but it is unnecessary now, as most employees are well trained.

As information technology constantly changes, Mr. Nannapaneni thinks that it is hard to tell which skills will be needed in the future. In the past, employers used to

employ workers with a single skill but now all of that has changed. Clients are always looking for multiple skills.

Colleges and universities were not a factor to Mr. Nannapaneni's consideration of locating in Shrewsbury, as there are no institutions of higher education that exists in Shrewsbury. In addition, most people prefer hiring employees with experience rather than entry-level graduates.

Mr. Nannapaneni states that Worcester does not have a lot of high-tech companies. Since it is not a mixed area where different types of companies exist, and is mainly comprised of manufacturing and health care facilities, Worcester needs to be more diversified. There should be more recreational facilities such as stores, clubs, and restaurants to attract more people into the area. In addition, public transportation needs improvement. The Worcester airport needs to attract more people and offer more flights.

When asked to rate the importance of the factors that Sigma Systems Inc. considered when locating in Shrewsbury, Mr. Nannapaneni gave the following ratings:

Technology infrastructure	2
Physical infrastructure	3.5
Overall infrastructure:	2
Weather/Climate	3
Availability of skilled workers	4
Availability of capital	1
Quality of life	5
Taxes	4
Proximity to markets	5
Regulatory climate	3
Cost of real estate	5
Cost of doing business	5

Sigma Systems Inc. recruits for certain positions outside of the Shrewsbury area, as they are a national company. This company has not encountered problems trying to

fill skilled labor positions now or in the past. The category of workers that they have had the most difficulty finding is the skilled workers with the experience in the latest technology. An example would be applications servers in websites.

Sigma Systems Inc. was provided with some financial incentives to settle in the area. They were provided with relocation expenses, benefits so they could create and help more clients. Other types of incentives that Mr. Nannapaneni found would have been attractive would be training incentives as well as education.

Finally, when asked what he thinks Worcester can do to close the skills gap if one exists, Mr. Nannapaneni answers that skilled workers will come to the area, provided that they are provided with the basic amenities. Worcester should offer itself as a safe city, a place where it is easy to commute, and provide a good school system.

13. **Optasite, Incorporated**: Mr. Michael Matthews, President/CEO and Founder & Mr. Marc Bellora, Account Executive

On Thursday, November 8, 2001, we met with Mike Matthews and Marc Bellora of Optasite, Incorporated. Optasite is an information technology based company that provides network optimization and facilities management. Mike Matthews is the President, Chief Executive Officer and founder of the company. Marc Bellora is an Account Executive who performs a wide array of duties at Optasite. The following is a summary of our interview.

Optasite, Inc. located in Worcester about a year and a half ago. The company focuses heavily on technology, but also provides a service model to its customers. Optasite was founded to meet the increasing demands of tower owners and carriers. New towers were going up so quickly, that the carriers didn't even know what they had out there. Previously, the method for collecting data on these towers was not standardized and left a lot of room for error. Optasite provides a digital data collection tool that trained contractors can use to go out into the field and collect data in a standardized manner.

Optasite, Inc. fulfills both the service and programming needs of its clients. Mr. Bellora talked about Optasite's three major components of the full circle service module; M/Scout, M/Guard, M/Pact. M/Scout is the electronic data-gathering tool that Optasite produces for collecting standardized data. M/Guard is software application that compiles the database of information provided by M/Scout. Finally, M/Pact is the service module of Optasite that can perform all services required by their clients.

Optasite requires workers who possess a four-year college degree. A few of the employees, especially in the product development area, also have a master's degree. Most of the employees' education is in an engineering discipline. Employees that have a degree in a non-engineering field typically have many years of experience in this type of industry. Employees must have a basic technical knowledge of tower, mounts, etc. Since Optasite also provides the servicing end of this technology, the company needs employees with customer service or basic sales skills.

In the future, Mr. Bellora saw the possible need for product development personnel. Optasite hopes to grow and diversify its business and would need personnel who can work to apply M/Scout technology to other things.

As far as the technological infrastructure of Worcester, Mr. Bellora found it pretty good. Optasite did have initial problems with long periods of network failure. This occurred approximately six months ago and caused Optasite to be without any voice or data capabilities for a few days. Since these initial problems, everything has been working better for Optasite.

Mr. Bellora would like to see improvement in the downtown area. He mentioned that Main Street is terrible and needs some re-routing to be done. The street is simply not attractive for companies looking at Worcester. In addition, housing in the Main Street area would be helpful. There could also be more restaurants in the downtown area, eliminating the need to drive down to Shrewsbury Street for a good meal. Mr. Bellora did mention that it wasn't that bad overall.

Many Optasite employees commute from the greater Worcester area. The typical commute for these employees is about an hour. Mr. Bellora, himself commutes from Southborough. Only a few employees live in Worcester.

Optasite requires employees to have general knowledge in the industry prior to joining the company. Optasite does provide training to contractors in methodology. They specifically train contractors on the M/Scout, because it is technology unique to Optasite. Another purpose of the training is to show contractors how Optasite does things and what they expect from the contractors.

Currently, Optasite is partnered with the University of Massachusetts graduate program. Optasite reports to classes at the business school on the standing of the company. The students then provide their opinion on what Optasite should be doing. Mr. Bellora thought that this partnership has been very beneficial to both Optasite at the UMass business school. The students provide Optasite with creative, out of the box thinking solutions. In return, Optasite provides the students a chance to work with a company as it continues to grow and evolve.

Mr. Bellora did not believe that there was a skills gap in the Worcester area. Currently, especially with the current economy, Optasite is able to find a lot of qualified people for every job opening. Optasite is not really hiring now, but may be looking for product development personnel in the future.

Mr. Matthews stated that the main reason that Optasite located in Worcester was because that was simply where the money was. The lead investor in Optasite is the Worcester Capital Partners and they are located here in Worcester. Optasite was provided with no financial incentives by the city of Worcester. Optasite chose Worcester

over a number of other New England communities (such as Portland, Hartford, Providence, Springfield, etc.) for a couple of other reasons. The proximity to Boston and the central access to everything else was one benefit of Worcester. In addition, the rent here in Worcester is about half of that in Boston, without being too far away from Boston and other major markets.

Mr. Matthews identified a few of the problems that Optasite has had in Worcester. Initially, Optasite had some trouble finding qualified administrative personnel. Mr. Matthews also discussed some technological problems he has encountered. Most of the problems had to do with access in Worcester. Mr. Matthews believed this was due to a lack of high technology companies in Worcester. Worcester didn't seem to have a sense of urgency in addressing this problem because there are only a few high-tech companies in Worcester. Worcester was poised to turn the corner on a lot of these problems, in the opinion of Mr. Matthews. The slow economy has affected the city's progress and it will now probably take a year or two for Worcester to be able to address these problems.

Worcester can improve on a few things in order to increase its attractiveness to information technology related companies. There seems to be a need for wireless training, as well as a need for students that are able to do computer basics. As a city, Worcester needs to work to attract entrepreneurs with support, money and brainpower. Worcester should also work with area colleges to encourage them to support entrepreneurial endeavors. These entrepreneurial efforts can provide substantial economic stimulus to the Worcester area. Mr. Matthews mentioned that John Merrill, of The Worcester Capital Partners, has been very helpful to Optasite.

The industry will continue to change very quickly. Just a few years ago, the focus was on the Internet. Now, wireless technology has emerged and the focus might be changing again to bio-terrorism/defense technology. The area schools must rally around these changing needs and meet the new demands.

14. **eSourceMortgage.com**: Mr. Ian Rossi, Director of Information Technology

On Monday, November 12, 2001, we met with Mr. Ian Rossi of eSourceMortgage.com. Mr. Rossi is the Director of Information Technology at eSourceMortgage.com. This local company attempts to simplify or "streamline" the entire mortgage process. The following is a summary of our interview.

In January 2000, eSourceMortgage.com relocated from Auburn to Worcester, Massachusetts. Worcester was chosen for a number of reasons. Its central location and easy access makes the commute for the employees relatively easy. ESourceMortgage.com also needed a workspace in a bigger city. The company received no financial incentives to move to Worcester.

Mr. Rossi stated that eSourceMortgage.com has never had a problem finding qualified employees. Currently, they retain a lot of applications of file and can call back one of those earlier applicants if they need someone right away. He mentioned that they've received up to 40 applicants in one day.

ESourceMortgage.com does provide on-site training for some employees. Typically, they train mortgage consultants who need to already possess good organization skills. In fact, they just trained about 15 people two weeks ago. EsourceMortgage.com will probably be hiring again at the beginning of the year. Salespeople and processors are currently the most in demand. A processor does need some experience in the industry, but eSourceMortgage.com will provide company specific training. A college degree is not required although many employees have gone to college. They do need to have at least graduated from high school. EsourceMortgage.com has had a couple of students

from local colleges work for them in the past. However, they have no official program or partnership in place at the current time.

When asked to rate the following aspects of Worcester, on a scale from one to five, with five being the highest, Mr. Rossi responded:

Overall infrastructure: 4
Weather/Climate: 3
Availability of skilled workers: 3
Availability of capital: 3
Quality of life: 2
Taxes: 3
Proximity to markets: 4
Regulatory climate: 4
Cost of real estate: 4
Cost of doing business: 4

Mr. Rossi stated that eSourceMortgage.com hires upper management from within the company. They recruit entry-level employees from Worcester and the surrounding communities. EsourceMortgage.com has not encountered any problems or roadblocks with their Worcester location. Mr. Rossi stated that everything in Worcester is pretty good. If they could improve on one thing, it would be the quality of life. However, this is typical of any larger city in America.

15. **Vitel Software, Incorporated**: Ms. Tana Scouras, Vice President & Product Engineer

On Tuesday, November 14, 2001, we conducted an interview with Ms. Tana Scouras of Vitel Software, Incorporated. Ms. Scouras is the Vice President and Product Engineer of the company. A summary of this interview is provided below.

Vitel Software Inc. is a commercial software development company. This company develops software for Fortune 1000 companies. Vitel Software Inc. located in Worcester ten years ago and employs up to twenty employees. Ms. Scouras mentioned that the labor pool and lower overhead costs were the specific aspects that this company looked into when locating in Worcester. The cost of rent was an important factor as well.

Ms. Scouras notes that there was an adequate supply of workers in the area. Since there were skilled workers in the Worcester area that didn't like to commute back and forth to Boston daily, Vitel Software Inc. was able to hire these skilled workers.

The employees of Vitel Software Inc. must have a minimum of a bachelor's degree in computer science. For engineers, Microsoft certification is also preferred. The working environment for this company is of the professional type, considering that many of the current employees have master's degrees and Microsoft certification.

When asked what type of skills she foresees as most needed in the future, Ms. Scouras stated very much the same workers that are needed now, such as software engineers, sales professions, finance, marketing and support staff.

The area colleges and universities were very much a factor in the company's settlement in Worcester. Ms. Scouras followed the model of Lotus when they decided to settle close to MIT. With this in mind, Ms. Scouras decided to settle Vitel Software Inc.

close to WPI so that she may take advantage of the opportunities that may exist with WPI students.

Ms. Scouras thinks that Worcester's existing facilities, services and installations are pretty good, along with the quality of life. She thinks more could be done with the universities and companies in Worcester. Ms. Scouras thinks that there should be a consortium for businesses and colleges to interact with one another at a more cooperative level. With more businesses locating in Worcester, it will attract more people into the area.

Ms. Scouras has found that the cost of bandwidth has decreased with the increased supply of bandwidth. When asked to rate the importance of the factors that Vitel Software Inc. considered when locating in Worcester, Ms. Scouras gave the following ratings:

Technology infrastructure	4
Physical infrastructure	2.5
Overall infrastructure:	3
Weather/Climate	1
Availability of skilled workers	5
Availability of capital	2
Quality of life	5
Taxes	5
Proximity to markets	N/A
Regulatory climate	N/A
Cost of real estate	5
Cost of doing business	3

Vitel Software Inc. has had difficulty in filling the skilled labor positions in the past. Engineers were the skilled workers that they had the most difficulty in finding when employment was at its lowest point.

Ms. Scouras states that Vitel Software Inc. is willing to training their employees. The types of training programs that they offer include some professional training, mentoring, internships and certification bonuses. Ms. Scouras has not worked with any area colleges to develop training programs, nor was she aware that these opportunities exist. Vitel Software Inc. recruits for positions in the area as well as outside the Worcester area.

Vitel Software Inc. was not provided with any financial incentives to settle in the area. However, Ms. Scouras states that she would have found tax cuts and training to be attractive.

When asked what she thinks needs to be done to improve opportunities for her company, Ms. Scouras notes that there needs to be a closer cooperation between colleges and the private sector. The colleges can act as the manpower, while the private sector can act as the capital.

Finally, when we asked Ms. Scouras what she thinks Worcester needs to do to close the skills gap if one does exist in the area, she stated that Worcester needs to market the fact that the city has skilled workers. They also need to attract more high tech companies into the area. With more businesses coming into the area, more people will come as well. The city also needs to reduce taxes and make it easier to locate here.

16. **Telesian Technology**: Ms. Shari Worthington, President

On Wednesday, November 21, 2001, we conducted a phone interview with Ms. Shari Worthington of Telesian Technology. Ms. Worthington is the President of Telesian Technology. The following is a summary of the interview.

Telesian Technology is a service provider for the industrial market and web development. Telesian Technology was founded in 1987. Ms. Worthington notes that there were no specific aspects her company was looking for when deciding to locate in Worcester. Since she moved in the area, she decided to start a company in the area as well. Area colleges and universities were not a factor in the company's settlement in Worcester.

Telesian Technology currently employs ten employees. Only three work in the office while the other seven work from their homes. The types of skilled workers that Telesian Technology primarily employs consist of marketing and web programmers. The types of skills that these employee must have consist of writing and communication skills, both verbally and written, and programming skills such as being able to work with dream weaver, database, JavaScript, visual basic, etc. At a minimum, employees must have at least a college degree, preferably a bachelor's degree.

Ms. Worthington believes that the same types of skilled workers that are needed now will be needed in the future as well. Telesian Technology is somewhat willing to train their employees. Ms. Worthington notes that they have worked with area colleges in the past to develop training programs but she has found that these partnerships were not beneficial to her company.

When asked to rate the importance of the factors that Telesian Technology considered when locating in Worcester, Ms. Worthington gave the following ratings:

Technology infrastructure	2
Physical infrastructure	2
Overall infrastructure:	2
Weather/Climate	1
Availability of skilled workers	3
Availability of capital	3
Quality of life	4
Taxes	5
Proximity to markets	4
Regulatory climate	4
Cost of real estate	5
Cost of doing business	5

When discussing about Worcester's infrastructure, Ms. Worthington mentioned that the city has a potential but doesn't make an effort to do anything about it. The only good thing about Worcester is that it has an easy access to the Mass Pike. Ms. Worthington's expectation of Worcester is quite low.

In the past, Telesian Technology has encountered problems trying to find skill labor positions. Ms. Worthington noted that web programmers were the category of skilled workers that were most difficult to find.

Telesian Technology recruits for certain positions outside of Worcester but does not aggressively recruit in the area. Ms. Worthington states that Telesian Technology was not provided with any financial incentives to settle in Worcester, although she found that lower taxes would have been attractive to her.

Ms. Worthington notes that there seems to be a vertical wall between Westborough and Worcester. There are so many high-tech companies outside of Worcester but the city has not done anything to help bring these companies into the area.

Therefore, when asked what she thinks Worcester can do to close the skills gap if one exists in the area, Ms. Worthington states that the city needs to court more high-tech companies into the area. Such an example would be to get EMC to locate in Worcester.

Appendix G:

Interview Summaries for Miscellaneous Companies

Staffing

1. **GeekStaff Incorporated**: Mr. Craig Smith

On Wednesday, November 7, 2001, we conducted an interview with Mr. Craig Smith via telephone. Mr. Smith is currently in the progress of moving his company, GeekStaff, into the Worcester area. GeekStaff is a staffing company that specializes in the information technology area. The following is a summary of this interview.

Craig Smith has already founded, grew and sold a similar business in the Albany, New York area. He hopes for similar success in the Worcester area by finding companies that need information technology workers or by finding a niche that isn't currently being worked.

