A NORTH END FIRE STATION IMPACT STUDY

BY: Rick Simon, Assistant Chief
Sidney Fire Department
Sidney, Ohio

An applied research project submitted to the Ohio Fire Executive Program

May 2002

ABSTRACT

The purpose of this research project was to study the impact locating a fire station in the north end of the City of Sidney Ohio would have on response times.

The problem that needed addressed in this case is that there was no up to date information concerning actual response times to different areas of the city and what impact a hypothetical third station have on that response time, including both first and second due companies.

The research method utilized in this paper is the experimental research method. The goal was to utilize computer modeling in order to show the difference in response times to the north end of the city from a theoretical third station as compared to the other two stations.

The research questions that need answered are: what is an acceptable response time, is there a significant difference in response time to the north end of the city as compared to other areas of the city, and what impact would the station have on other parts of the city.

The procedure utilized was to incorporate a computer-modeling program to compare response times to the north end from the existing two stations versus response times from a theoretical third station in the north end. Call history was analyzed to verify that the computer modeling is fairly accurate. An analysis of second due responses was also done in order to analyze the benefits to the entire city.

The results have shown that there would be a significant impact on the north end. They indicate 17.7% of the total road miles would see a first due response time changed from over four minutes to less than four minutes. The second due response impact would see a reduction in 28.3% of the total road miles from 4-8 minutes to less than four minutes.

The recommendation would be to build a station in the north end in order to reduce response times to the north end and to reduce the response time for the second due company, not only to the north end of the city, but to other areas also.

Table of Contents

APPENDICES

FIGURES

INTRODUCTION

The purpose of this research project was to determine what impact building a fire station in the north end of the city would have on response times to that area. In addition, the impact on response times for second due companies was analyzed in order to see if there would be additional benefits to any parts of the city beyond the north end. This project was to be part of a larger project that would analyze the following: cost to build and equip a station, cost to staff a station and an evaluation of overall improvement of fire and emergency medical services to the citizens of Sidney.

There were several issues driving this project in addition to the need to have certain questions answered concerning the necessity of a fire station in the north end. Among these issues were: would the citizens benefit from insurance rate reduction due to the addition of a station, occasional questioning of the need for a station by some members of the public and City Council and how would the addition of a fire station impact the department as an organization. Travel time seemed to be the most important aspect of these issues and this project was intended to answer that question.

In 1995 the Insurance Services Organization (ISO), for the purpose of setting insurance rates for the City of Sidney, evaluated the city's fire department. As a result, it was learned that the city received deficiency points in the evaluation due to the general distance of properties in the north end of the city from station 1. Station 1 is a centrally located station in the downtown area. There has been a station in the center of the city since the inception of a career fire department in 1903. From the 1960's until the present the city was the beneficiary of significant growth in the north and west ends of the city. In 1981 the city built a fire station in the west end of the city and placed an engine and a medic there. This was the result of a land donation to the

city and a request for a station close to the industrial base in the west end. Many of the companies in the west end benefited from a reduction in insurance rates because of this station.

Since the 1980's there has been significant residential growth in the north end of the city and on occasion there has been informal discussion by some members of the public and City Council concerning the possible need for a fire station in the north end. In 1997 the city formed the Comprehensive Steering Plan Committee (CSPC) in order to evaluate and prioritize capital projects and service delivery to the citizens of the city. Third on the priority list was the study of the need for a fire station in the north end of the city. The plan calls for the construction of a station after a positive assessment and public support (CSPC 1997 p. 3.13). This research project is part of an overall larger presentation to City Council concerning this matter.

This research project utilized the experimental research method to analyze this situation. The basis of all the research is to use computer modeling to show the impact a hypothetical third station located in the north end of the city would have on response time for first and second due companies. First due companies are those that are expected to arrive first in it's response area. Second due companies are those that are expected to arrive in order after the first due companies. Second due companies are important in that they provide services vital for firefighter safety and the rapid execution of life-saving functions such as search and rescue.

The hypothesis is that the addition of a fire station in the north end of the city will have a significant impact on response times within a definable geographic area. The goal is to show the current situation with the two stations and their response times. After this is completed, a hypothetical third station would be added to a computer model and that computer model would predict the response times so a comparative analysis could be made. Determinations would have

to be made as to what is an acceptable response time is so that parameters for the computer modeling and the comparative analysis can be made.

BACKGROUND AND SIGNIFICANCE

Several issues drove this project. As discussed earlier, there has been some general discussion at various times over the last 15 years or so concerning a possible fire station in the north end of the city. In 1996 the department moved into a new central station that replaced an existing station. At the time City Council was considering the replacement station, some members of City Council foresaw the need for a station in the north end and suggested that the replacement station be moved to the north of the downtown area in order to better serve the north end of the city. At the time, the Chief of the department defended the location downtown, primarily on the basis that moving the station farther north would increase response times to the east and south end of the cities. It would also move the aerial ladder farther away from the downtown area and industrial areas of the west end and could hurt us during the next ISO (Insurance Services Organization) review, thus penalizing the city in other parts of the city over one of the very same issues we are trying to remedy in the north end.

In 1997 the city formed the Comprehensive Steering Plan Review Committee. This committee's report was the driving force behind the desire to bring this matter to the forefront for City Council. The project was listed as a short-term issue and will be brought before City Council later this year for consideration. This project will be part of that presentation.

The City of Sidney is a community of approximately 20,000 people and the city covers 10.83 square miles. The department also protects all of Clinton Township, which surrounds the city, and approximately 50% of two other townships. The city has a mix of low, medium and

high-density housing. The city also has a significant commercial and industrial base, much of which is located in the west end of the city. The city's daytime population nearly doubles due to the jobs located here.

The city is protected by a fire department that is comprised of 27 firefighters, 3 lieutenants and 3 assistant chiefs that serve in the suppression division. There are two lieutenants that serve in the fire prevention division. The command staff is made up of the chief and a deputy chief. One secretary provides clerical support to the entire department. In 2001 the department responded to 2,485 medical incidents, 556 fire incidents for a total of 3,041 incidents. The department responds from two stations, the central station is located two blocks west of the courthouse, which is located in the downtown area and station 2 is located in the west end. Please note the map on appendix A for a layout of the city and the general geographic location of the two stations. The green and tan colors indicate the response districts for the two stations.

In 1992 the city's safety forces switched to the 911 phone system and at the same time installed computer-aided dispatch to complement the 911 system. In order to get the maximum efficiency from the computer-aided dispatch, it was necessary to divide the city's neighborhoods and business districts into sectors. At the time there was already some talk of a potential third station in the north end, so when the sectors were placed on the map and numbered, it was decided to number the north end of the city separately so that call data could be tracked more easily. This was done based on the layout of the city at the time and the dividing line was placed between the north end and the downtown area based on a general consensus of the area that a potential station might cover. There was very little science put into the placement of the lines and was based mostly on antecdotal evidence that came from familiarity by firefighters of travel routes. See the reference map appendix B for the layout of the sectors for the city.

As a part of this project I was able to retrieve basic call information in order get a feel for the demand for service for different areas of the city. This information shows that the north end of the city had calls for service demand of 12% of the total call for the city. Station 2's response area had 20.1% of the calls and the downtown area covered by station 1 had 67.9% of the calls for service. This number does not include the 12% of calls in the north end that are handled by station 1. These figures cover all calls from 1998 to 2001. See appendix C for the calls for service demand map.

The stations are staffed with career firefighters. There are 11 personnel on each of the three shifts. They include one assistant chief, one lieutenant, and nine fire fighters. One assistant chief and seven firefighters are assigned to the central station and the minimum staffing is one assistant chief and four firefighters. Station 2 is staffed with one lieutenant and two firefighters. The minimum staffing is three personnel at station 2. The staffing is an important issue, especially at station 1 because the issue of second due response companies is a factor that was examined in this report.

The significance of this issue is important. The primary concern, especially to the department staff is that the apparent unduly long response times to the north end of the city could result in a loss of life and excessive property damage due to the advanced stages a fire could reach before the arrival of the first due companies. It also seemed that the arrival time of the second due company from station 2 was significant. The acceptable response time of fire department forces after the ignition of a fire is a controversial issue, and there is a large amount of literature covering this matter and will be discussed later in the literature review. Another issue that needs to be addressed is the issue of initiation of medical care in a timely manner. This was also a concern of the fire department staff and the first due analysis that was done took this

into consideration, although the response times of emergency medical apparatus was not the primary focus of this study. It was felt that a study of fire apparatus response times could be later correlated to the medical response side of this issue. Since fire equipment is generally slower, a study of fire apparatus response times would be a worst-case scenario study as compared to medical apparatus. This issue will be discussed in more detail in the literature review section.

An issue that is significant to the city is the ISO evaluation that was last done in 1995. In this evaluation, the city received deficiencies due to the travel distance from station 1 to many areas of the north end. The city prior to this review had spent a significant amount of money upgrading the infrastructure of the water system and to increase the staffing of the fire department. After the review, ISO changed the city's insurance classification from a Class 5 to a Class 4. However, the change of classifications was by only a few points and a later review by ISO found that they made a mathematical error and we actually should have stayed a Class 5. The money the city had spent had been negated by the increase in risks in the city and the increased responses by the fire department. One possible advantage of adding a station to the north end may be that in the next ISO review, we may gain enough points to improve our insurance classification or at least maintain a true Class 4 classification

An issue that has not been discussed publicly is the fact that if it indeed was the case there was a significantly longer response time to the north end of the city, would it put the city at risk of civil litigation in the case of a death or a major property loss due to a delayed arrival time? At the very least, the city risks the perception by residents and business owners in the north end of the city that it is receiving inferior service as compared to other areas of the city.

Other noteworthy issues that are sidebars to this subject are items such as increasing the first alarm staffing, improved coverage of multiple calls, and implementation of safety standards

at fire incidents. Among these is the establishment of a rapid intervention crew more rapidly than the department is currently doing at this time.

LITERATURE REVIEW

Several pieces of literature were used to research this project. One of the articles researched was a pamphlet published by the International City Managers Association MIS report titled *Fire Station Location: Analysis and Technology* (1987). This pamphlet covers many aspects of fire station location, however review of this pamphlet was restricted to the section on "Fire Incident Locations and Response Time Analysis". One of the most important points made in this section is the statement "The location of fire stations is based on the theory that a rapid response is essential to protecting life and property since fire spread is largely a function of time" (Gay& Siegel 1987 p. 3). Gay and Siegel also state:

> Response time has been important in making station location decisions because research indicates that a room can progress from ignition to flashover (simultaneous ignition of all contents) in six to nine minutes. Hence, a fire department objective is to arrive at the scene prior to flashover. Achieving this objective is a difficult task because response time is a complex variable that includes: 1) detection and reporting of the fire; 2) dispatch of suppression units; 3) turnout (the interval required to mount the apparatus and leave the station; 4) travel time to the fire scene; and 5) setup (the interval required to deploy firefighters and equipment and begin to extinguish the fire). The location of fire stations impacts only the fourth aspect (travel time) of this complex variable. (p.3)

For this project the only concern was with the distance of the stations from the north end and how that that translates into travel time. For the most part, detection and reporting can be assumed to be constant, as can the turnout time and time required to initiate action. The turnout time and action initiation are made with the assumption that staffing circumstances are similar in the two stations and any potential new stations.

The previous quotation discusses the fact that flashover can occur in six to nine minutes or sooner. Flashover is the point at which all combustible items in a room or structure ignite, almost simultaneously. When the time required to detect and report the fire, the turnout time and the time required to initiate action are deducted from this six to nine minutes, the only time left is for travel time. It is important to arrive and initiate action before flashover in order to have any hopes of removing live victims or preventing significant property damage. Detection and reporting are variable, however the turnout time and time required to initiate action can be fairly constant under normal circumstances. As is shown later, there is a standard for turnout time and that is one minute, and even that can be difficult to achieve when firefighters are required to be fully dressed before boarding the apparatus. Time required to initiate action is generally benchmarked at one minute. This leaves a time of four to seven minutes and we still have not placed a definitive time allotment for detecting and reporting the fire.