Mr. Smith starts by determining the demand for an IT staffing company in a certain area. This is done by using online websites such as Monster.com and hotjobs.com. He searches their databases as a person looking for work in the IT sector in a particular area such as Worcester. After submitting his request, the online site provides the company name or contact information of companies that are searching for that type of qualified personnel. Mr. Smith then contacts these companies, informs them that he is an IT staffing business and learns if they might be interested in utilizing a company such as GeekStaff.

Mr. Smith sold his business in Albany in November 1999. At that time, the need for information technology companies was huge and he could not fill all of the job openings. Mr. Smith stated that he probably could have doubled his business in a month if he had been able to find the qualified workers that he needed. Currently, the situation

is almost the complete opposite. There is a surplus of qualified workers for every job opening. In addition, companies are able to meet their own employment needs and do not need the help of an outside staffing company such as GeekStaff. Before the events of September 11th, it was predicted that the economy would recover sometime in the first quarter. Now, it is believed that this will not happen until the second or third quarter.

The workers that Mr. Smith attempts to place with companies almost always have a four-year college degree in their field. If they do not have a four-year degree, they must have certification in a specific area. In addition, the majority of workers should have a minimum of 2-3 years of working experience.

One of the methods that Mr. Smith might provide additional training to potential employees is through cooperation with area colleges and training programs. He found this very successful in the Albany area and would definitely want to do it here in the Worcester area. Mr. Smith will take individuals with a general technology background and provide a 30-day crash course in a specific application a company might require. These programs are successful for a number of reasons. Colleges and universities usually agree to the partnership because this additional training makes their students more employable. The companies are glad to see these training programs take place because they will provide individuals with the knowledge of the specialized software that the particular company might operate.

Mr. Smith also provided us with his personal views on what Worcester might offer in order to become more successful in attracting information technology companies to the area. The three major components were offering training programs, funding for those training programs and a readily available contact person that acted as a liaison

between employers and employees. Worcester must be willing to put together targeted training programs and find some subsidized funding to make those programs happen. He stated that Albany had been successful in producing needed entry-level personnel by provided extra training that was paid for by state training grants. These cost-free programs were especially attractive to lower income individuals and recent college graduates.

2. **Manpower, Incorporated**: Mr. Kevin Wilson, Worcester Branch Manager

On Friday, November 9, 2001, we interviewed Mr. Kevin Wilson of Manpower Inc. Mr. Wilson is the branch manager for the Worcester branch of Manpower, an international staffing company. A summary of the interview follows below.

Manpower was previously located in Auburn but later moved to the present Worcester location for the reason of the cost of rent. The Worcester branch has been located in Worcester for about a year and half. Now that the branch is located in Worcester, it is more visible, along with it being in more of a central location. There are a number of significant landmarks in Worcester to help people locate where they need to go.

When Manpower located here, there was an adequate supply of workers in the area. Mr. Wilson stated that he has not had difficulty finding workers in the Worcester area. A new staffing specialist has been recently hired to help Manpower fill staffing positions for companies. The Worcester branch of Manpower is concentrated on staffing customer service individuals. Mr. Wilson hopes for information technology companies to contact Manpower for sales and human resource individuals.

Work experience is necessary for individuals to have when Manpower looks at them for staffing. Mr. Wilson said that the level of education is not much of a factor compared to individuals who know how to deal with people and have customer relations experience. Kevin Wilson foresees that customer service representatives will be one of the very most needed workers in the future. As technology increases in the world, people will need more help understanding how to use it.

The infrastructure of Worcester is excellent in the eyes of Mr. Wilson. He believes that Worcester has done a fantastic job with the public transportation system. Many of the workers that Manpower employs use the public transportation. Although, Mr. Wilson mentioned that the transportation could be improved in some respects. For example, Manpower has many workers that travel to the Mid-State Park in Auburn but the bus stops at the Auburn Mall, which is a mile to a mile and a half short of the Park. The public transportation should make an effort to extend routes a short distance when it notices it is needed. Mr. Wilson also said that when businesses look to locate they look into the restaurants, convenience stores, dry cleaners, etc.

Mr. Wilson is aware that Quinsigamond Community College offers training programs and would like to work with them. Manpower also has its own training service called the Global Learning Center, which is a free service that teaches college level courses. There have been 28 newly added courses to the Global Learning Center.

Ventured Capital Firm

The Worcester Capital Partners: Mr. John Merrill, Managing Director

On Friday, November 9, 2001, we met with John Merrill of The Worcester Capital Partners. The Worcester Capital Partners is a venture capital firm that invests in early stage, high technology companies in the Worcester area. Mr. Merrill serves as the Managing Director. The following is a brief summary of our interview with Mr. Merrill.

The Worcester Capital Partners was founded in August, 2000, and had raised $16.4 million by February, 2001. The investors are typically local institutions like WPI, Clark, Holy Cross, banks, insurance groups and high net-worth individuals. Village Ventures, a larger venture capital firm, committed $5 million of the $16.4 million. Village Ventures invests in about 13 non-traditional venture capital markets. Worcester would be classified as one of those non-traditional markets. After the Capital Partners were able to raise $16.4 million, they began to invest in companies that had developed technology, but lacked capital resources.

Mr. Merrill mentioned that one advantage of the Worcester area, was that it was so close to the Route 128 and I-495 area but was much more favorable because of their infrastructure and lower cost of business. Mr. Merrill spends about a third of his time in the Worcester area and the majority of the remainder of the time talking to companies in the 128 and 495 areas, trying to convince them that Worcester is more favorable to their company.

In the past, the low property costs, when compared to Boston, was a major selling point for Mr. Merrill to use when speaking with other companies. This is still true today,

although the migration from the east has increased property costs in Worcester over the last couple of years. Worcester Polytechnic Institute and the graduate program at Clark University are also major benefits of Worcester. Also mentioned, was that the type of living here in Worcester is much better than that in Boston.

Mr. Merrill and The Worcester Capital Partners are finished raising funds for the time being. They now hope to invest in six or seven more companies over the next three to four years. To do this, they must be able to show them that we have the resources to support companies that move to Worcester area. Mr. Merrill hopes that our report might be able to factually show that skilled workers do exist here in the area.

Mr. Merrill believes that the physical infrastructure here in Worcester is fine, but it can always improve. The recent efforts with the Worcester Airport, Route 146 connector and the commuter rail are all examples of good improvements in Worcester. He also mentioned that the bandwidth in Worcester is available and affordable. Another advantage of Worcester is its access to a number of airports. T.F. Green in Providence, Logan in Boston, Manchester and Worcester are all readily accessible from Worcester. Worcester is located within an hour to almost all major markets in New England.

Worcester can improve opportunities for companies in a number of ways. First, Worcester needs to become more business friendly. Currently, the tax rate is not very attractive for Worcester. The biggest thing that Worcester needs to do is market itself. The city of Worcester has about a $400 million budget, but only spends less that $400,000 on marketing. This amount is not nearly enough. Mr. Merrill believed that the Worcester Regional Chamber of Commerce had begun efforts on improving its marketing in recent years. However, too many people simply don't know about

Worcester and what the city can offer. Mr. Merrill also believed that, somehow, Worcester needed to retain more of its 30,000 or so students that attend institutions of higher education in Worcester. Finally, Mr. Merrill stated that once Worcester is able to establish a noticeable cluster, it should be able to build upon itself and prosper.

Non-Profit Consortium

Center for Advanced Fiberoptic Applications (CAFA): Mr. Olen Bielski III, Director of Business Development.

On Tuesday, November 13, 2001, we met with Mr. Olen Bielski III of the Center for Advanced Fiber Optic Applications. CAFA is an industry lead non-profit consortium. Mr. Bielski is the Director of Business Development. A summary of the interview is provided below.

The Center for Advanced Fiber Optic Applications located in Southbridge eight years ago in 1993. CAFA chose to locate in Southbridge because this area represented the fiber optics industry. There is and has been an adequate supply of skilled workers in the area. However, the consortium has encountered problems in the past as well as now, trying to fill skilled labor positions. CAFA finds itself having the most difficulty in finding entry-level, technical, scientific, engineers and researchers in the fiber optics and photonics industry.

The types of skills that CAFA's employees need to have are good problem solving skills and good mathematical background skills, especially in the areas of algebra and geometry. CAFA requires that their employees must have at a minimum a high school degree, or an associate's degree in fiber optics.

Colleges and universities were not a factor in CAFA's settlement in Southbridge because, as mentioned earlier, CAFA's location was due to the area's reputation as the fiber optics industry. However, colleges, universities, and high schools have played a role in this consortium. CAFA has established training programs with Quinsigamond Community College in Worcester for adult learners to learn the skills needed in the fiber

optics industry. In addition, CAFA has partnered with two local high schools in the area to get the student's interest in creating an academic/technical program.

Mr. Bielski has found that the cost of bandwidth has decreased with the increased supply of bandwidth. When asked to rate the importance of the factors that CAFA considered when locating in Southbridge, Mr. Bielski gave the following ratings:

Technology infrastructure	4
Physical infrastructure	2-3
Overall infrastructure:	4
Weather/Climate	5
Availability of skilled workers	4
Availability of capital	3-4
Quality of life	5
Taxes	4
Proximity to markets	4-5
Regulatory climate	4-5
Cost of real estate	4-5
Cost of doing business	4-5

When discussing about the physical infrastructure, Mr. Bielski notes that central Massachusetts needs to do a better job of educating and to paint a better picture of what's available. He says that it is hard to recruit engineers and scientists because of the competition with Route 128. Employees get paid the same wages, yet workers out there are doing a better job of selling their products.

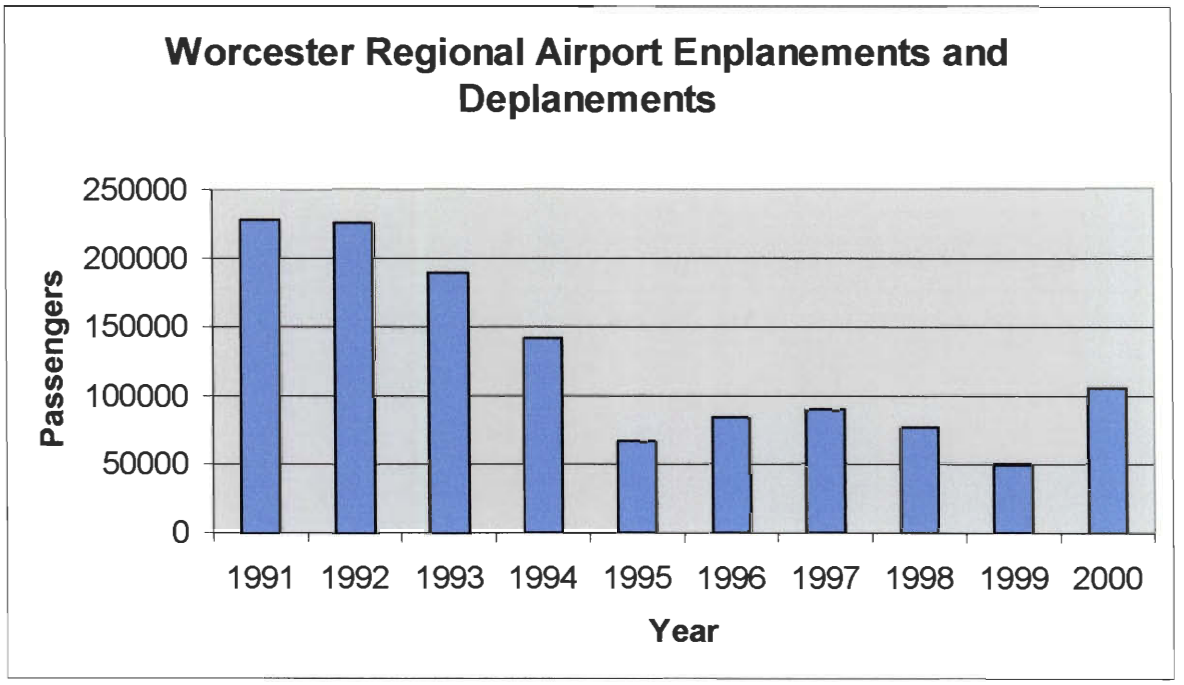
CAFA recruits for positions outside of the Southbridge area. They try to help other companies as well. At the same time, they also recruit for certain positions within the Southbridge area. When asked if CAFA was provided with any financial incentives to settle in the area, Mr. Bielski stated that there simply was not. Since it is a non-profit organization, the state funds them to operate the consortium. Mr. Bielski also saw that a

better regional marketing plan would have helped improve the consortium's opportunities.

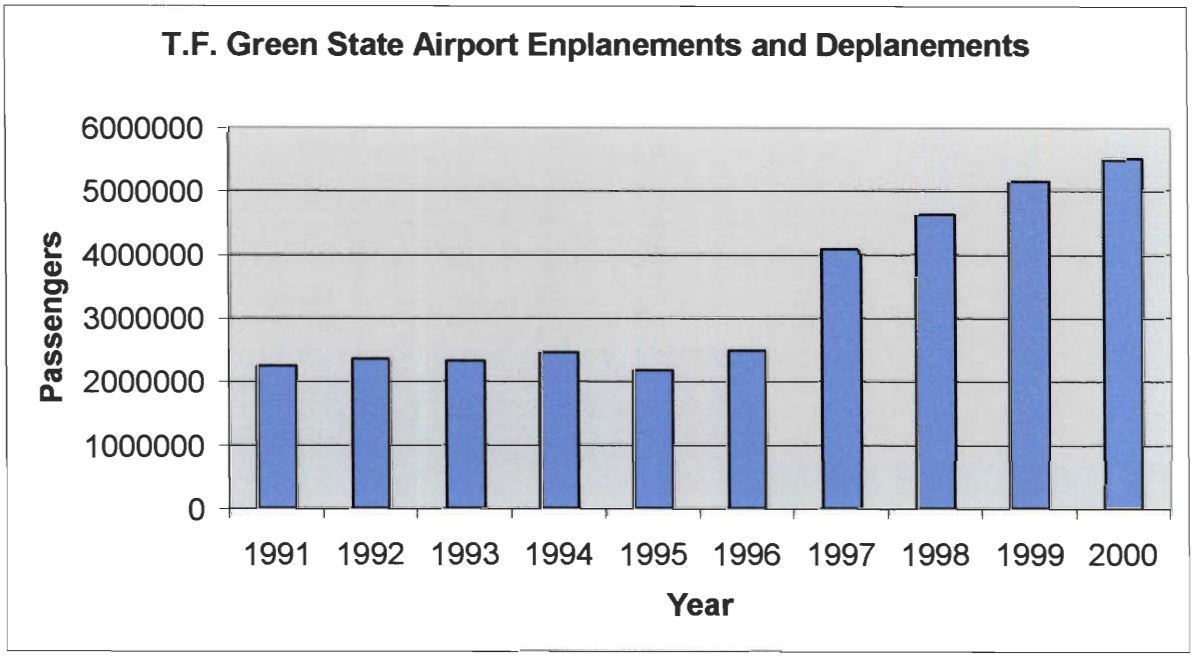
Finally, when asked what he thinks Worcester can do to close the skills gap if one exists, Mr. Bielski answers that the city needs to work in a collective manner with the local and state government, industries, and institutions of higher learning to show the diverse opportunities that exist in central Massachusetts.