The National Fire Protection Association (NFPA) publishes standards for almost all aspects of fire protection and response. Among these is NFPA standard 1710, which is the standard for organization and deployment of fire department resources for career departments. This document addresses response times and section 5.2.3.1.1 states that:

> The fire department's fire suppression resources shall be deployed to provide for the arrival of an engine company within a 4-minute response time and/or the initial

> full alarm assignment within an 8-minute response time to 90 percent of the incidents as established in Chapter 4. (NFPA 1710 p.1710-8)

Response time is defined in section 3.3.42.4 as "The time that begins when units are enroute to the emergency incident and ends when units arrive at the scene" (NFPA 2001 p.1710-6)). The significant part of this research was to establish a credible and realistic response time and see if we met that response time in the north end and compare that to the rest of the city. As mentioned earlier, response times for emergency medical incidents were not a primary focus of this study, however it is worth some research to affirm that response times for medical incidents is similar to response times for structure fires. NFPA 1710 section 5.3.3.4.2 states that "The fire department's EMS for providing first responder with AED shall be deployed to provide for the arrival of a first responder with AED company within a 4-minute response time to 90 percent of the incidents as established in Chapter 4" (NFPA 2001 p.1710-9). As we see, NFPA 1710 holds that response times for fire and EMS incidents are very similar. Another source of confirmation of EMS response times was the American Heart Association's recommendation for a response time. American Heart Association's *Advanced Cardiac Life Support* states that: "The first EMS responders dispatched to a cardiac arrest must carry defibrillator, oxygen, and airway management equipment. They should arrive at the patient's side in less than 4 minutes from the call to 911"(ACLS p.17-7).

In August of 1998, Deputy Chief Clinton Peterson of the Ames Fire Department, Ames, Iowa submitted an applied research project titled *Response Time 1998 Ames Fire Department Study*. The study was similar to the research project performed here. While there were many facets of the city and the fire department that were studied, the primary focus of the study was determining a reasonable response time and determining the areas of the city currently within the

response time. Chief Petersen notes after much research and literature review that "The literature review identifies our industry's recommendation of five minutes for response times. Additional information on fuel loads and modern construction methods add significant justification that a five-minute response time is more important today than in the past" (Petersen 1998 p 8). Petersen lists in his report response time as: dispatch time, turnout time, travel time and setup time. Conservative estimates of two-minute dispatch time, turnout time, and setup time allows for just a 3-minute travel time. This is less than the four-minute time allowed for in NFPA 1710.

The literature review supported utilizing a four-minute response time for the purposes of this research project. Conclusions can be drawn from the ICMA report that a four-minute response time is reasonable. The NFPA and American Heart Association standards clearly call for a four-minute response time. The research by Chief Petersen clearly determined that a four-minute or better response time was indicated as a standard to use for my research purposes. . Determination of an appropriate response time standard was key to this project and the literature review was overwhelmingly beneficial to this researcher.

PROCEDURES

An experimental method of research was used for this project. My intent was to research the current situation with the department's response time and to analyze the impact a potential third station might have on those response times. The belief was that the research would show that a third station located in the north end would have a significant statistical impact on the travel times to the north end and would also have some impact on travel times to other areas of the city.

The variables built into the computer program involved the addition of a third station to our current two-station situation and is only a hypothetical result. The computer program takes into account normal driving conditions and does not account for variables such as extreme weather conditions, road construction and the varying driving habits of different fire department personnel.

In order to analyze the current response time situation, it was necessary to do some historical research as part of this project. The most important reason for doing this was to be able to use this historical data to verify and validate the fact that the computer program used was fairly accurate and could be trusted to give an accurate picture of the impact a third station would have on response times. To do the historical research, I found it necessary to look at actual response times by fire apparatus on emergency runs. Due to the way our computer system tracks our calls, it was necessary to pick specific apparatus that responded to specific areas of the city. Because of these restrictions, it was only possible to go back to January of 1998 to start the study and to carry it through 2001, due to like numbering of older and replacement apparatus. The city is broken down into 53 sectors that are residential neighborhoods and commercial and business districts. A computer report generating the response times for the engine responding from the station that was first due to arrive on the scene for that sector was run. The times for each sector were totaled and then divided by the total number of calls for that sector in order to get an average response time for that sector. See appendix D and E. There were a few outliers taken out because the times were inordinately shorter or longer than the majority of the runs. Most of these were obvious typographical errors by our dispatchers that were not corrected by the person filling out the incident report. A very small percentage of these were likely due to the fact that there may have been units in the area of the incident already, which may have resulted in a low

response time or the inordinately long response times may have been due to the fact that units may have been on another incident and did not respond from the station. These average response times for these sectors gave the historical perspective necessary to confirm that the computer software used was reliable and reasonably accurate. The call history from the sectors are a two dimensional aspect on the map and represent a generalized area on the map. The computer program utilizes nodes on a map and is more exact when considering the fact that we respond to a specific point rather than a general area.

After generating the historical data necessary, a computer program known as Flame was used to generate hypothetical response times for our current situation and for a potential third station located in the north end. Flame is a geographic information based system developed by the Bode Research Group. It utilizes U.S. Census Bureau mapping. Flame was first developed and released in 1992 and has been updated several times, most recently in 2001. The program has been used by many different size political entities and has been used for research by cities like Sydney Australia, New York City, Moscow and Los Angeles. Flame is one of three computer programs recommended by the Commission of Fire Accreditation International.