Appendix H:

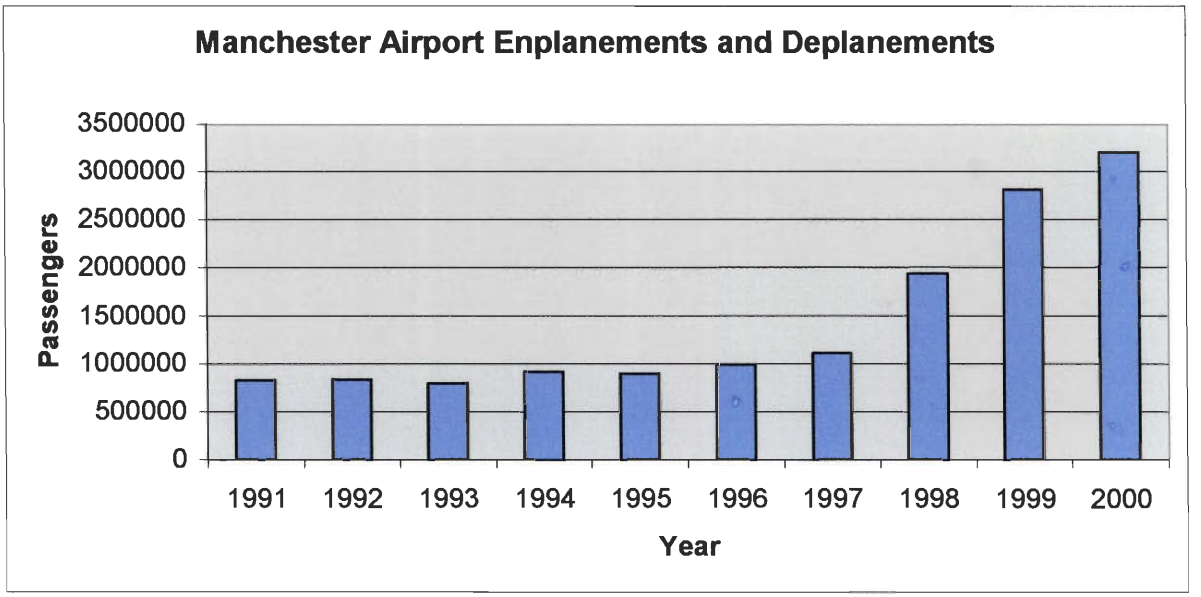
Airport Findings



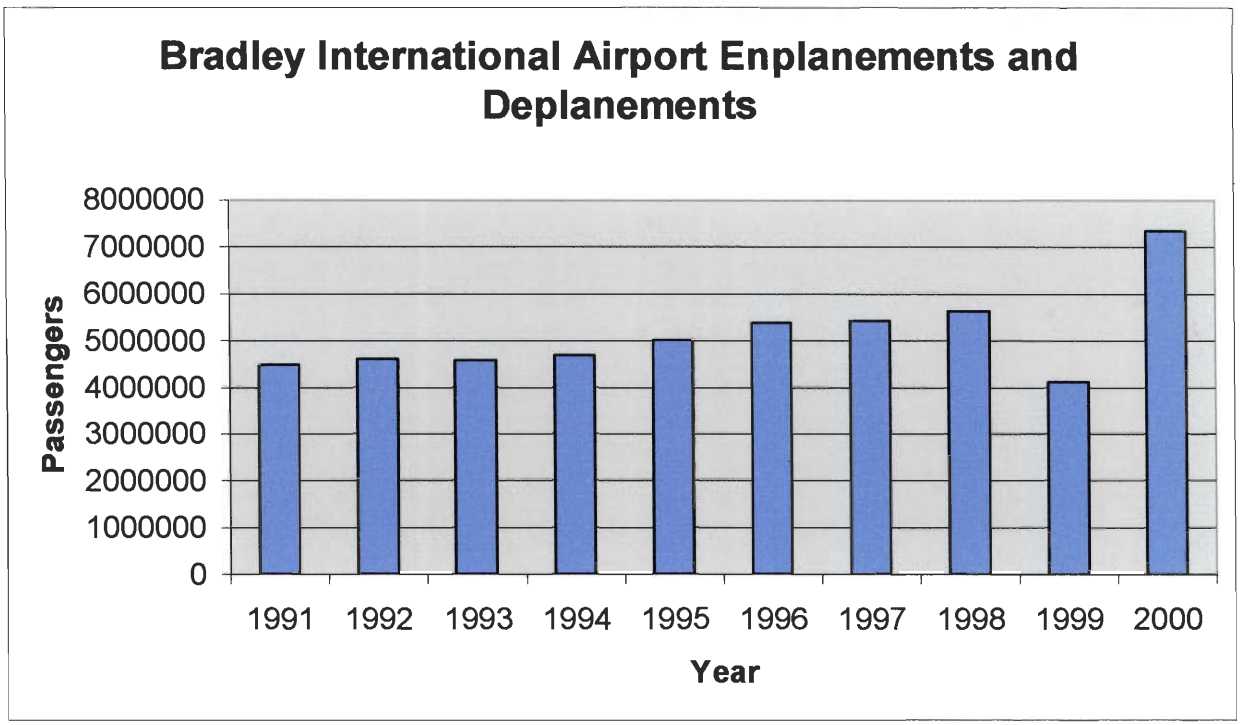
Source: Worcester Regional Airport



Source: T.F. Green Airport



Source: Manchester Airport



Source: Bradley International Airport

Appendix I:

Occupational Employment Statistics for Worcester

2000 Worcester Area Occupational Employment and Wages Estimates

Management Occupations

SOC Code Number	Occupation Title	Employment	Wage Estimates			
			Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
11-0000	**Management Occupations**	15,170	$30.18	$33.60	$69,880	2.4 %
11-1011	Chief Executives	1,110	$62.65	$53.31	$110,880	5.7 %
11-1021	General and Operations Managers	4,520	$33.13	$36.91	$76,770	4.0 %
11-1031	Legislators	50	$7.01	$7.18	$14,940	3.1 %
11-2011	Advertising and Promotions Managers	130	$23.65	$25.63	$53,320	5.3 %
11-2021	Marketing Managers	280	$33.73	$34.42	$71,600	4.4 %
11-2022	Sales Managers	680	$41.61	$40.80	$84,870	3.2 %
11-2031	Public Relations Managers	70	$19.68	$24.29	$50,520	8.7 %
11-3011	Administrative Services Managers	830	$23.19	$23.68	$49,250	4.1 %
11-3021	Computer and Information Systems Managers	570	$33.55	$34.18	$71,100	3.7 %
11-3031	Financial Managers	1,440	$26.15	$28.57	$59,430	3.6 %
11-3040	Human Resources Managers	430	$27.71	$29.77	$61,930	3.8 %
11-3051	Industrial Production Managers	440	$30.84	$32.71	$68,030	4.8 %
11-3061	Purchasing Managers	220	$27.45	$28.57	$59,430	3.5 %
11-3071	Transportation, Storage, and Distribution Managers	170	$26.52	$28.38	$59,040	5.0 %
11-9021	Construction Managers	270	$27.41	$29.41	$61,170	5.1 %
11-9031	Education Administrators, Preschool and Child Care Center/Program	80	$18.16	$21.03	$43,740	7.7 %

11-9032	Education Administrators, Elementary and Secondary School	420	(2)	(2)	$69,990	2.4 %
11-9033	Education Administrators, Postsecondary	560	$25.55	$27.40	$56,990	2.6 %
11-9041	Engineering Managers	590	$48.89	$47.71	$99,240	5.8 %
11-9051	Food Service Managers	490	$16.64	$17.80	$37,020	4.6 %
11-9081	Lodging Managers	40	$13.97	$18.29	$38,040	18.9 %
11-9111	Medical and Health Services Managers	580	$25.09	$25.50	$53,030	5.4 %
11-9121	Natural Sciences Managers	80	$36.52	$40.35	$83,940	8.5 %
11-9141	Property, Real Estate, and Community Association Managers	220	$27.13	$29.50	$61,360	12.2 %
11-9151	Social and Community Service Managers	250	$16.20	$17.34	$36,060	3.9 %

Business and Financial Operations Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
13-0000	**Business and Financial Operations Occupations**	7,420	$20.64	$22.48	$46,760	2.5 %
13-1021	Purchasing Agents and Buyers, Farm Products	30	$20.24	$20.16	$41,940	6.9 %
13-1022	Wholesale and Retail Buyers, Except Farm Products	260	$15.56	$17.83	$37,080	6.6 %
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	450	$19.79	$19.70	$40,990	2.1 %
13-1031	Claims Adjusters, Examiners, and Investigators	870	$18.50	$18.46	$38,390	2.7 %
13-1041	Compliance Officers, Except Agriculture,	50	$23.29	$23.99	$49,900	5.3 %

	Construction, Health and Safety, and Transportation					
13-1051	Cost Estimators	360	$20.77	$22.27	$46,330	3.8 %
13-1061	Emergency Management Specialists	(4)	$21.49	$24.40	$50,750	9.6 %
13-1071	Employment, Recruitment, and Placement Specialists	540	$15.37	$16.73	$34,800	5.7 %
13-1072	Compensation, Benefits, and Job Analysis Specialists	130	$21.05	$22.43	$46,640	3.5 %
13-1073	Training and Development Specialists	230	$21.80	$22.63	$47,060	2.5 %
13-1111	Management Analysts	620	$30.72	$32.12	$66,800	5.4 %
13-1121	Meeting and Convention Planners	40	$16.49	$17.59	$36,590	4.0 %
13-2011	Accountants and Auditors	1,310	$19.92	$21.29	$44,290	5.2 %
13-2021	Appraisers and Assessors of Real Estate	90	$15.62	$15.39	$32,000	8.9 %
13-2031	Budget Analysts	(4)	$24.84	$24.68	$51,320	2.6 %
13-2041	Credit Analysts	30	$19.60	$19.50	$40,570	11.7 %
13-2051	Financial Analysts	170	$25.56	$27.87	$57,970	7.6 %
13-2052	Personal Financial Advisors	260	$29.74	$34.84	$72,470	16.4 %
13-2053	Insurance Underwriters	490	$24.17	$25.01	$52,030	2.4 %
13-2061	Financial Examiners	(4)	$25.41	$28.82	$59,940	5.2 %
13-2072	Loan Officers	200	$26.56	$29.60	$61,570	8.8 %
13-2082	Tax Preparers	(4)	$10.63	$12.16	$25,300	19.1 %

Computer and Mathematical Occupations

			Wage Estimates			
SOC Code	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual	Mean RSE

Number					(1)	
15-0000	**Computer and Mathematical Occupations**	3,460	$26.17	$26.43	$54,970	2.6 %
15-1011	Computer and Information Scientists, Research	(4)	$31.94	$31.95	$66,450	5.0 %
15-1021	Computer Programmers	430	$25.08	$25.89	$53,850	5.8 %
15-1031	Computer Software Engineers, Applications	(4)	$27.59	$29.92	$62,240	6.8 %
15-1032	Computer Software Engineers, Systems Software	740	$29.83	$30.12	$62,660	2.5 %
15-1041	Computer Support Specialists	600	$16.95	$17.71	$36,840	3.1 %
15-1051	Computer Systems Analysts	560	$28.10	$27.95	$58,130	3.2 %
15-1061	Database Administrators	130	$21.21	$23.03	$47,910	4.1 %
15-1071	Network and Computer Systems Administrators	340	$26.28	$26.65	$55,430	2.9 %
15-1081	Network Systems and Data Communications Analysts	70	$26.60	$27.52	$57,240	3.7 %
15-2011	Actuaries	(4)	$33.30	$36.09	$75,060	6.3 %

Architecture and Engineering Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
17-0000	**Architecture and Engineering Occupations**	4,860	$27.20	$29.41	$61,170	6.9 %
17-1022	Surveyors	(4)	$20.44	$21.28	$44,270	3.5 %
17-2051	Civil Engineers	180	$25.85	$26.19	$54,470	3.2 %
17-2071	Electrical Engineers	420	$34.91	$35.17	$73,150	2.9 %
17-2072	Electronics Engineers, Except Computer	90	$38.84	$38.42	$79,910	5.8 %
17-	Environmental	110	$29.51	$29.17	$60,660	3.3 %

2081	Engineers					
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	(4)	$21.15	$23.05	$47,940	6.1 %
17-2112	Industrial Engineers	150	$29.29	$30.95	$64,370	5.3 %
17-2131	Materials Engineers	100	$26.17	$27.25	$56,680	3.0 %
17-2141	Mechanical Engineers	410	$26.57	$28.23	$58,710	3.7 %
17-3011	Architectural and Civil Drafters	(4)	$19.01	$18.77	$39,030	2.2 %
17-3012	Electrical and Electronics Drafters	120	$27.06	$26.18	$54,450	8.1 %
17-3013	Mechanical Drafters	100	$18.73	$18.91	$39,330	2.1 %
17-3022	Civil Engineering Technicians	(4)	$17.31	$19.07	$39,660	13.1 %
17-3023	Electrical and Electronic Engineering Technicians	350	$20.98	$21.66	$45,050	5.3 %
17-3024	Electro-Mechanical Technicians	100	$18.80	$19.15	$39,830	3.0 %
17-3025	Environmental Engineering Technicians	(4)	$18.44	$19.17	$39,880	6.7 %
17-3026	Industrial Engineering Technicians	60	$21.66	$21.57	$44,860	3.5 %
17-3027	Mechanical Engineering Technicians	220	$20.44	$21.47	$44,670	3.3 %
17-3031	Surveying and Mapping Technicians	50	$12.43	$13.77	$28,650	11.1 %

Life, Physical, and Social Science Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
19-0000	**Life, Physical, and Social Science Occupations**	1,490	$20.42	$23.47	$48,820	5.5 %
19-1042	Medical Scientists, Except Epidemiologists	(4)	$28.05	$30.36	$63,150	3.0 %

19-2012	Physicists	(4)	$38.67	$37.88	$78,780	4.1 %
19-2031	Chemists	(4)	$28.79	$30.01	$62,420	2.9 %
19-2032	Materials Scientists	(4)	$42.19	$41.87	$87,090	3.3 %
19-2041	Environmental Scientists and Specialists, Including Health	(4)	$18.21	$20.22	$42,050	5.5 %
19-3021	Market Research Analysts	110	$20.34	$21.22	$44,130	3.9 %
19-3031	Clinical, Counseling, and School Psychologists	120	$20.99	$22.09	$45,960	5.3 %
19-4021	Biological Technicians	(4)	$19.02	$19.04	$39,610	10.2 %
19-4031	Chemical Technicians	180	$15.97	$16.26	$33,810	3.4 %
19-4091	Environmental Science and Protection Technicians, Including Health	(4)	$17.96	$16.91	$35,170	7.5 %

Community and Social Services Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
21-0000	**Community and Social Services Occupations**	4,310	$13.19	$15.36	$31,960	4.6 %
21-1011	Substance Abuse and Behavioral Disorder Counselors	100	$12.92	$13.46	$27,990	6.6 %
21-1012	Educational, Vocational, and School Counselors	530	$22.61	$21.26	$44,210	6.0 %
21-1014	Mental Health Counselors	200	$10.76	$11.64	$24,220	3.8 %
21-1015	Rehabilitation Counselors	260	$10.31	$10.64	$22,130	2.3 %
21-1021	Child, Family, and School Social Workers	550	$15.89	$16.56	$34,450	7.1 %
21-1022	Medical and Public Health Social Workers	330	$18.93	$19.13	$39,790	6.1 %

21-1023	Mental Health and Substance Abuse Social Workers	210	$17.54	$17.85	$37,120	5.5 %
21-1091	Health Educators	210	$13.34	$18.44	$38,350	11.4 %
21-1093	Social and Human Service Assistants	1,390	$10.33	$11.25	$23,400	4.3 %

Legal Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
23-0000	**Legal Occupations**	880	$24.02	$28.84	$59,980	6.5 %
23-1011	Lawyers	480	$33.64	$35.19	$73,190	9.7 %
23-2011	Paralegals and Legal Assistants	160	$18.93	$18.82	$39,140	4.1 %

Education, Training, and Library Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
25-0000	**Education, Training, and Library Occupations**	13,590	$19.10	$18.69	$38,870	2.4 %
25-1022	Mathematical Science Teachers, Postsecondary	(4)	(2)	(2)	$50,600	3.9 %
25-1065	Political Science Teachers, Postsecondary	40	(2)	(2)	$61,200	11.7 %
25-1066	Psychology Teachers, Postsecondary	(4)	(2)	(2)	$53,020	2.7 %
25-1081	Education Teachers, Postsecondary	(4)	(2)	(2)	$47,970	7.0 %
25-1121	Art, Drama, and Music Teachers, Postsecondary	(4)	(2)	(2)	$45,000	5.8 %
25-1123	English Language and Literature Teachers, Postsecondary	120	(2)	(2)	$48,400	3.4 %
25-1124	Foreign Language and Literature Teachers, Postsecondary	(4)	(2)	(2)	$54,000	3.8 %