The Flame program is a customizable program that uses a very accurate street mapping system that is part of the base program. Streets may be added and deleted as necessary. It is also possible to indicate which streets are one-way and this was done. Other variables such as stopping time at stoplights and stop signs and turning times can be manipulated to simulate real life situations. All of these were set to reflect our driving circumstances and driving policies.

Two Stations

The first report executed with the program was the station response area report. This was done with the two stations located on the map, as they actually exist. This was compared with

the actual station response map that we use. See appendix F and G. This station response map was developed and fine-tuned over the last twenty years. A close comparison of the station response map currently in use with the station response area map generated by the Flame program indicates that they are almost identical, with only a city block or so variance in the response districts. This would indicate that the mapping and projection by Flame is accurate.

The next step in the study was to do a computer projection of the first due response times with two stations programmed into the system. The term first due response time for this study indicates the time for the engine company likely to arrive first on the scene from the closest station. The Flame program allows for the use of three different time segments. Since we are using a four-minute drive time for the first due company as a benchmark and an eight-minute response time as a benchmark for the second due company, I chose time segments of 0-4, 4-6 and 6-8 minutes. See appendix H for the first due map.

The times on the Flame program were then compared to the actual call history for each sector. I found these to be very accurate; in most sectors there were less than 30 seconds variation. Once again, because the sectors are a two dimensional area and the Flame program deals with specific points on a map and is not necessarily a two dimensional area, only an approximation of accuracy can be made. The computer program is only estimation, however I feel it is accurate enough to project a realistic scenario.

The next step in the procedure was to calculate the second due response times for two stations. Second due engine companies are those that are expected to arrive after the first due companies. The second due calculations are shown in appendix I. A second due analysis was done in order to assess the compliance with NFPA 1710, which requires that the full alarm

assignment arrive on the scene in less than eight minutes or less on 90% of the incidents. In our case, a full alarm assignment encompasses only the first and second due companies.

Now that the calculations for two stations had been completed, it was necessary to calculate the impact of a third station in the north end of the city. Although this study was not about specifically locating a station, it was necessary to choose a location to do the impact study. When the computer-aided dispatch system along with the sectors were developed in 1992, there had already been some discussion of building a station in the north end. At that time it was decided to number the sectors for what was thought to be a potential north end station response district for future data collection. This area is shown in appendix B. It was decided that a location that was for the most part centrally located in 300-sector area should be selected. After review of the sector map, it was decided to locate the theoretical station at Broadway Avenue and East Parkwood St. The city owns parkland there, although there has not been any previous discussion of a station at this location. The location is slightly skewed to the east, due to potential residential development in the near future in the area of the northeast section of the city. See appendix J for the location of the theoretical station 3.

Three Stations

The calculations were then repeated with three stations instead of two stations. The first report executed with the Flame program was the station response area. This map may be seen on appendix K. The response area for this station would entail a significant geographic area. Note the response area the Flame program indicates this station would cover and compare it with the sector map developed in 1992 that was based on more or less anecdotal evidence by members of the department. With the exception of one small neighborhood in the southeast corner of the response district proposed by Flame, there is almost no difference in the maps.

The first due map with three stations was the next report that I ran in the Flame program. This map can be seen on appendix L. A comparison of this map may be made with the first due map with two stations. This map is located in appendix H.

The second due map with three stations was the next simulation executed with the Flame program. This map is appendix M. This map may also be compared with the second due map with two stations in appendix I.

The results of the study comparing the two-station and three-station scenarios revealed that there were significant statistical differences in the area affected by the addition of a third station. There was a17.7% reduction in the number of total road miles under the four minute travel time for the first due company. The number of second due road miles reduced to a lower time segment was 28.3% of the total road miles.

RESULTS

The results were examined in the same order that the response reports were run in the Flame program. The basic research question was, "What will adding a third station in the north end have on travel times for first and second due companies"? The first report is the station area response map. The most striking aspect of this report is that the computer program is projecting a response district for station 3 that is amazingly close to the hypothetical response district that was developed when the department's computer-aided dispatch program was developed in 1992. Although the station location used for a hypothetical station in this research project is just that, hypothetical, it is logically placed and would more than likely be similarly placed if a station location study had been completed. The approximate geographic area of the station 3 response-district would be about 22%. This number is slightly ambiguous since the station location is a

variable in this circumstance. In the current location, this would be approximately 55% the size of station 1's district and 58% the size of station 2's district.

The results of the first due response analysis showed some significant changes in the travel time as measured in road miles. There are several means by which changes in travel times can be measured. For instance, one way to measure the impact would be to measure geographic area. Due to the fact that the Flame program produces a map that is very irregularly shaped and the delineation between time segments can change block-by-block, it would be difficult to achieve an accurate measurement. Another way to measure the impact would be to assess the population impacted. As of this writing, year 2000 census data on a block-by-block basis was not yet available therefore; using this aspect with current information was not an option.

Since the purpose of this project was to examine response time, it was determined that the closest way to correlate the changes was to examine the road miles affected by the proposed station. There are 118.8 road miles within the city. Since much of the literature review that resulted in the use of the four-minute travel time in this project was centered on the time-to-flashover, it was decided to remove the road mileage for Interstate 75 and the roadway within Tawawa Park since there are no significant structures on either roadway. A study specifically involving EMS would certainly have to add these roads into the study. The results of the changes effected by the third station are listed in the chart in figure 1.

Figure 1. First due comparison chart in road miles.

STATION LAYOUT	***0-4 MINUTES***	***4-6 MINUTES***	***6-8 MINUTES***	
TWO STATIONS	**71.5%**	**23.9%**	**4.6%**	% OF TOTALS
THREE STATIONS	**89.2%**	**10.5%**	**.3%**	% OF TOTALS
GAIN/LOSS	**+17.7%**	**-13.4%**	**-4.3%**	CHANGE IN TOTAL %
CHANGE BY CATEGORY	**+24.8%**	**-56.0%**	**-93.5%**	% CHANGE/ CATEGORY

As the chart indicates, the percentage of road miles in the 6-8 minute category is not anything close to a majority of the total road miles. However, the chart would indicate that the majority of these miles are located in the north end of the city and the addition of a third station would for the most part leave very little of the city in the 6-8 minute travel time. This is significant when considering the 6-9 minutes to flashover. Additionally, the number of road miles that changed from the 4-6 minute time segment to the 0-4 minute time segment is noteworthy. What is most noteworthy is the fact that all of the travel times in the north end of the city that are over four minutes would be changed to a travel time of less than four minutes. Comparing the Flame maps on appendix H and appendix L exhibits this very well. The only streets that will still be over a four-minute travel time are not located in the north end and would not be impacted on the first due response by a north end station. Most of these areas are isolated pockets remote from station 1 and station 2.

The second due response maps perhaps revealed the most striking results (appendix I and M). While NFPA 1710 calls for the full alarm companies to be on the scene within eight

minutes on 90% of the incidents and the department is able to meet that requirement, the chart would indicate a significant reduction in the arrival time of the second due company. Since the engine from station 2 is second due to all of the areas in the northern, eastern and southern ends of the city, adding a station in the north end would impact the arrival time of the second due company to almost all of these areas to some degree. The chart shows that 44.2% of the road miles for the second due company are in the 6-8 minute category. Of these, 64% of these miles are shifted to the 4-6 and 0-4 minute categories. This is a significant reduction in arrival time for the second due company. See figure 2 for the changes in the travel times for the second due companies.

Figure 2. Second due comparison chart in road miles.

STATION LAYOUT	***0-4 MINUTES***	***4-6 MINUTES***	***6-8 MINUTES***	
TWO STATIONS	21.0%	34.8%	44.2%	% OF TOTALS
THREE STATIONS	35.5%	48.6%	15.9%	% OF TOTALS
GAIN/LOSS	+14.5%	+13.8%	-28.3%	CHANGE IN TOTAL %
CHANGE BY CATEGORY	+69.0%	+39.7%	-64.0%	% CHANGE/ CATEGORY

The original hypothesis was that the addition of a third station in the north end of the city would have a significant impact on travel time to that area. The results of the experiment performed through the computer program would support the hypothesis as the charts and results stated would indicate.

DISCUSSION

The results of this study reveal the fact that a third station placed in the north end of the city would have a distinct impact on travel times to the north end of the city. As the maps reveal, there is a significant part of the north end that currently has a travel time of somewhere between four and eight minutes. Adding a station would result in all of these areas having a four-minute or less travel time. The addition of a third station would put a fire or medical unit on the scene in the north end in the time recommended by NFPA 1710. Arriving on the scene before flashover will result in the improved opportunity to rescue any victims, save property and will help to avoid injury to firefighters. The arrival of a medical unit within four minutes will also improve the survival chances of someone in cardiac arrest.

There would still be 10.8% of the city road miles over four minutes, however none of these are in the north end. Most of these are scattered in various remote parts of the city. The one exception of this is the Riverbend subdivision, which is located in the east end of the city. There are a substantial number of housing units in this area and the expectation was that the studies would show that the first due response times would drop; however the study indicated that this was not the case. One aspect of this area that would benefit would be the travel time of the second due company to this area. The travel time would be reduced by 2-4 minutes.

The second due response time reduction is a significant safety issue for the organization even though our current times fall within the recommendations of NFPA 1710. By having second due companies on the scene sooner, it would allow for the manning of backup lines, quicker ventilation or establishment of rapid intervention crews and search teams. All of these tasks relate directly to safety and the faster rescue of a victim or extinguishment of a fire.

The other facet of adding the station is the fact that not only is the travel time reduced, but also the total staffing for the entire city would be increased. We currently do not have the personnel required to man two attack lines, staff search and ventilation crews, and fill engineer and command staff positions adequately. Assuming a similar staffing situation to that of station 2, the on-duty minimum staffing would be increased by 37.5%. This is a considerable increase in the staffing available. Not only would the addition of a station benefit those that live in the north end of the city, but the additional personnel would benefit the entire city in the event of a fire anywhere in the city and would help to better cover multiple calls. The purpose of this study was to determine the impact placing a fire station in the north end of the city would have. It is clear that a station in the north end would not only have a significant impact on the north end as measured by travel time, but it would also benefit many other areas of the city due to shortened travel times for the second due company and the additional staffing that would be available.

Research online at the Learning Resource Center at the National Fire Academy did not reveal a similar study since this study was unique to the City of Sidney. The research did find two research projects that discussed response times and what is an appropriate response time. Timothy Vadnais, Fire Chief of the White Bear Lake Fire Department, wrote a paper titled *Fire Department Response Times---What is Adequate?* Vadnais writes, "Firefighting efforts must begin early in order to avoid structure collapse. The information gathered puts the safety margin at four to six minutes when structural members are involved in the fire" (Vadnais 1990, p. 13). Vadnais's definition of response time included all time, from the alarm receipt to the time that firefighting activities were initiated (Vadnais 1990 p. 2). The adoption of a four-minute drive time for the purpose of this study was very liberal and could have easily been shortened with ample justification. Vadnais had also completed a survey of fire officers attending the National

Fire Academy. There were 117 members of departments that ranged in all sizes completed the survey. Of the respondents, 85% of those surveyed felt that response times should be less than six minutes (Vadnais 1990 p. 12). Petersen (1998) recommends that the city of Ames adopt a five-minute response time and that further study of the role of emergency medical services may require the five-minute response time be lowered to four minutes (p. 35). Once again, Petersen's definition of response time includes turnout time as well as drive time.

RECOMMENDATIONS

The original research question was whether the addition of a station in the north end of the city would impact response times and ultimately service to the north end of the city and the rest of the city as well. It is recommended that the city move forward with consideration of the construction and staffing of a fire station in the north end of the city as called for in the city's comprehensive plan. The data clearly shows that a third fire station in the north end of the city would extensively impact the travel times in the north end of the city for first due companies. Nearly 18% of the road miles for the first due company would have a measurable reduction in travel time. The data also shows that there would be a reduction in the travel times for the second due company on over 28% of the road miles. The additional staffing would certainly benefit the department as a whole and the citizenry would benefit as well. Increasing the staffing would certainly enhance firefighter safety; increase the probability of rescuing a live victim and the possibility of reducing property damage.