25-1126	Philosophy and Religion Teachers, Postsecondary	(4)	(2)	(2)	$48,570	3.8 %
25-1194	Vocational Education Teachers, Postsecondary	160	$10.44	$13.16	$27,370	18.3 %
25-2011	Preschool Teachers, Except Special Education	930	$10.49	$11.24	$23,380	3.2 %
25-2012	Kindergarten Teachers, Except Special Education	300	(2)	(2)	$41,630	2.4 %
25-2021	Elementary School Teachers, Except Special Education	2,630	(2)	(2)	$45,000	2.4 %
25-2022	Middle School Teachers, Except Special and Vocational Education	1,440	(2)	(2)	$45,880	2.1 %
25-2031	Secondary School Teachers, Except Special and Vocational Education	1,740	(2)	(2)	$46,230	1.9 %
25-2041	Special Education Teachers, Preschool, Kindergarten, and Elementary School	260	(2)	(2)	$42,450	2.8 %
25-2042	Special Education Teachers, Middle School	(4)	(2)	(2)	$43,570	2.7 %
25-2043	Special Education Teachers, Secondary School	230	(2)	(2)	$38,890	3.9 %
25-3011	Adult Literacy, Remedial Education, and Ged Teachers and Instructors	250	$13.93	$14.77	$30,730	4.6 %
25-3021	Self-Enrichment Education Teachers	270	$16.25	$17.32	$36,030	12.5 %
25-4021	Librarians	290	$21.03	$21.01	$43,700	2.2 %
25-4031	Library Technicians	250	$12.03	$11.99	$24,950	2.7 %
25-9031	Instructional Coordinators	270	$18.57	$19.28	$40,100	2.9 %
25-9041	Teacher Assistants	2,120	(2)	(2)	$20,330	2.9 %

Arts, Design, Entertainment, Sports, and Media Occupations

SOC Code Number	Occupation Title	Employment	Wage Estimates			
			Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
27-0000	**Arts, Design, Entertainment, Sports, and Media Occupations**	1,660	$15.90	$17.69	$36,790	5.8 %
27-1014	Multi-Media Artists and Animators	(4)	$24.83	$27.21	$56,590	6.2 %
27-1023	Floral Designers	(4)	$11.93	$11.74	$24,420	16.5 %
27-1024	Graphic Designers	190	$16.49	$17.33	$36,040	4.8 %
27-1025	Interior Designers	80	$18.29	$21.97	$45,690	21.7 %
27-2022	Coaches and Scouts	70	(2)	(2)	$36,390	6.7 %
27-3031	Public Relations Specialists	70	$18.30	$19.30	$40,140	4.5 %
27-3042	Technical Writers	50	$27.58	$28.56	$59,400	4.7 %
27-3043	Writers and Authors	50	$16.62	$20.39	$42,410	4.6 %
27-4011	Audio and Video Equipment Technicians	30	$13.60	$14.83	$30,850	7.6 %

Healthcare Practitioners and Technical Occupations

SOC Code Number	Occupation Title	Employment	Wage Estimates			
			Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
29-0000	**Healthcare Practitioners and Technical Occupations**	14,930	$21.04	$23.13	$48,110	2.5 %
29-1011	Chiropractors	(4)	$21.09	$21.08	$43,840	13.6 %
29-1020	Dentists	(4)	$62.95	$62.26	$129,500	5.9 %
29-1031	Dietitians and Nutritionists	80	$16.68	$18.31	$38,090	4.7 %

29-1051	Pharmacists	380	$32.79	$32.66	$67,940	1.9 %
29-1062	Family and General Practitioners	550	$46.20	$41.54	$86,400	14.8 %
29-1063	Internists, General	(4)	$62.49	$55.99	$116,470	17.3 %
29-1066	Psychiatrists	30	$60.83	$57.67	$119,960	11.4 %
29-1071	Physician Assistants	50	$19.86	$20.34	$42,320	4.3 %
29-1111	Registered Nurses	6,480	$22.50	$22.63	$47,060	2.4 %
29-1122	Occupational Therapists	190	$22.86	$22.13	$46,040	5.9 %
29-1123	Physical Therapists	310	$25.30	$25.20	$52,420	1.8 %
29-1125	Recreational Therapists	80	$10.96	$11.69	$24,310	5.6 %
29-1126	Respiratory Therapists	340	$21.22	$21.15	$44,000	2.2 %
29-1127	Speech-Language Pathologists	140	$20.06	$19.43	$40,410	8.6 %
29-1131	Veterinarians	40	$27.77	$28.50	$59,270	1.9 %
29-2011	Medical and Clinical Laboratory Technologists	310	$20.92	$20.96	$43,590	1.8 %
29-2012	Medical and Clinical Laboratory Technicians	(4)	$17.03	$16.19	$33,680	5.4 %
29-2021	Dental Hygienists	(4)	$30.01	$29.10	$60,520	4.0 %
29-2031	Cardiovascular Technologists and Technicians	170	$15.99	$16.47	$34,250	2.4 %
29-2032	Diagnostic Medical Sonographers	120	$22.79	$22.91	$47,650	3.8 %
29-2033	Nuclear Medicine Technologists	50	$21.21	$21.28	$44,260	2.6 %
29-2034	Radiologic Technologists and Technicians	340	$20.36	$20.72	$43,100	3.0 %
29-2041	Emergency Medical Technicians and Paramedics	780	$11.13	$11.30	$23,500	4.3 %
29-2051	Dietetic Technicians	50	$10.76	$10.90	$22,680	4.5 %
29-	Pharmacy Technicians	470	$10.04	$12.70	$26,410	9.0 %

2052						
29-2055	Surgical Technologists	160	$15.31	$15.45	$32,130	3.2 %
29-2056	Veterinary Technologists and Technicians	70	$10.86	$10.84	$22,540	1.8 %
29-2061	Licensed Practical and Licensed Vocational Nurses	1,680	$18.02	$18.58	$38,650	2.4 %
29-2071	Medical Records and Health Information Technicians	220	$12.49	$14.11	$29,340	5.9 %
29-2081	Opticians, Dispensing	(4)	$15.28	$15.11	$31,430	8.3 %
29-9010	Occupational Health and Safety Specialists and Technicians	30	$22.50	$23.14	$48,140	8.3 %
29-9091	Athletic Trainers	80	(2)	(2)	$32,730	7.5 %

Healthcare Support Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
31-0000	**Healthcare Support Occupations**	9,310	$11.02	$11.41	$23,730	2.1 %
31-1011	Home Health Aides	1,260	$9.78	$9.88	$20,550	4.2 %
31-1012	Nursing Aides, Orderlies, and Attendants	4,720	$10.76	$11.01	$22,890	1.8 %
31-2011	Occupational Therapist Assistants	30	$16.56	$17.58	$36,570	3.7 %
31-2021	Physical Therapist Assistants	90	$16.99	$17.74	$36,890	2.4 %
31-2022	Physical Therapist Aides	(4)	$12.53	$12.86	$26,760	3.4 %
31-9011	Massage Therapists	90	$15.71	$17.01	$35,390	16.0 %
31-9091	Dental Assistants	740	$15.21	$15.03	$31,260	4.6 %
31-9092	Medical Assistants	450	$13.45	$13.09	$27,240	3.3 %
31-9093	Medical Equipment Preparers	(4)	$10.74	$11.08	$23,040	2.7 %
31-	Medical	150	$13.57	$13.45	$27,970	2.5 %

9094	Transcriptionists					
31-9095	Pharmacy Aides	220	$10.36	$11.14	$23,160	2.9 %
31-9096	Veterinary Assistants and Laboratory Animal Caretakers	190	$9.76	$10.18	$21,170	9.3 %

Protective Service Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
33-0000	**Protective Service Occupations**	4,760	$12.98	$14.84	$30,880	7.4 %
33-1012	First-Line Supervisors/Managers of Police and Detectives	130	$31.00	$31.08	$64,640	3.6 %
33-1021	First-Line Supervisors/Managers of Fire Fighting and Prevention Workers	120	$14.01	$16.89	$35,130	21.9 %
33-2011	Fire Fighters	1,390	$12.11	$14.25	$29,640	19.6 %
33-3021	Detectives and Criminal Investigators	30	$25.27	$25.10	$52,200	2.4 %
33-3051	Police and Sheriff's Patrol Officers	1,180	$19.72	$19.63	$40,830	2.8 %
33-9032	Security Guards	1,480	$9.78	$10.42	$21,680	4.3 %
33-9091	Crossing Guards	140	$7.62	$8.12	$16,890	3.7 %

Food Preparation and Serving Related Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
35-0000	**Food Preparation and Serving Related Occupations**	17,490	$8.15	$8.81	$18,330	1.5 %
35-1011	Chefs and Head Cooks	230	$11.48	$13.55	$28,190	4.6 %
35-1012	First-Line Supervisors/Managers of Food Preparation and Serving Workers	1,170	$12.78	$13.16	$27,370	2.2 %

35-2011	Cooks, Fast Food	130	$7.93	$8.01	$16,650	5.4 %
35-2012	Cooks, Institution and Cafeteria	1,030	$10.15	$10.25	$21,320	2.0 %
35-2014	Cooks, Restaurant	680	$11.38	$11.13	$23,160	2.7 %
35-2015	Cooks, Short Order	860	$9.04	$9.07	$18,870	9.9 %
35-2021	Food Preparation Workers	2,050	$8.11	$8.39	$17,440	1.7 %
35-3011	Bartenders	1,130	$6.85	$7.73	$16,080	3.1 %
35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	2,470	$6.94	$7.27	$15,120	2.0 %
35-3022	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	1,540	$6.89	$7.36	$15,310	2.9 %
35-3031	Waiters and Waitresses	3,910	$8.93	$8.93	$18,580	3.2 %
35-3041	Food Servers, Nonrestaurant	280	$8.08	$8.26	$17,170	3.6 %
35-9011	Dining Room and Cafeteria Attendants and Bartender Helpers	370	$6.86	$7.22	$15,010	2.1 %
35-9021	Dishwashers	850	$7.81	$7.89	$16,410	2.1 %
35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	570	$8.39	$8.56	$17,810	2.0 %

Building and Grounds Cleaning and Maintenance Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
37-0000	**Building and Grounds Cleaning and Maintenance Occupations**	6,120	$10.15	$10.97	$22,810	2.8 %
37-1011	First-Line Supervisors/Managers of Housekeeping and Janitorial Workers	360	$15.80	$16.39	$34,080	2.4 %

37-1012	First-Line Supervisors/Managers of Landscaping, Lawn Service, and Groundskeeping Workers	230	$15.84	$17.06	$35,490	9.6 %
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	2,940	$10.92	$11.05	$22,990	3.6 %
37-2012	Maids and Housekeeping Cleaners	1,190	$8.66	$8.58	$17,840	2.1 %
37-3011	Landscaping and Groundskeeping Workers	1,320	$9.67	$10.23	$21,280	4.6 %
37-3013	Tree Trimmers and Pruners	(4)	$13.46	$13.62	$28,330	4.7 %

Personal Care and Service Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
39-0000	**Personal Care and Service Occupations**	3,300	$8.58	$10.28	$21,380	3.7 %
39-1021	First-Line Supervisors/Managers of Personal Service Workers	100	$12.20	$13.89	$28,900	9.6 %
39-2021	Nonfarm Animal Caretakers	120	$8.12	$9.08	$18,880	4.5 %
39-3031	Ushers, Lobby Attendants, and Ticket Takers	80	$6.58	$6.72	$13,980	3.8 %
39-3091	Amusement and Recreation Attendants	270	$6.84	$8.40	$17,460	12.3 %
39-3093	Locker Room, Coatroom, and Dressing Room Attendants	40	$8.54	$9.25	$19,230	3.6 %
39-5012	Hairdressers, Hairstylists, and Cosmetologists	810	$8.48	$10.57	$21,990	8.0 %
39-5092	Manicurists and Pedicurists	(4)	$6.60	$7.38	$15,360	14.6 %
39-6032	Transportation Attendants, Except Flight Attendants and Baggage Porters	(4)	$6.47	$6.80	$14,140	7.4 %

39-9011	Child Care Workers	490	$8.23	$8.92	$18,550	5.9 %
39-9021	Personal and Home Care Aides	180	$8.64	$8.86	$18,430	3.4 %
39-9031	Fitness Trainers and Aerobics Instructors	370	$10.54	$12.33	$25,650	7.1 %
39-9032	Recreation Workers	360	$8.39	$9.55	$19,870	4.8 %
39-9041	Residential Advisors	120	$12.09	$12.07	$25,110	3.1 %

Sales and Related Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
41-0000	**Sales and Related Occupations**	22,690	$10.05	$13.95	$29,020	2.6 %
41-1011	First-Line Supervisors/Managers of Retail Sales Workers	2,210	$14.32	$15.47	$32,180	3.2 %
41-1012	First-Line Supervisors/Managers of Non-Retail Sales Workers	440	$27.37	$28.47	$59,210	5.0 %
41-2011	Cashiers	6,190	$7.53	$7.84	$16,310	1.3 %
41-2021	Counter and Rental Clerks	750	$8.13	$9.96	$20,710	7.9 %
41-2022	Parts Salespersons	390	$12.44	$13.76	$28,610	7.4 %
41-2031	Retail Salespersons	6,040	$8.08	$9.78	$20,340	4.5 %
41-3011	Advertising Sales Agents	160	$15.58	$16.49	$34,310	6.3 %
41-3021	Insurance Sales Agents	1,220	$19.06	$20.96	$43,600	6.6 %
41-3031	Securities, Commodities, and Financial Services Sales Agents	210	$25.29	$29.28	$60,900	6.0 %
41-3041	Travel Agents	180	$12.94	$12.67	$26,350	3.3 %
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific	540	$24.98	$26.76	$55,650	3.5 %

	Products					
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	2,900	$21.48	$24.49	$50,930	3.5 %
41-9011	Demonstrators and Product Promoters	(4)	$12.78	$12.95	$26,940	4.3 %
41-9022	Real Estate Sales Agents	90	$15.48	$15.88	$33,040	5.9 %
41-9031	Sales Engineers	220	$30.70	$36.05	$74,980	13.2 %
41-9041	Telemarketers	160	$10.08	$12.38	$25,750	9.4 %
41-9091	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers	(4)	$23.59	$24.26	$50,470	4.3 %

Office and Administrative Support Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
43-0000	**Office and Administrative Support Occupations**	35,080	$12.06	$12.74	$26,490	0.9 %
43-1011	First-Line Supervisors/Managers of Office and Administrative Support Workers	1,880	$18.30	$19.21	$39,960	2.1 %
43-2011	Switchboard Operators, Including Answering Service	(4)	$10.01	$10.25	$21,310	2.8 %
43-3011	Bill and Account Collectors	550	$13.33	$14.18	$29,500	1.7 %
43-3021	Billing and Posting Clerks and Machine Operators	910	$12.97	$13.48	$28,040	2.9 %
43-3031	Bookkeeping, Accounting, and Auditing Clerks	2,500	$13.03	$13.51	$28,100	3.2 %
43-3051	Payroll and Timekeeping Clerks	300	$13.64	$14.46	$30,080	1.9 %
43-3061	Procurement Clerks	100	$13.34	$14.91	$31,010	8.3 %