Additional studies analyzing possible future demands for service in all parts of the city would be of some benefit. For instance, do demographic trends indicate that the populace, on average, in the north end of the city is or will be older than the rest of the populace? If this is the

case, there will likely be an increased demand for EMS in this area. Another area of additional study would have to include future growth, not only in the north end but also in all areas of the city. The next area of residential development in the north end of the city will likely be to the northeast and some study of travel times to this area needs to be done.

Further studies on cost of staffing, construction and maintenance needs to be completed. The cost to the citizens of building and staffing a station would be considerable. The need for a new station can be justified by the facts, finding the finances for such a station will perhaps be the greatest obstacle. Budget planning will have to be an integral part of this process. The city's comprehensive plan calls for public support and obviously this will translate into the citizens of the community being willing to support, financially, another fire station and the firefighters needed to staff it.

REFERENCES

City of Sidney Steering Plan Committee. (1997). *Comprehensive Plan.* Sidney, OH: Author

International City Management Association. (1987) *Fire Station Location Analysis: A Comprehensive Planning Approach***.** ICMA MIS Report, 19(7). Washington D.C.: Author

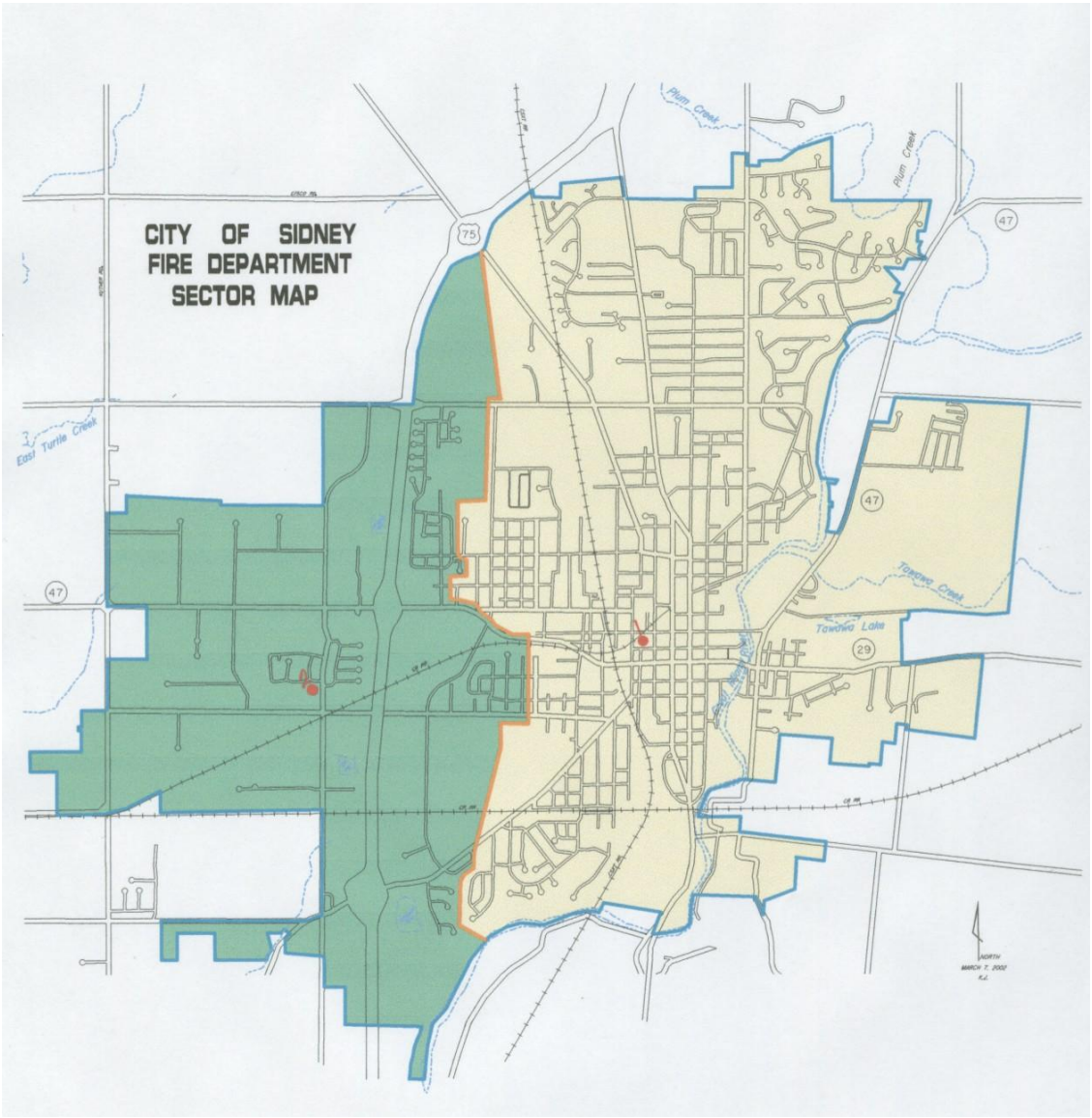
National Fire Protection Association. (2001). *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* (NFPA 1710). Quincy, MA: Author

Petersen, C. (1998) *1998 Ames Fire Department Response Time Study.* Emmitsburg, MD: National Fire Academy Learning Resource Center.

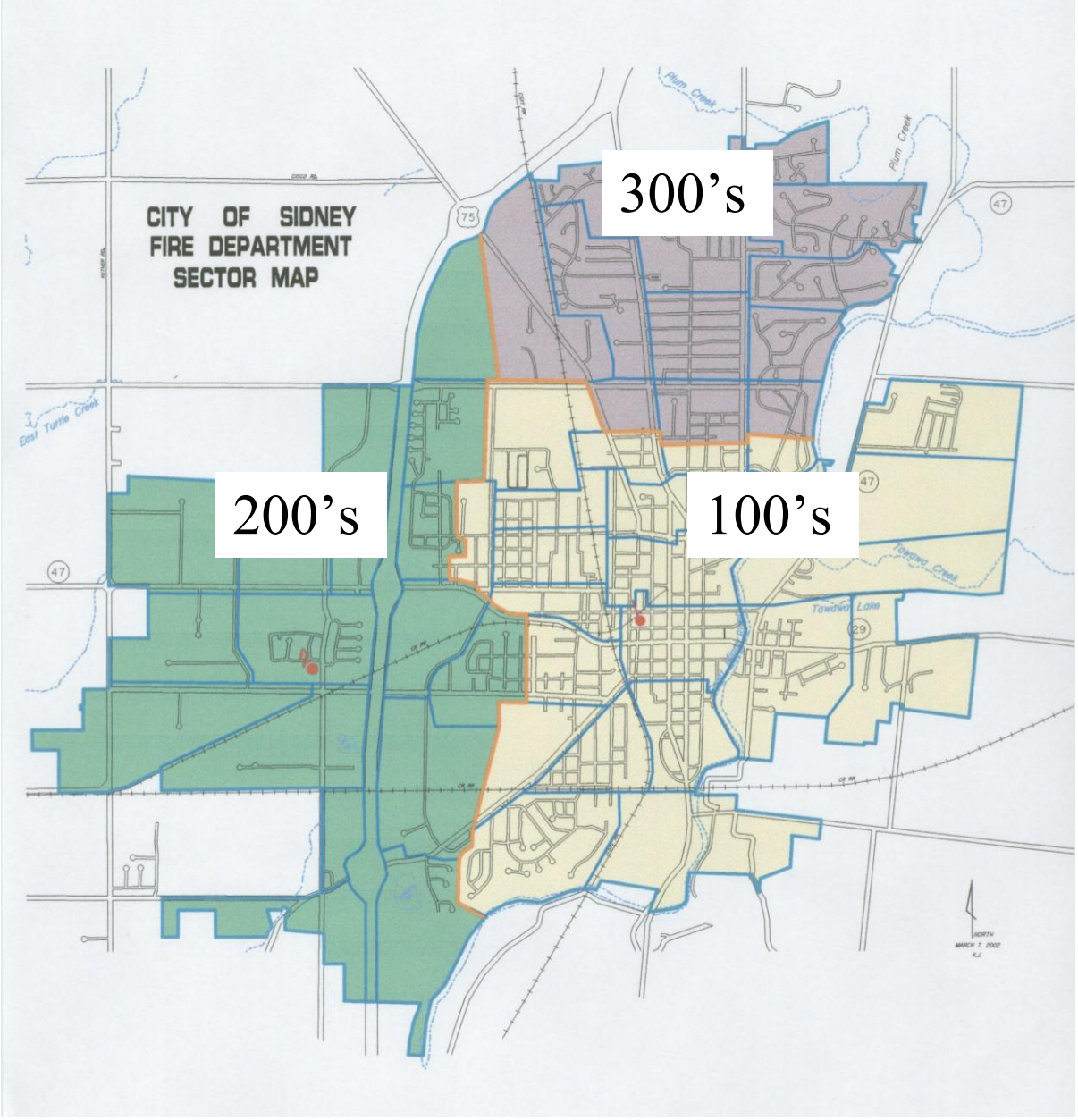
Stoddard, F.G. (Ed.). (1997). *Advanced Cardiac Life Support.* Dallas, TX: Author

Vadnais, T. (1990). *Fire Department Response Times---What Is Adequate?*. Emmitsburg, MA: National Fire Academy Learning Resource Center.