43-3071	Tellers	990	$9.46	$9.49	$19,740	1.7 %
43-4031	Court, Municipal, and License Clerks	90	$17.55	$18.60	$38,690	3.1 %
43-4041	Credit Authorizers, Checkers, and Clerks	50	$14.80	$16.21	$33,720	10.3 %
43-4051	Customer Service Representatives	2,890	$12.56	$12.97	$26,990	2.4 %
43-4071	File Clerks	440	$9.55	$9.70	$20,170	2.4 %
43-4081	Hotel, Motel, and Resort Desk Clerks	230	$11.31	$10.86	$22,580	5.0 %
43-4111	Interviewers, Except Eligibility and Loan	240	$10.92	$11.63	$24,180	3.5 %
43-4121	Library Assistants, Clerical	220	$9.65	$10.52	$21,880	3.6 %
43-4131	Loan Interviewers and Clerks	180	$12.76	$12.73	$26,470	4.4 %
43-4141	New Accounts Clerks	(4)	$12.25	$12.36	$25,700	4.0 %
43-4151	Order Clerks	340	$13.56	$14.48	$30,120	3.3 %
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	260	$13.48	$13.90	$28,920	2.0 %
43-4171	Receptionists and Information Clerks	1,530	$9.49	$9.74	$20,260	1.8 %
43-5021	Couriers and Messengers	190	$10.04	$10.08	$20,960	2.5 %
43-5031	Police, Fire, and Ambulance Dispatchers	240	$13.40	$13.13	$27,320	2.9 %
43-5032	Dispatchers, Except Police, Fire, and Ambulance	220	$12.23	$12.91	$26,850	3.9 %
43-5041	Meter Readers, Utilities	80	$16.22	$16.15	$33,590	1.7 %
43-5061	Production, Planning, and Expediting Clerks	450	$16.11	$16.72	$34,780	3.3 %
43-5071	Shipping, Receiving, and Traffic Clerks	1,530	$11.28	$12.11	$25,200	1.9 %
43-5081	Stock Clerks and Order Fillers	3,650	$9.65	$10.06	$20,920	1.5 %
43-5111	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	60	$14.61	$14.19	$29,510	4.1 %

43-6011	Executive Secretaries and Administrative Assistants	2,380	$15.17	$15.84	$32,940	1.8 %
43-6012	Legal Secretaries	320	$15.90	$16.31	$33,920	5.0 %
43-6013	Medical Secretaries	1,030	$13.91	$13.44	$27,960	4.5 %
43-6014	Secretaries, Except Legal, Medical, and Executive	3,850	$11.70	$11.73	$24,390	1.9 %
43-9011	Computer Operators	370	$12.80	$13.96	$29,030	4.5 %
43-9021	Data Entry Keyers	560	$11.82	$11.57	$24,070	2.5 %
43-9022	Word Processors and Typists	150	$12.40	$13.09	$27,220	3.9 %
43-9031	Desktop Publishers	90	$16.43	$16.56	$34,440	9.0 %
43-9041	Insurance Claims and Policy Processing Clerks	(4)	$14.24	$14.63	$30,430	2.7 %
43-9051	Mail Clerks and Mail Machine Operators, Except Postal Service	200	$10.64	$10.98	$22,850	2.4 %
43-9061	Office Clerks, General	3,540	$10.74	$11.14	$23,170	1.1 %
43-9071	Office Machine Operators, Except Computer	110	$11.03	$11.99	$24,940	7.0 %

Farming, Fishing, and Forestry Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
45-0000	**Farming, Fishing, and Forestry Occupations**	70	$8.15	$11.03	$22,950	6.9 %
45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	(4)	$7.69	$8.13	$16,910	6.4 %

Construction and Extraction Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE

47-0000	**Construction and Extraction Occupations**	7,530	$17.19	$18.63	$38,740	4.3 %
47-1011	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	440	$27.20	$26.76	$55,660	4.5 %
47-2031	Carpenters	1,670	$14.75	$14.82	$30,820	10.7 %
47-2051	Cement Masons and Concrete Finishers	(4)	$18.73	$17.99	$37,430	6.3 %
47-2061	Construction Laborers	1,000	$14.80	$15.74	$32,730	4.4 %
47-2071	Paving, Surfacing, and Tamping Equipment Operators	110	$12.19	$12.76	$26,550	8.4 %
47-2073	Operating Engineers and Other Construction Equipment Operators	460	$16.86	$19.30	$40,150	5.1 %
47-2111	Electricians	1,260	$24.55	$25.71	$53,490	9.1 %
47-2141	Painters, Construction and Maintenance	220	$13.01	$13.75	$28,600	4.6 %
47-2151	Pipelayers	50	$16.45	$16.65	$34,630	4.2 %
47-2152	Plumbers, Pipefitters, and Steamfitters	460	$17.45	$17.18	$35,740	5.4 %
47-2211	Sheet Metal Workers	(4)	$21.23	$19.56	$40,690	6.4 %
47-3012	Helpers--Carpenters	30	$10.83	$11.30	$23,500	5.6 %
47-3013	Helpers--Electricians	170	$13.62	$13.88	$28,860	6.6 %
47-3014	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	(4)	$9.93	$10.24	$21,300	6.8 %
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	50	$12.18	$12.13	$25,230	3.2 %
47-4011	Construction and Building Inspectors	100	$18.31	$17.65	$36,720	2.9 %
47-4051	Highway Maintenance Workers	240	$16.23	$16.30	$33,900	1.5 %
47-5021	Earth Drillers, Except Oil and Gas	60	$24.56	$22.91	$47,660	8.0 %

Installation, Maintenance, and Repair Occupations

SOC Code Number	Occupation Title	Employment	Wage Estimates			
			Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
49-0000	**Installation, Maintenance, and Repair Occupations**	7,820	$15.75	$16.32	$33,950	2.2 %
49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	500	$20.45	$22.02	$45,810	2.8 %
49-2011	Computer, Automated Teller, and Office Machine Repairers	130	$15.80	$16.25	$33,810	2.9 %
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	110	$24.50	$26.96	$56,070	16.2 %
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	(4)	$14.42	$14.22	$29,590	16.0 %
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	(4)	$23.35	$21.60	$44,920	3.3 %
49-3021	Automotive Body and Related Repairers	480	$16.19	$15.54	$32,320	9.2 %
49-3023	Automotive Service Technicians and Mechanics	1,300	$14.10	$14.56	$30,280	5.3 %
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	180	$16.69	$16.87	$35,100	3.3 %
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	80	$17.55	$17.63	$36,670	4.0 %
49-3053	Outdoor Power Equipment and Other Small Engine Mechanics	30	$11.80	$12.70	$26,420	7.1 %
49-3093	Tire Repairers and Changers	(4)	$7.07	$8.21	$17,070	11.4 %
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	400	$16.35	$17.98	$37,390	8.8 %

49-9041	Industrial Machinery Mechanics	220	$16.91	$17.57	$36,540	2.9 %
49-9042	Maintenance and Repair Workers, General	2,240	$14.86	$15.10	$31,400	2.7 %
49-9043	Maintenance Workers, Machinery	350	$15.94	$15.82	$32,900	3.4 %
49-9044	Millwrights	90	$18.53	$18.48	$38,440	5.3 %
49-9051	Electrical Power-Line Installers and Repairers	160	$27.59	$28.40	$59,080	5.3 %
49-9098	Helpers--Installation, Maintenance, and Repair Workers	(4)	$14.41	$13.37	$27,810	5.0 %

Production Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
51-0000	**Production Occupations**	24,120	$12.93	$14.22	$29,580	3.5 %
51-1011	First-Line Supervisors/Managers of Production and Operating Workers	1,430	$21.53	$22.29	$46,360	1.6 %
51-2021	Coil Winders, Tapers, and Finishers	(4)	$10.94	$11.13	$23,160	4.5 %
51-2022	Electrical and Electronic Equipment Assemblers	1,190	$12.27	$12.54	$26,090	3.4 %
51-2023	Electromechanical Equipment Assemblers	50	$13.87	$14.42	$30,000	5.1 %
51-2031	Engine and Other Machine Assemblers	40	$10.92	$12.55	$26,100	4.0 %
51-2041	Structural Metal Fabricators and Fitters	200	$14.33	$15.13	$31,470	8.1 %
51-2092	Team Assemblers	2,430	$10.41	$11.74	$24,420	6.2 %
51-3011	Bakers	590	$10.03	$10.49	$21,810	4.4 %
51-3021	Butchers and Meat Cutters	110	$18.58	$17.16	$35,680	8.2 %
51-3092	Food Batchmakers	30	$10.73	$10.70	$22,250	11.1 %
51-4011	Computer-Controlled Machine Tool Operators, Metal and	(4)	$17.76	$16.27	$33,840	5.2 %

	Plastic					
51-4012	Numerical Tool and Process Control Programmers	70	$22.40	$22.26	$46,300	4.5 %
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	860	$28.03	$22.82	$47,460	16.1 %
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	230	$17.44	$16.69	$34,720	7.0 %
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	630	$12.04	$11.88	$24,720	3.5 %
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	190	$12.58	$13.15	$27,360	5.3 %
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	570	$14.62	$14.95	$31,100	2.9 %
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	320	$16.18	$16.85	$35,040	4.1 %
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	180	$14.90	$14.71	$30,600	3.6 %
51-4041	Machinists	970	$17.22	$16.85	$35,040	2.2 %
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	780	$9.97	$10.51	$21,870	4.5 %
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	780	$22.89	$19.85	$41,280	9.7 %

51-4111	Tool and Die Makers	460	$17.91	$17.97	$37,380	1.7 %
51-4121	Welders, Cutters, Solderers, and Brazers	540	$14.21	$13.93	$28,980	2.7 %
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	80	$18.86	$16.82	$34,990	10.9 %
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	110	$15.87	$15.70	$32,660	4.2 %
51-4193	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	160	$10.40	$11.51	$23,940	8.5 %
51-4194	Tool Grinders, Filers, and Sharpeners	180	$12.04	$12.24	$25,450	3.3 %
51-5011	Bindery Workers	100	$11.03	$11.95	$24,850	3.1 %
51-5021	Job Printers	100	$17.88	$17.74	$36,900	4.1 %
51-5022	Prepress Technicians and Workers	(4)	$16.96	$17.38	$36,140	3.7 %
51-5023	Printing Machine Operators	530	$13.12	$14.48	$30,110	4.2 %
51-6011	Laundry and Dry-Cleaning Workers	840	$6.68	$7.41	$15,410	4.2 %
51-6021	Pressers, Textile, Garment, and Related Materials	(4)	$8.68	$9.12	$18,970	4.0 %
51-6031	Sewing Machine Operators	110	$8.49	$9.16	$19,050	4.5 %
51-6051	Sewers, Hand	(4)	$11.45	$10.69	$22,240	5.5 %
51-6052	Tailors, Dressmakers, and Custom Sewers	(4)	$10.64	$11.31	$23,530	3.7 %
51-6061	Textile Bleaching and Dyeing Machine Operators and Tenders	50	$12.04	$11.74	$24,430	5.0 %
51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	90	$12.34	$12.23	$25,440	3.5 %
51-6064	Textile Winding, Twisting, and Drawing	110	$10.02	$10.09	$20,990	3.2 %

	Out Machine Setters, Operators, and Tenders					
51-6091	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers	130	$12.40	$12.46	$25,910	2.5 %
51-6092	Fabric and Apparel Patternmakers	40	$14.43	$15.62	$32,480	3.3 %
51-7011	Cabinetmakers and Bench Carpenters	180	$13.57	$14.27	$29,670	5.2 %
51-7021	Furniture Finishers	40	$13.25	$14.13	$29,390	8.3 %
51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	30	$10.78	$11.42	$23,760	4.9 %
51-7042	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	50	$9.36	$9.77	$20,320	8.7 %
51-8021	Stationary Engineers and Boiler Operators	(4)	$22.73	$21.19	$44,080	8.7 %
51-8031	Water and Liquid Waste Treatment Plant and System Operators	190	$19.41	$19.61	$40,790	2.2 %
51-9011	Chemical Equipment Operators and Tenders	(4)	$15.73	$15.71	$32,680	5.7 %
51-9021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	60	$14.97	$14.29	$29,720	5.0 %
51-9022	Grinding and Polishing Workers, Hand	50	$11.92	$12.55	$26,100	5.9 %
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	270	$12.32	$12.67	$26,350	5.0 %
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders	1,080	$13.62	$13.60	$28,290	2.4 %
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	890	$13.43	$13.76	$28,620	2.6 %
51-9083	Ophthalmic Laboratory Technicians	(4)	$10.44	$10.67	$22,180	4.4 %
51-9111	Packaging and Filling Machine Operators and Tenders	140	$10.77	$11.10	$23,100	9.6 %
51-	Coating, Painting, and	180	$10.97	$11.87	$24,690	6.1 %

9121	Spraying Machine Setters, Operators, and Tenders					
51-9131	Photographic Process Workers	30	$8.79	$9.51	$19,780	6.7 %
51-9132	Photographic Processing Machine Operators	(4)	$10.54	$11.03	$22,930	5.6 %
51-9191	Cementing and Gluing Machine Operators and Tenders	(4)	$11.20	$11.37	$23,640	2.8 %
51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	(4)	$13.62	$13.03	$27,110	6.0 %
51-9196	Paper Goods Machine Setters, Operators, and Tenders	180	$11.49	$11.84	$24,630	8.5 %
51-9198	Helpers--Production Workers	670	$9.45	$9.84	$20,460	2.8 %

Transportation and Material Moving Occupations

			Wage Estimates			
SOC Code Number	Occupation Title	Employment	Median Hourly	Mean Hourly	Mean Annual (1)	Mean RSE
53-0000	**Transportation and Material Moving Occupations**	14,960	$11.32	$12.41	$25,810	2.5 %
53-1021	First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand	270	$16.18	$17.51	$36,410	7.7 %
53-1031	First-Line Supervisors/Managers of Transportation and Material-Moving Machine and Vehicle Operators	160	$16.54	$18.35	$38,170	6.6 %
53-3021	Bus Drivers, Transit and Intercity	330	$11.80	$11.35	$23,610	7.4 %
53-3022	Bus Drivers, School	1,180	$10.82	$11.18	$23,250	4.3 %
53-3031	Driver/Sales Workers	(4)	$12.48	$12.22	$25,420	4.3 %
53-3032	Truck Drivers, Heavy and Tractor-Trailer	2,150	$16.50	$17.30	$35,980	2.2 %

53-3033	Truck Drivers, Light Or Delivery Services	2,150	$13.75	$13.60	$28,300	6.4 %
53-3041	Taxi Drivers and Chauffeurs	230	$7.10	$7.82	$16,260	6.3 %
53-6021	Parking Lot Attendants	80	$8.04	$8.76	$18,230	6.5 %
53-6031	Service Station Attendants	480	$7.65	$7.78	$16,180	2.3 %
53-7011	Conveyor Operators and Tenders	(4)	$9.58	$9.58	$19,930	7.3 %
53-7021	Crane and Tower Operators	110	$13.11	$13.22	$27,510	8.7 %
53-7032	Excavating and Loading Machine and Dragline Operators	240	$18.15	$17.54	$36,480	3.9 %
53-7051	Industrial Truck and Tractor Operators	810	$13.46	$16.88	$35,100	5.8 %
53-7061	Cleaners of Vehicles and Equipment	120	$8.50	$9.77	$20,320	12.5 %
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	4,000	$10.21	$10.86	$22,590	2.8 %
53-7063	Machine Feeders and Offbearers	300	$9.96	$10.41	$21,640	2.4 %
53-7064	Packers and Packagers, Hand	2,050	$8.02	$8.58	$17,850	2.4 %
53-7081	Refuse and Recyclable Material Collectors	30	$10.66	$12.02	$25,000	11.6 %

Appendix J:

Worcester Telegram & Gazette Microfiche Data

Worcester Telegram & Gazette			
9-Apr-00			
Title	**Company**	**Location**	**Category**
Administrative Assistant	Bohler Engineering PC		Non-technical
Administrative Assistant			Non-technical
Administrative Assistant			Non-technical
Assembler	Express Temps	Worcester	other
Assembly Inspection	UNILECT	Auburn	other
Machine Operators	Tyco Electronics	Waltham	other
Platers	Tyco Electronics	Waltham	other
Assembler	Tyco Electronics	Waltham	other
Maintenance Technician	Tyco Electronics	Waltham	other
Manufacturing Technician	Kelly Services		other
Technical Representative	Simplex	Worcester	other
Desktop Support			Software
LAN Manager			internet/new media
Manufacturing Supervisor	Alpha Wire Company	Leominster	other
Cable Operator	Alpha Wire Company	Leominster	hardware
MIS Technician	Spectro Coating Corporation	Leominster	internet/new media
Accounts Receivable Administrator	Arch	Westborough	Non-technical
Data/Voice Installation Technician			hardware
Electrical Helper		Worcester	hardware
EM Assembler	ConnecTotal Staffing		other
Electrical Technician	ThermoPlastics Engineering Corporation		hardware
Fiber Optics	Express Temps	Worcester	hardware
Fiber Optics	New Era Staffing	Sturbridge	hardware
Inspector	UNILECT Industries	Auburn	other
Inspector	Strategy		other
Instructor	PeopleForever Computer Training		other
Personal Computer Assembler & Technician		Marlborough Area	Hardware/Software
Solderer	Solectron	Westborough	hardware
SMT Inspector	Solectron	Westborough	other
SMT Operator	Solectron	Westborough	other
QA	Solectron	Westborough	other
Assembler	Solectron	Westborough	other
Chemical Lab Technician	Shipley	Marlborough	other
Quality Inspector	AC Technology Corporation	Uxbridge	other
Technician/Structural Cable			hardware
Computer Trainer	PC Plus Learning Centers	Auburn	Software
Database Developer	Accurate Staffing		Software
Electrical Engineer	Tesmer Area Associate		engineer
Electrical Engineer	Dynamic Staffing		engineer
Electrical Engineer	ConTact Tech		engineer
I & C Layout Engineer	ConTact Tech		engineer
In-Circuit Test Engineer	ConTact Tech		engineer
Technical Installation Specialist	XBR	Milford	other
Senior Software Developer	XBR	Milford	Software
System Support Specialist	XBR	Milford	Software
Software Configuration Specialist	XBR	Milford	Software
Training Manager	XBR	Milford	other
Embedded Software Engineer	Harris	Littleton	Software
Digital Audio DSP Engineer	Harris	Littleton	Software
Senior Hardware Engineer	Harris	Littleton	hardware
Engineering Project Manager	Harris	Littleton	engineer
Commercial & Gov't Sales Manager	Harris	Littleton	Non-technical
Photolithography/Etch Operator	Film Microelectronics Inc.	North Andover	other
Burn-In Technician	Film Microelectronics Inc.	North Andover	other
Web Master	Judd Wire Inc.	Turner Falls	internet/new media
Web Designer	Judd Wire Inc.	Turner Falls	internet/new media
Graphics/HTML Web Designer	Rotman Auctions	Worcester	internet/new media
Web Developer	Rotman Auctions	Worcester	internet/new media
Web Master	Rotman Auctions	Worcester	internet/new media
LAN Administrator	Rotman Auctions	Worcester	internet/new media
UNIX Administrator	Rotman Auctions	Worcester	Software
LAN Administrator/Manager	Rotman Auctions	Worcester	internet/new media
Global IT Director	Nortel Routers		Software
SAP Developer	Nortel Routers		Software
Senior Network Manager	Nortel Routers		software
NT Engineer	Nortel Routers		software
Senior LAN Engineer	Nortel Routers		internet/new media
Customer Service Representative		Leominster	Non-technical
Web Developer			internet/new media

14-May-00			
Software Engineers	Sonus Networks	Westford	Software
Firmware Engineers	Sonus Networks	Westford	Software
Sustaining Engineers	Sonus Networks	Westford	Engineer
System Engineers	Sonus Networks	Westford	Engineer
Software Project Engineers	Sonus Networks	Westford	Software
Software Managers	Sonus Networks	Westford	Software
Hardware Engineers	Sonus Networks	Westford	Hardware
Diagnostic Engineers	Sonus Networks	Westford	Engineer
Software Developer	Speedline Technologies	Franklin	Software
Software Sustaining Engineer	Speedline Technologies	Franklin	Software
Production Control/ Materials Manager	Lucent Technologies	Sturbridge	other
Controls/ Automation Engineer	Lucent Technologies	Sturbridge	Engineer
Network Administrator	Guardian Industries	Webster	Internet/New Media
Computer Analyst / Programmer		Marlborough	Software
Computer Technician	Search Committee	Leominster	other
Spectral Test Engineer	Barr Associates, Inc. (Optical Fiber Tech.)	Westford	Engineer
Process Engineer	Barr Associates, Inc. (Optical Fiber Tech.)	Westford	Engineer
Optical Thin Film Design	Barr Associates, Inc. (Optical Fiber Tech.)	Westford	other
LAN administrators	Lane Employment	Marlborough	Internet/New Media
UNIX administrators / Systems Engineer	Lane Employment	Marlborough	Engineer
Software Developers & Customer Support & Specialis	Lane Employment	Marlborough	Software
Software Engineers, Linguistics	Tesmer Allen Associates	Westboro	Software
SQA Manager - Internet Automated Regression	Tesmer Allen Associates	Westboro	other
Network Engineer	Tesmer Allen Associates	Westboro	Engineer
Unix Administration	Tesmer Allen Associates	Westboro	Software
Network Technician, hubs, routers	Tesmer Allen Associates	Westboro	Hardware
Internet Web Designer	pcplustechgroup.com	Auburn	Internet/New Media
Software Engineer	IAR Systems	Marlborough	Software
Software Enginner	Vitel Software	Worcester	Software
MIS Manager	Hudson RPM Distributors	Boylston	Internet/New Media
Network Engineer	Barry Communications		Engineer
Tech Support Engineer	Public Safety Software Company	Grafton	Engineer
Web Designer / Developer	PC - Plus Online, Inc.	Auburn	Internet/New Media
Web Developer / Jr.	Suburban Staffing		Internet/New Media
Solderers / Assemblers		Local Worcester area	Hardware
Assemblers		Worcester	Hardware
Tel / Data / Fiber/ Video / Lead Tech. / Project Mgr.	LANmark Communications	Auburn	other
Field Technicians	LANmark Communications	Auburn	other
OSP Technicians	LANmark Communications	Auburn	other
Telephony	LANmark Communications	Auburn	other
Electro-Mechancial Assembly	Agentry Staffing Services		Hardware
EM Assemblers	ConnecTotal Staffing	Framingham	Hardware
Fiber Optics	New Era Staffing, Inc.	Charleton, Sturbridge companies	other
IT Manager	Folio	Worcester	Internet/New Media
SW Engineering Managers	Sun MicroSystems	Burlington	Engineer
SW Development Managers	Sun MicroSystems	Burlington	other
SQA and System Integration Test	Sun MicroSystems	Burlington	other
Performance Characterization	Sun MicroSystems	Burlington	other
System Software Programming	Sun MicroSystems	Burlington	Software
Java Application Development & Integration	Sun MicroSystems	Burlington	Software
Applications Programmer / Analyst	DCU - Digital Federal Credit Union	Maynard	Software
Assemblers	Integrity Technical Services		Hardware
Assemby	Metz Personnel	Worcester, Marlborough, Hudson	Hardware
Personal Computer Assemblers & Technicians	NetCom	Marlborough	Hardware
Electronic Technicians	Agentry Professional Staffing	Worcester	Hardware
RF Electronic Technician	Agentry Professional Staffing	Worcester	Hardware
Electro-Mechancial Technician	Agentry Professional Staffing	Worcester	Hardware
Technicians / Unstructured Cabling	CEC Communication		Hardware
Technicians - Telecommunications	www.awesometv.com		Hardware
11-Jun-00			
Software Engineer	Arris	Andover	Software
Hardware Engineer	Arris	Andover	Hardware
Systems Engineer	Arris	Andover	Engineer
Marketing Development Specialist	Arris	Andover	Non-Technical
Product Line Engineer/Developer	Arris	Andover	Engineer
Technical Trainer	Arris	Andover	other
Systems Test Engineer	Arris	Andover	Engineer
Debug Technician	Arris	Andover	Software
Sr. Unix Administrator	Alpha	Woburn	Software
Reliability Engineer	Alpha	Woburn	Engineer
Process Engineer	Alpha	Woburn	Engineer

Manufacturing Cell Coordinator	Alpha	Woburn	other
Wafer Fab Semiconductor Shift Supervisor	Alpha	Woburn	Hardware
Repair/Maintenance MBE Technician	Alpha	Woburn	Hardware
Wafer Fab Equipment Technician	Alpha	Woburn	Hardware
Wafer Fab Operator	Alpha	Woburn	other
Test Operator	Alpha	Woburn	other
Accounting Clerk	Alpha	Woburn	Non-Technical
Material/Chemical Handler	Alpha	Woburn	other
Test Development Engineer	Maxim Integrated Products	Chelmsford	Engineer
Design Engineer	Maxim Integrated Products	Chelmsford	Engineer
Application Engineer	Maxim Integrated Products	Chelmsford	Engineer
Mask Designer	Maxim Integrated Products	Chelmsford	Software
Accounting Supervisor	PC Plus Technologies	Auburn	Non-Technical
Telecommunications Engineer	NEESCom	Westboro	Engineer
Lead Developer	Inforonics	Littleton	Software
Developer	Inforonics	Littleton	Software
Development Manager	Inforonics	Littleton	other
Database Architect	Inforonics	Littleton	Software
Project Manager	Inforonics	Littleton	other
Director of Marketing	Inforonics	Littleton	Non-Technical
CTO	Inforonics	Littleton	other
System Architect	Inforonics	Littleton	Hardware
Web Designer	Inforonics	Littleton	Internet/New Media
Manager	Future Electronic Corporation	Bolton	other
Operater (programmer)	Future Electronic Corporation	Bolton	Software
Hardware Engineer	Sun Microsystems	Burlington	Hardware
Software Engineer	Sun Microsystems	Burlington	Software
Technical Support Engineer	Sun Microsystems	Burlington	Non-Technical
System Architect	Sun Microsystems	Burlington	Hardware
System Analyst	Leominster Credit Union	Leominster	other
Data Warehouse Programmer	Fallon Clinic	Worcester	Software
Data Warehouse Lead	Fallon Clinic	Worcester	Software
Controls Engineer	Tesmer Allen Associates	Westboro	Engineer
Controller	Total Peripherials	Northboro	other
Administrative Assistant		Worcester	Non-Technical
Analyst/Accountant			Non-Technical
Automation Designer	Tesmer Allen Associates	Westboro	other
Buyer/Planner	AC Technology Corporation	Uxbridge	Non-Technical
Computer Trainer/Consultant	PC Plus Learning Center	Auburn	other
Computer Operator	Tesmer Allen Associates		other
Applications Programmer Analyst	McKesson HBOC		Software
Computer-Internet Web Page Designer	PC Plus Technologies	Auburn	Internet/New Media
Customer Service Associate	Dynamic Detail Inc.		Non-Technical
Database Developer	Accurate Staffing		Software
Database Developer			Software
Assistant Controller	Concord Communications, Inc.	Marlboro	other
Manager of Compensation and Benefits	Concord Communications, Inc.	Marlboro	Non-Technical
Employment Specialist	Concord Communications, Inc.	Marlboro	Non-Technical
Course/Developer Instructor	Concord Communications, Inc.	Marlboro	Non-Technical
Sr. Customer Support Engineer	Concord Communications, Inc.	Marlboro	Non-Technical
Customer Support Engineer	Concord Communications, Inc.	Marlboro	Non-Technical
Inside Sales Maintenance	Concord Communications, Inc.	Marlboro	Non-Technical
Sr. Professional Services Engineer	Concord Communications, Inc.	Marlboro	Engineer
Sr. Professional Services Engineer, Telco & Service F	Concord Communications, Inc.	Marlboro	Engineer
Software Development Manager	Concord Communications, Inc.	Marlboro	Software
Engineering Product Manager	Concord Communications, Inc.	Marlboro	Software
Principal Software Engineer	Concord Communications, Inc.	Marlboro	Software
Sr./Principal Software Engineer, Integration	Concord Communications, Inc.	Marlboro	Software
Sr./Principal Software Engineer, Database Developm	Concord Communications, Inc.	Marlboro	Software
Sr./Principal Software Engineer, Tactical Engineering	Concord Communications, Inc.	Marlboro	Software
Sr. SQA Engineer	Concord Communications, Inc.	Marlboro	Engineer
Lead Software Tools Engineer	Concord Communications, Inc.	Marlboro	Engineer
Performance Engineer	Concord Communications, Inc.	Marlboro	Engineer
Device Certification Engineer	Concord Communications, Inc.	Marlboro	Engineer
Software Installation Engineer	Concord Communications, Inc.	Marlboro	Software
Usability/UI Designer	Concord Communications, Inc.	Marlboro	Software
Applications Project Manager/Project Leader	Concord Communications, Inc.	Marlboro	Software
Database/Technical Analyst	Concord Communications, Inc.	Marlboro	Software
Marketing Specialist	Concord Communications, Inc.	Marlboro	Non-Technical
Graphics Designer	Concord Communications, Inc.	Marlboro	other
Public Relations Director	Concord Communications, Inc.	Marlboro	Non-Technical
Rules Writer	Concord Communications, Inc.	Marlboro	Non-Technical
Business Development Representatives	Concord Communications, Inc.	Marlboro	Non-Technical
Transportation Manager	Future Electronic Corporation	Bolton	Non-Technical
Materials Manager	EMX Controls Inc.	Uxbridge	other
Electrical Engineer	Strategy		Engineer
Solutions Architects & Designer	Articulent Inc.	Hopkinton	other

Database Architects	Articulent Inc.	Hopkinton	Software
Business Development/Partner	Articulent Inc.	Hopkinton	Non-Technical
Relationship Manager	Articulent Inc.	Hopkinton	Non-Technical
Marketing	Articulent Inc.	Hopkinton	Non-Technical
Unix Engineer	Articulent Inc.	Hopkinton	Software
Quality Engineer	Tesmer Allen Associates	Westboro	Engineer
Receiving	AC Technology Corporation	Uxbridge	Non-Technical
Oracle Database Administrator	Accurate Staffing		Software
Accounting Analyst	Future Electronic Corporation	Bolton	Non-Technical
Project Engineer	Communications Test Design Inc.	Westboro	Engineer
Telecommuncations Equipment installer	Communications Test Design Inc.	Westboro	Hardware
Quality Assurance Specialist	Communications Test Design Inc.	Westboro	other
Web Coordinator	Mt. Wachusett Country Club	Gardner	Internet/New Media
PC/Network Support Specialist	Presmet Corporation	Worcester	Internet/New Media
Production Planner	Atlantic Microwave Corp.	Bolton	other
Antenna-Test Technician	Atlantic Microwave Corp.	Bolton	other
Test Technician	Atlantic Microwave Corp.	Bolton	other
Sales Engineer	Atlantic Microwave Corp.	Bolton	Non-Technical
Sales Administrator	Atlantic Microwave Corp.	Bolton	Non-Technical
Leasing Coordinator	Arch Communcations	Westboro	Non-Technical
Licensing Coordinator	Arch Communcations	Westboro	Non-Technical
Accounts Recievable Administrator	Arch Communcations	Westboro	Non-Technical
Communications Technician	RGS Communcations	Leominster	other
Communications Cabling Installer	LANmark Communications	Auburn	Hardware
Computer Network Technician		West Boylston	Internet/New Media
Electrical Properties Technician	American Superconductor	Westboro	other
Cyrogenics/Electromagnetics Technician	American Superconductor	Westboro	other
Deformation Technician	American Superconductor	Westboro	other
Assembler/Machine Operator	Schott Fiber Optic	Southbridge	Engineer
Fusing Operator	Schott Fiber Optic	Southbridge	other
Inside Sales	Hardware Specialty	Marlboro	Non-Technical
Installer	Mustang Microsystems	Hudson	other
Electro-Mechanical Assembler	Integrity Technical Services		Hardware
Electronics Test Technician	WeStaff	Leominster	other
Electro-Mechanical Assembler	SelecTemps		Hardware
Testers	SelecTemps		other
Solderers	SelecTemps		Hardware
Electro-Mechanical Assembler	E.D.A. Inc.	Foxboro	Hardware
Quality Control Inspector	E.D.A. Inc.	Foxboro	other
Test Technician	E.D.A. Inc.	Foxboro	other
Design Engineer	E.D.A. Inc.	Foxboro	Engineer
Software Engineer	E.D.A. Inc.	Foxboro	Software
Software Quality Engineer	E.D.A. Inc.	Foxboro	Software
Production Operator	Allegro Microsystems	Worcester	other
Equipment Technician	Allegro Microsystems	Worcester	Hardware
Electro-Mechanical Assembler	ConnecTotal		Hardware
Quality Control Inspector	New Era Staffing	Worcester	other
Wafer Fab Operator	Analog Devices	Cambridge	other
Equipment Maintence Technician	Analog Devices	Cambridge	Hardware
Quality Control/Construction Technician	Charter Communications	Perrerell	other
Receptionist	XBR Co	Milford	Non-Technical
Telecommunications Technician	Hogan Communications	Easthampton	other
Cable Installation Technician	Hogan Communications	Easthampton	Hardware
9-Jul-00			
Facility Maintenance Supervisor	Lucent Technologies	Sturbridge	other
Materials Control Project Engineer	Lucent Technologies	Sturbridge	Engineer
Senior Quality Assurance Engineer	Lucent Technologies	Sturbridge	Engineer
Desktop & System Hardware Technician	Lucent Technologies	Sturbridge	Hardware
Programmer Analyst/Systems Support			Software
Field Technicians	Vitts Network Inc.	Central Mass.	other
Quality Assurance Engineer	MacNeill Engineering Worldwide	Marlborough	Engineer
Computer Operators	Tesmer Allen Associates	Westboro	other
Lead Network Engineer	Tesmer Allen Associates	Westboro	Internet/New Media
Senior Network Engineer	Tesmer Allen Associates	Westboro	Internet/New Media
Oracle-Database Analyst	Tesmer Allen Associates	Westboro	Software
Senior P/A's IBMMF, COBOL	Tesmer Allen Associates	Westboro	Software
AS400 Administrator	Tesmer Allen Associates	Westboro	other
Network Manager	Tesmer Allen Associates	Westboro	Internet/New Media
Mechanical Engineers	Tesmer Allen Associates	Westboro	Engineer
Manufacturing Engineers	Tesmer Allen Associates	Westboro	Engineer
Business Analyst	Corning	Marlboro/Natick	Non-Technical
Fiber Optic Technician	Corning	Marlboro	Hardware
Kitting Technician	Corning	Marlboro	other
Coating Technicians - Fiber Optics	Corning	Marlboro/Natick	other

Shipper/Receiver Clerk	Corning	Marlboro/Natick	Non-Technical
Maintenence Technician	Corning	Marlboro/Natick	other
Packaging Assembly	Corning	Woburn	Non-Technical
Optical Sub-Assembly	Corning	Woburn	Hardware
Optical Testing Technician	Corning	Woburn	other
ISO 9001 Lead Auditor	Barr Associates	Westford	other
Jr. Product Design Engineer	Barr Associates	Westford	Engineer
Jr. Process Engineer	Barr Associates	Westford	Engineer
System Administrator	Samuel Bent LLC	Gardner	other
Software Engineer	MyEZsale.com	Framingham	Software
Network Administrator	MyEZsale.com	Framingham	Internet/New Media
Technical Support Specialists	Wire Ready	Northborough	Non-Technical
Telecommunications Technician	Accurate-Staffing		other
Accountant	Specialized Software Inc.	Worcester	Non-Technical
Assembler/Mechanic		Route 20	Hardware
Assemblers	NBSS	Westboro	Hardware
Assembly	Snelling Personnel Services		Hardware
Communications Cable Installers	LANmark Communications	Auburn	Hardware
Lead Technicians	Precise Technology	Grafton	other
Inspectors/Packers	Precise Technology	Grafton	Non-Technical
Shipper/Receiver/Maintenance Helper	Precise Technology	Grafton	Non-Technical
Material Handler	Precise Technology	Grafton	other
Quality Inspection Auditors	Precise Technology	Grafton	other
Electrical Helper/Cablers		Worcester	Hardware
Electrical Assemblers	The Agentry	Worcester	Hardware
Development Technician	America Superconductor	Westboro	other
Manufacturing Engineers	MedSource Technologies	Brimfield	Engineer
Mechanical Assembly Technician	Dover Instrument Corportion	Westboro	other
Product/Technical Support	TeleResources		Non-Technical
Software Support Technician		Marlboro	Software
Technicial Support Techician	Dynamic Staffing		Non-Technical
Web Developer	ConnecTotal Staffing		Internet/New Media
13-Aug-00			
Technician	Shipley Company	Marlborough	other
Quality Engineer	Corning NetOptix	Marlborough	Engineer
Maintenance Technician	Corning NetOptix	Marlborough	other
Optics	Corning NetOptix	Marlborough	other
Electrical Controls Software Engineer	Convergent Prima	Sturbridge	Software
Information Systems Manager	Convergent Prima	Sturbridge	Internet/New Media
Computer/Network Proffesional	PC Plus Technologies Inc.		other
Electronics Technician	AC Technology Corporation	Uxbridge	other
Electronics Technician			other
VP Engineer, Software Development	Tesmer Allen Associates		Software
Sr. Patrol Administrator	Tesmer Allen Associates		other
Sr. Project Manager	Tesmer Allen Associates		other
Sr. Network Engineer	Tesmer Allen Associates		Engineer
Java Developer	Tesmer Allen Associates		Software
Tech Support	Tesmer Allen Associates		Non-Technical
Internet Developer	Accurate Staffing		Internet/New Media
Internet Developer	Accurate Staffing		Internet/New Media
Internet Developer	Accurate Staffing		Internet/New Media
Service Technician	Accurate Staffing		other
MIS Director	Harrington Memorial Hopital	Soutbridge	Internet/New Media
Electronic Engineer	Shanklin Corporation	Ayer	Engineer
Network Administrator	Accurate Staffing		Internet/New Media
Network Administrator	Accurate Staffing		Internet/New Media
Network Administrator	Accurate Staffing		Internet/New Media
PC Technician			other
MCSE	Lane Employment	Marlborough	Software
MCSE	Lane Employment	Marlborough	Software
Network Engineer	Lane Employment	Marlborough	Internet/New Media
Network Engineer	Lane Employment	Marlborough	Internet/New Media
Office Administrator	Artis Corporation	Worcester	Non-Technical
PC Circuit Board Technician	New Era Staffing		Hardware
Senior Programmer	Paragen Systems	Westborough	Software
Telecommunications Mangager	Holy Cross	Worcester	other
Telecommunications Technician	Accurate Staffing		other
Web Designer/Developer	PC Plus Online Inc.	Auburn	Internet/New Media
Electro-Mechanical Assembler	SelecTemps		Hardware
Assembler	Integrity Technical Services		Hardware
Assembler	AC Technology Corporation	Uxbridge	Hardware
Assembler	Speedline Technologies	Franklin	Hardware
Computer Technician			other
Customer Service	AC Technology Corporation	Uxbridge	Non-Technical

Electrical Assembler		Worcester	Hardware
Solder/SMT Operator	Amerisian Inc.	Worcester	Hardware
Electro-Mechanical Assembler	ConnecTotal		Hardware
Draw Tower Operator	Schott Fiber Optic	Soutbridge	other
Assembler	Schott Fiber Optic	Soutbridge	Hardware
Surfacing Operator	Schott Fiber Optic	Soutbridge	other
SMT Machine Operator	Kelly Services		Hardware
Rework Technician	Kelly Services		other
Debug Technician	Kelly Services		Software
IC Tester	Kelly Services		other
QA Inspector	Kelly Services		other
Material Handler	Kelly Services		other
Functional Test Operator	Kelly Services		other
Wave Operator	Kelly Services		other
Voice/Data Technician	Black Box Network Services		Hardware
Senior Technician	Pinkerton System Integration		other
Voice/Data Installer			Hardware
10-Sep-00			
Senior Buyer/Planner	MediSense	Bedford	Non-Technical
Master Scheduler	MediSense	Bedford	Non-Technical
Validation Engineer	MediSense	Bedford	Engineer
Manufacturing Engineers	MediSense	Bedford	Engineer
Test SW Engineers	MediSense	Bedford	Software
Senior Hardware Engineer	MediSense	Bedford	Hardware
Engineer Technician	MediSense	Bedford	Engineer
Controls Engineer	Lucent Technologies	Sturbridge	Engineer
Process Engineer	Lucent Technologies	Sturbridge	Engineer
Development Engineers	Lucent Technologies	Sturbridge	Engineer
Production Planner	Lucent Technologies	Sturbridge	other
National Accounts Manager	Lucent Technologies	Sturbridge	Non-Technical
Engineering Administrator	Bese Corporation	Waltham	other
Mechanical Designer	Bese Corporation	Waltham	other
Electrical Designer	Bese Corporation	Waltham	other
Cobol Programmer Entry Level	Allmerica Financial	Worcester	Software
SQL Programmer/Analyst	Madison Cable Corportion	Worester	Software
Manager, LAN Technical Support	Vitel Network Services	Marlborough	Non-Technical
Technical Specialist	Vitel Network Services	Marlborough	other
Product Development Engineer	TRW Fastening Systems	Westminster	Engineer
Unix System Administrator	UMass Amherst	Amherst	Software
Web Designer	Creative Group	Westboro	Internet/New Media
Graphic Designers	Creative Group	Westboro	other
Network/ Information Systems Coordinator	Town of Northborough	Northborough	Internet/New Media
Network Communications Analyst	McKessonHOC		Internet/New Media
IT Manager/Systems Administrator	Folio	Worcester	Internet/New Media
Graphic Artist	Main Street Journal	Marlboro	other
Electronic Technician	AC Technical Corporation	Uxbridge	other
Fiber Optics Engineer	Propos Associates		Engineer
Quality Engineers	Propos Associates		Engineer
Senior System Specialists	Tesmer Allen Associates	Westboro	other
System Administrator	Tesmer Allen Associates	Westboro	Internet/New Media
Manager of Desktops	Tesmer Allen Associates	Westboro	Non-Technical
Mechanical Engineers	Tesmer Allen Associates	Westboro	Engineer
Manufacturing Engineers	Tesmer Allen Associates	Westboro	Engineer
Software Engineers	Tesmer Allen Associates	Westboro	Software
Senior Network Engineer	Tesmer Allen Associates	Westboro	Internet/New Media
Software Support Specialists	Lane Employment	Marlborough	Software
Network Design Engineer	Lane Employment	Marlborough	Internet/New Media
Network Firewall Engineer	Lane Employment	Marlborough	Internet/New Media
Internet Developers	Accurate-Staffing		Internet/New Media
Network Administrator/Engineer	SMOC Residential Services	Hudson	Internet/New Media
IT Curriculum & Support Specialist	Montachusett Regional Voc. Tech. School	Fitchburg	Internet/New Media
Software Developer	Artis Corporation	Worcester	Software
Web Design Lead	Accurate-Staffing		Internet/New Media
SQL/DBA Programmer	Accurate-Staffing		Software
Web Specialist	New Era Staffing, Inc.		Internet/New Media
Field Service Technician	Savin Corporation	Wellesley	other
Assemblers	Snelling Personnel Services	Marlboro/Westboro	Hardware
Electro-Mechanical Assembler	Integrity Technical Services		Hardware
Assembly	Metz Personnel	Hudson	Hardware
Assembly/Gen. Lab	Dynamic Staffing		Hardware
Cable Assemblers	SelecTemps	Leominster	Hardware
Entry-Level Production Operators	Allegro Microsystems	Worcester	other
Experienced Equipment Technician	Allegro Microsystems	Worcester	Hardware
Technical Assistant	Worcester State College	Worcester	other

Electrical Helper/Cablers		Worcester	Hardware
Electrical Assemblers	The Agentry	Worcester/Westboro	Hardware
Electro/Mechancial Technician	The Agentry	Worcester	Hardware
Electro/Mechancial Assemblers	SelecTemps		Hardware
EM Assemblers	ConnecTotal Staffing		Hardware
Coating Technicians - Fiber Optics	Integrity Technical Services		other
Electronic Technican	Integrity Technical Services		other
Test Technician	Integrity Technical Services		other
Fiber Optic Technician	Integrity Technical Services	Marlborough	other
Installers	Lucent Technologies	Sturbridge	other
Production Operators	Lucent Technologies	Sturbridge	other
Graphics Designer	AD Com Inc.		other
Graphics Designer	Casey Design	Worcester	other
Mechanical Assemblers	Fabco Manufacturing Co.	Hudson	Hardware
Cable/Harness Assembly	Columbia Technologies	Worcester	Hardware
Electro/Mechanical Assembly	Columbia Technologies	Worcester	Hardware
Engineering Administrator	Columbia Technologies	Worcester	other
Project Management	Columbia Technologies	Worcester	Non-Technical
Purchasing	Columbia Technologies	Worcester	Non-Technical
Inventory/Cost Analyst	Columbia Technologies	Worcester	Non-Technical
Billing/Collecting Clerk	Columbia Technologies	Worcester	Non-Technical
Accounts Payable Clerk	Columbia Technologies	Worcester	Non-Technical
Administrative Assistant	Columbia Technologies	Worcester	Non-Technical
Exp. Extruder Operators/Cablers	BSCC	Leominster	other
Mechanical Assemblers	Shaklin	Aye	Hardware
Solderers / Assemblers	Pomerantz Staffing		Hardware
Web Master			Internet/New Media
Assembler	Schott Fiber Optic	Soutbridge	Hardware
Sales Profesional	PC Plus Technologies	Auburn	Non-Technical
8-Oct-00			
Application Engineer	Intel	Marlboro	Engineer
UNIX System Engineer	Intel	Marlboro	Software
VMS System Engineer	Intel	Marlboro	Engineer
Web Developer	Telecom Now!	Marlboro	Internet/New Media
Sr. Network Security Engineer	Pegasus Satellite Television	-	Internet/New Media
NT Network Administrator	Pegasus Satellite Television	-	Internet/New Media
Software Developer	Vitel Software	Worcester	Software
DBA/Programmer	Accurate Staffing	-	Software
Sales Administrator	Innoveda	Marlboro	Non-Technical
Systems Administrator	Harrington Memorial Hospital	Southbridge	other
R & D Manager	Schott Fiber Optics	Southbridge	other
Process Development Engineer	Schott Fiber Optics	Southbridge	Engineer
Optical Scientist	Schott Fiber Optics	Southbridge	other
Manufacturing Engineer	Schott Fiber Optics	Southbridge	Engineer
Application Development Manager	Mass. Dept. of Mental Health	Worcester	Software
UNIX Systems Administrator	Lane Employment Services	Marlboro	Software
Software Support	Lane Employment Services	Marlboro	Non-Technical
Network Engineer	Lane Employment Services	Marlboro	Internet/New Media
Sr. WAN Engineer - Nortell	Tesmer Allen Associates	-	Internet/New Media
UNIX Administrator	Tesmer Allen Associates	-	Software
Sr. WAN Engineer - Cisco	Tesmer Allen Associates	-	Internet/New Media
System Administrator	Tesmer Allen Associates	-	other
Programmer	Tesmer Allen Associates	-	Software
IT or MIS Specialist	-	Auburn	Internet/New Media
Manager of Web Development	Suburban Staffing	Worcester	Internet/New Media
Network Admin./Engineer	Accurate Staffing	-	Internet/New Media
Sr. UNIX System Administrator	-	Marlboro	Software
Software Engineer	Tesmer Allen Associates	-	Software
Software Developer	Vitel Software	Worcester	Software
Web Developer	Suburban Staffing	Worcester	Internet/New Media
Systems Engineer	Lane Employment Services	Marlboro	Engineer
12-Nov-00			
Programmer / Production Analyst	Umass Medical School	Worcester	Software
Web Development Manager	Umass Medical School	Worcester	Internet/New Media
Solderers / Assemblers	Excel Staffing Inc.		Hardware
Software Engineers	Excel Staffing Inc.		Software
Mechanical Engineers	Excel Staffing Inc.		Engineer
Engineer - Mechanical Design	United Professional Placement		Engineer
Web Developers	Tesmer Allen Associates	Westboro	Internet/New Media
WAN Engineers	Tesmer Allen Associates	Westboro	Internet/New Media
Network Administrator	Tesmer Allen Associates	Westboro	Internet/New Media
MIS Administrator	Twin Cities CDC	Fitchburg	Internet/New Media

Software Developers	Vitel Software	Worcester	Software
SQL Programmer/Analyst	Accurate-Staffing		Software
C / C++ Developer	PFPC	WEstboro	Software
Fiber Optic Technician	Consolidated Electrical Services	Norwood	other
Electrical Assemblers	The Agentry	Worcester/Westboro	Hardware
PC Assemblers			Hardware
Solderers / Assemblers	Pomerantz Staffing	Worcester	Hardware
10-Dec-00			
Admin. Assitant	Metz Personnel	Westborough	Non-Technical
Electo-Mechanical Assembler			Hardware
Electo-Mechanical Assembler	Dynamic Staffing	Worcester	Hardware
Rework/Touch up Solderers	Solectron		Hardware
Final Inspectors	Solectron		other
Incoming Inspectors	Solectron		other
SMT Machine Operator	Solectron		Hardware
Assembler	Solectron		Hardware
Material Handler	Solectron		other
Test Technician	Solectron		other
Electronic Assembler	Valpay Fisher	Hopkinton	Hardware
Electo-Mechanical Assembler	Adaptive Instruments Corp.	Hudson	Hardware
Electronic Technician	New Era Staffing Inc		other
Electronic Assembler	ConnecTotal		Hardware
Electo-Mechanical Assembler	Integrity Technical Services		Hardware
Electrical Assembler		Worcester	Hardware
Panel Builder	ConnecTotal		Hardware
SMT Assembler	Integrity Technical Services		Hardware
SMT Assembler	Strategy		Hardware
Quatlity Control	ConnecTotal		other
Technician	R & D Services		other
Web Developer	Strategy		Internet/New Media
Network Administrator	That Corporation		Internet/New Media
Software Qualificatino & Regression Test Engineer	EMC	Milford	Software
Web/Server Technician	New Era Staffing Inc		Internet/New Media
Internet Designer	Accurate Staffing		Internet/New Media
Internet Developer	Accurate Staffing		Internet/New Media
Sr. Network Specialist	Tesmer Allen Associates		Internet/New Media
Sr. P/A	Tesmer Allen Associates		other
Sr. P/A	Tesmer Allen Associates		other
P/A	Tesmer Allen Associates		other
P/A	Tesmer Allen Associates		other
Database Administrator	Tesmer Allen Associates		Software
Network Engineer	Barry Communication	Worcester	Internet/New Media
Network Engineer	Accurate Staffing		Internet/New Media
Software Trainer	Wire Ready NSI	Northborough	Software
Software Engineer	Tesmer Allen Associates		Software
14-Jan-01			
Senior DBA	PFPC	Westboro	Software
Junior COBOL Programmer	PFPC	Westboro	Software
Senior Software Engineer	PFPC	Westboro	Software
LAN Engineer	PFPC	Westboro	Internet/New Media
Network Consultant	PFPC	Westboro	Internet/New Media
Systems Analyst	PFPC	Westboro	other
Principal Software Engineer	PFPC	Westboro	Software
Lead Analyst	PFPC	Westboro	other
Software Support Engineer	PFPC	Westboro	Software
Network Consultant - Novel/NT	PFPC	Westboro	Internet/New Media
Senior UNIX Systmes Administrator	PFPC	Westboro	Software
Software Engineer	Artel	Marlboro	Software
Hardware Engineer	Artel	Marlboro	Hardware
Program Manager	Artel	Marlboro	other
Regional Sales Manager	Artel	Marlboro	Non-Technical
Receptionist	Artel	Marlboro	Non-Technical
PC/LAN Specialist	FirstMass	Fitchburg/Worcester	Internet/New Media
Data Warehouse Programmer	Fallon Community Health Plan	Worcester	Software
Data Warehouse Analyst	Fallon Community Health Plan	Worcester	Software
System Engineer	Kopin	Taunton	other
Manager - Information Systems	-	Worcester	Internet/New Media
Director of IS	City of Marlboro	Marlboro	Internet/New Media
Computer Technician	-	Worcester	other
Network Technician	Charter Communications	Worcester	Internet/New Media
Executive Secretary	Corning	Marlboro	Non-Technical

Development Engineer	APW-Wright Line	Worcester	Engineer
Application Engineer	APW-Wright Line	Worcester	Engineer
Director of Technical Operations	Omnirel	Leominster	other
Application Engineer	Baumann	-	Engineer
11-Feb-01			
Senior Analyst/Programmer	UMASS	Hadley	Software
Senior Applications Analyst	UMASS	Amherst	Software
Network Manager	Nichols College	Dudley	Internet/New Media
Software Developer	BindView	Southboro	Software
SQA Engineers	BindView	Southboro	Engineer
Receptionist/Administrative Assistant	BindView	Southboro	Non-Technical
Senior Business System Analyst	Tesmer Allen Associates	Westboro	Non-Technical
Oracle DBA	Tesmer Allen Associates	Westboro	Software
SQL DBA	Tesmer Allen Associates	Westboro	Software
Java Programmer	Tesmer Allen Associates	Westboro	Software
System Administrator/Tech Support	Tesmer Allen Associates	Westboro	other
LAN/WAN Designer	Tesmer Allen Associates	Westboro	Internet/New Media
Sales	eSourceMortgage.com	Worcester	Non-Technical
Processing	eSourceMortgage.com	Worcester	Non-Technical
Administrative	eSourceMortgage.com	Worcester	Non-Technical
Information Technology	eSourceMortgage.com	Worcester	Internet/New Media
IT Sales Professionals	IBM	Waltham	Non-Technical
Technicians	IBM	Waltham	other
Test Software Engineer	IBM	Waltham	Software
ASIC Design Engineer	IBM	Waltham	Engineer
Technical/Operations Support	BayState Savings Bank	Worcester	other
Technology Intergration Specialist	Northboro Public Schools	Northboro	other
PC Technician	Accurate Staffing	-	other
Collection Specialist	Protocol	Leominster	other
Technical Aide	Southboro Public Schools	Southboro	other
Technical Education Teacher	Algonquin Regional HS	Algonquin	other
11-Mar-01			
Process Engineer	IBM	Marlboro	Engineer
Equipment Engineer	IBM	Marlboro	Engineer
Equipment Technician	IBM	Marlboro	other
Field Technician	IBM	Marlboro	other
Process Technician	IBM	Marlboro	other
Product Development Engineer	Optimum Technologies Inc	-	Engineer
Client Server System Adm.	E. Conn. State University	Willimantic, CT	Internet/New Media
Technology Assistant	Wachusett Regional School District	Jefferson	other
Senior Programmer/Analyst	J.A. Webster	Sterling	Software
Software Developer	Lane Employment Services	Marlboro	Software
Project Leader	Lane Employment Services	Marlboro	other
Programmer Analyst	Lane Employment Services	Marlboro	Software
Network Configuration Manager	Lane Employment Services	Marlboro	Internet/New Media
Network Engineer	Lane Employment Services	Marlboro	Internet/New Media
Application Analyst	Accurate Staffing	-	Software
Data Analyst	Accurate Staffing	-	other
Oracle DBA	Accurate Staffing	-	Software
Oracle Analyst	Accurate Staffing	-	Software
Data Warehouse Programmer	Accurate Staffing	-	Software
Security Engineer	Tesmer Allen Associates	-	Engineer
Network Administrator	Tesmer Allen Associates	-	Internet/New Media
UNIX Administrator	Tesmer Allen Associates	-	Software
Oracle DBA	Tesmer Allen Associates	-	Software
Application Web Architect	Tesmer Allen Associates	-	Internet/New Media
Network Administrator	Tesmer Allen Associates	-	Internet/New Media
Systems Analyst	World Energy Exchange	Worcester	other
Administrative Assistant	CELT Corporation	Marlboro	Non-Technical
Systems/Database Admin.	Accurate Staffing	-	other
Internet Custormer Service	Manpower	Framingham	Non-Technical
8-Apr-01			
Information Systems Director	Town of Amherst	Amherst	Internet/New Media
Computer Programmer / Analyst	WalTech	Marlborough	Software
Field Service Technician	ConnecTotal Staffing		other
Field Technicians	Accurate-Staffing	MetroWest / Boston	other
Unix NT	Lane Employment	Marlborough	Software
Software Developers	Lane Employment	Marlborough	Software

Telecommunications Technician	Lane Employment	Marlborough	other
PeopleSoft Developers	Lane Employment	Marlborough	Software
Senior Java Developer	Tesmer Allen Associates	Westboro	Software
Senior Software Developer	Tesmer Allen Associates	Westboro	Software
Unix System Administrator	Tesmer Allen Associates	Westboro	Software
Network Engineer	Tesmer Allen Associates	Westboro	Internet/New Media
Mechanical Engineers	Tesmer Allen Associates	Westboro	Engineer
PC Technician	Accurate-Staffing		other
Software Developers	Accurate-Staffing		Software
Software/Database Specialist	Accurate-Staffing		Software
SQL Programmer/Analyst	Accurate-Staffing		Software
Assembler / Soldering	Diversified Staffing Group		Hardware
Draw Tower Operations & Fusing Operators	Schott Fiber Optics	Southbridge	Hardware
Inspectors/Packers	Schott Fiber Optics	Southbridge	other
Assemblers	Schott Fiber Optics	Southbridge	Hardware
Technician / Structured Cabling	Commercial Communications Inc.	Worcester	other
13-May-01			
Programmer/Analyst	Quinsigamond Community College	Worcester	Software
Database Specialist	Accurate Staffing		Software
Electronic Technician	ConnecTotal		other
Programmer/Analyst		Worcester	Software
Programmer	Hansco Info Tech	Ludlow	Software
Sr. Database Administrator	Tesmer Allen Associates		Software
Progress Database Adminsitrator			Software
Java Developer			Software
P/A			other
Oracle Developer			Software
MIS	Hudson RPM Distributors	Boylston	Internet/New Media
Software Engineer	Accurate Staffing		Software
Sr. Accountant		Charlton	Non-Technical
Admin. Assistant	Bohler Engineering PC	Southborough	Non-Technical
Sales Coordinator	Surf Control	Westborough	Non-Technical
Customer Service Rep.	TeleSpectrum	Littleton	Non-Technical
Customer Service Rep.	AC Technology	Uxbridge	Non-Technical
Electro-Mechanical Assembler	Accurate Staffing	Hudson	Hardware
Tech. Sales Profesional	PC Plus Technologies	Auburn	Non-Technical
Sales Rep.	Choice One Communications	Worcester	Non-Technical
10-Jun-01			
Buyer	Film MicroElectronics Inc.	Cambridge	Non-Technical
Facility/Maintence Technician	Film MicroElectronics Inc.	Cambridge	other
Surface Mount Assembler	Film MicroElectronics Inc.	Cambridge	Hardware
Cisco Engineer	Accurate Staffing		Software
Electronics Technician	Accurate Staffing		other
Sr Web Developer	Tesmer Allen Associates		Internet/New Media
PeopleSoft, Technical Leader	Tesmer Allen Associates		Software
Security Manager	Tesmer Allen Associates		other
QA Engineer	Tesmer Allen Associates		Engineer
Java Developer	Tesmer Allen Associates		Software
Oracle Developer	Tesmer Allen Associates		Software
Web Manager	Clark University	Worcester	Internet/New Media
System Adminstrator	Accurate Staffing		Software
System Adminstrator Assistant	Accurate Staffing		Software
Programmer/Analyst	Health Plans, Inc.	Worcester	Software
PeopleSoft, Technical Leader	Accurate Staffing		Software
Web Designer			Internet/New Media
Accounts Recievable Specialist	Flomerics	Southborough	Non-Technical
Accounts Recievable Specialist	The Greysmith Companies		Non-Technical
Fiber Optic	WeSTAFF	Worcester	other
Communication Wiring Technician			Hardware
Electro-Mechanical Assembler	ConnecTotal		Hardware
Electronic Technician	ConnecTotal		other
Voice/Data Cabler			Hardware
Sales Proffesional			Non-Technical
Sr. Account Representative	Lightship Telecom	Worcester	Non-Technical
Telecom Sales Rep.	Choice One Communications Inc.	Worcester	Non-Technical
8-Jul-01			
Network Technician	Worcester Public Schools	Worcester	Internet/New Media
MIS Operations Manager	Worcester T & G	Worcester	Internet/New Media
Graphics Production Systems Analyst	Worcester T & G	Worcester	other

Sr. Developer	Tesmer Allen Associates		Software
Network Specialist			Internet/New Media
Project Manager			other
SQA			other
Oracle DBA			Software
Systems Programmer			Software
Electronic Technician	ConnecTotal	Southbridge	other
Draw Tower Operator	Schott Fiber Optic	Southbridge	other
Assembler	Schott Fiber Optic	Southbridge	Hardware
Sales Professional	PC Plus Technologies	Auburn	Non-Technical
12-Aug-01			
Sybase, SQL, & Oracle DBA	Accurate-Staffing	Springfield	Software
Java Programmer	Accurate-Staffing		Software
PeopleSoft Application Administrator	Accurate-Staffing		Software
Programmer	Accurate-Staffing		Software
Software Trainer	Accurate-Staffing		Software
DBA, DB2; Programmer, PowerBuider	Tesmer Allen Associates	Westboro	Software
Oracle Developer	Tesmer Allen Associates	Westboro	Software
Database Analyst, Medical	Tesmer Allen Associates	Westboro	Software
Java Developer	Tesmer Allen Associates	Westboro	Software
Machine Design	Tesmer Allen Associates	Westboro	other
Network Administrator	Town Hall	Amherst	Internet/New Media
Draw Tower Operators	Schott Fiber Optics	Southbridge	other
Assemblers	Schott Fiber Optics	Southbridge	Hardware
Machine Operators	Schott Fiber Optics	Southbridge	other
CNC Production Machine Operator	Schott Fiber Optics	Southbridge	other
Grinding Machine Operators	Schott Fiber Optics	Southbridge	other
Assembly	ManPower	Worcester	Hardware
Electro-Mechanical Assembler	Adaptive Instruments	Hudson	Hardware
Assemblers	The Agentry Staffing		Hardware
Technology Sales Professional	PC-Plus Technologies	Auburn	Non-Technical
Graphic Designer			other
9-Sep-01			
Unix System Adminstrator	Biogen Inc.	Cambridge	Software
Sr. Systems Adminstrator			other
Sr. Systems Adminstrator			other
Oracle Database Administrator			Software
Sr. Telecom Analyst			other
Sr. End User Technological Analyst			other
Oracle Technical Support	Datavantage	Westboro	Software
Software Configuration Specialist			Software
Projet Manager			other
Customer Support Specialist			Non-Technical
Applications Developer	Timbersoft Corporation.		Software
Analog Product Engineer	Film Microelectronics, Inc.	Marlborough	Engineer
Web Developer	Tesmer Allen Associates		Internet/New Media
P/A (Java, SQL)			other
QA Analyst			other
Oracle Developer			Software
P/A (PeopleSoft)			other
Computer/Network Engineer	PC Plus Technologies	Auburn	Internet/New Media
Database Administrator	Accurate Staffing		Software
Systems Officer	Trust Tax Services of America	Worcester	other
Java Programmer	Accurate Staffing		Software
Network Technologist	Worcester Public Schools	Worcester	Internet/New Media
Software Programmer			Software
Assembler	ConnecTotal		Hardware
Assembler	Karl Storz - Endo Vision		Hardware
Draw Tower Operator	Schott Fiber Optics	Southbridge	other
Assembler	Schott Fiber Optics	Southbridge	Hardware
Coding Specialist	Heywood Hospital	Gardner	Software
Sales Professional	PC Plus Technologies	Auburn	Non-Technical
14-Oct-01			
Database Administrator	VNACare Network, Inc.	Worcester	Software
Manufacturing Engineer	Karl Storz Endovision	Charlton	Engineer
Graphic Designer	Telegram & Gazette	Worcester	other
P/A, Distributed Systems, SQL, VB, Unix	Tesmer Allen Associates	Westboro	Software
Network Engineer	Tesmer Allen Associates	Westboro	Engineer
Network Engineer, LAN/WAN	Tesmer Allen Associates	Westboro	Engineer

Oracle Web Portal Developer	Tesmer Allen Associates	Westboro	Software
Mechanical Engineers	Tesmer Allen Associates	Westboro	Engineer
Assembly/ Machine Operators		Worcester/Southbridge	Hardware
Draw Tower Operators	Schott Fiber Optics	Southbridge	other
Assemblers	Schott Fiber Optics	Southbridge	Hardware
Machine Operators	Schott Fiber Optics	Southbridge	other
CNC Production Machine Operator	Schott Fiber Optics	Southbridge	other
Grinding Machine Operators	Schott Fiber Optics	Southbridge	other