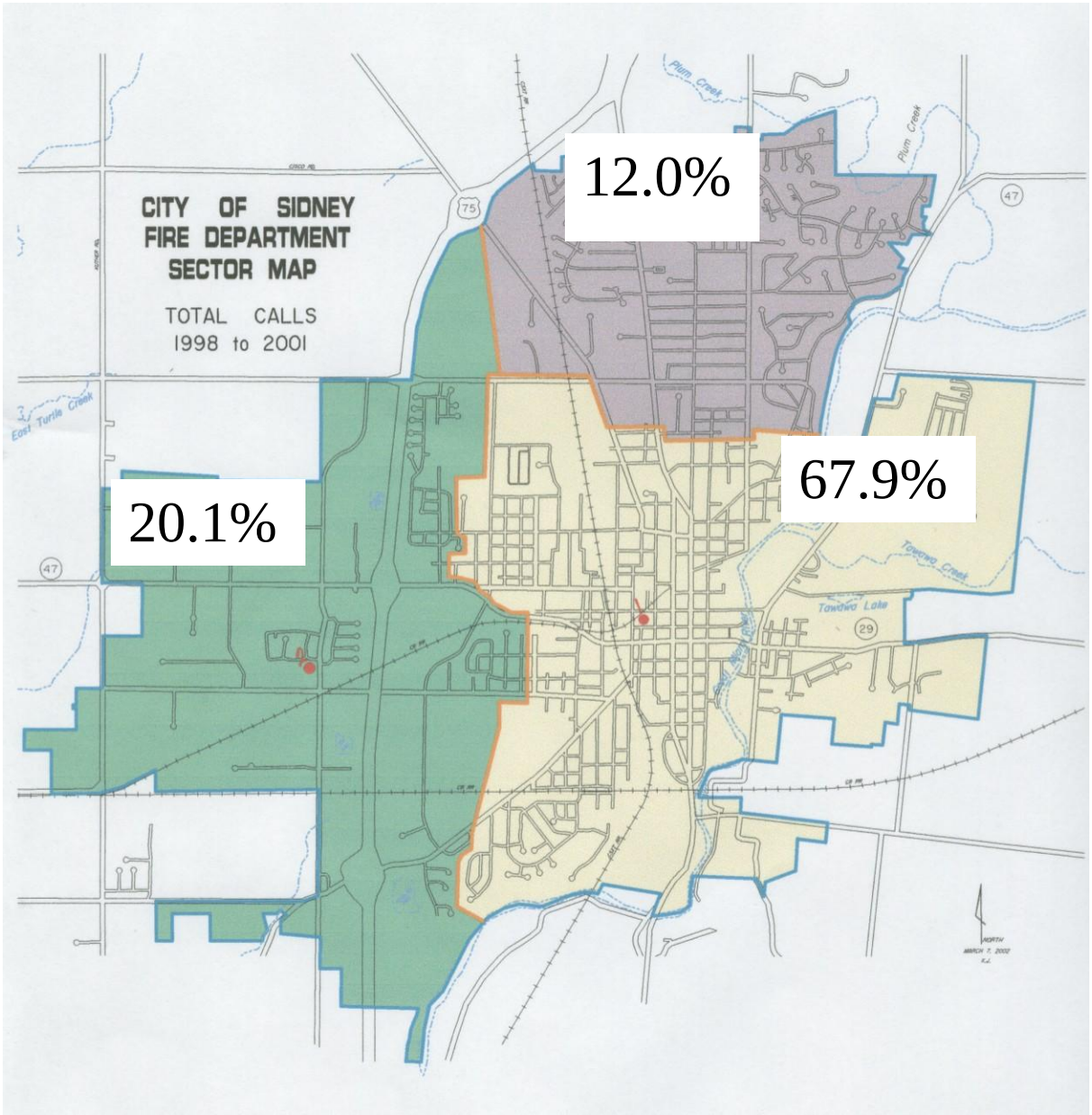
Appendix A


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
Plum Creek
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
75
47
47
47
29

Appendix B


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
300's
200's
100's
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
75
47
29
NORTH
MARCH 7, 2002

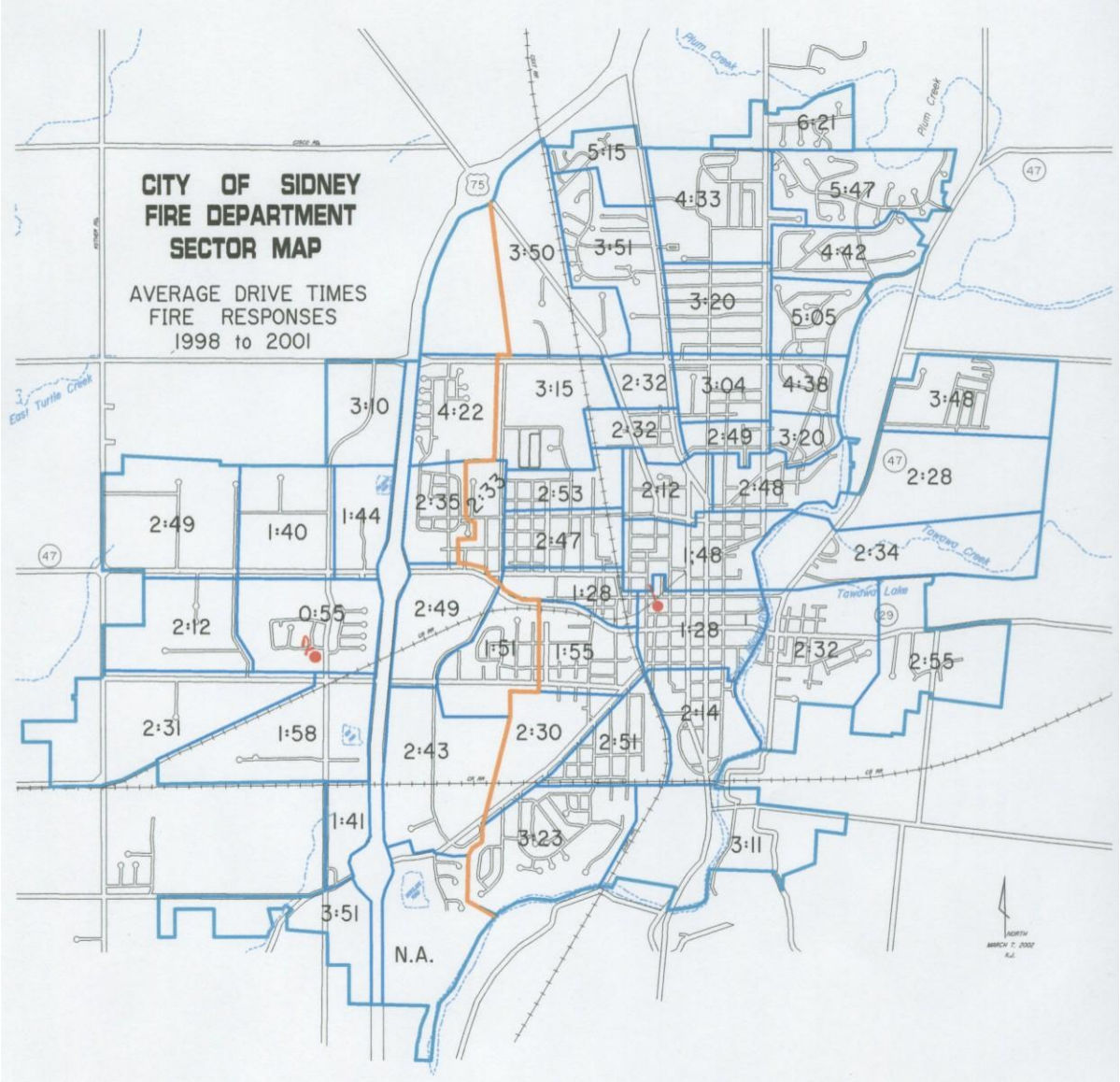
Appendix C


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
TOTAL CALLS
1998 to 2001
12.0%
67.9%
20.1%
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
75
47
29

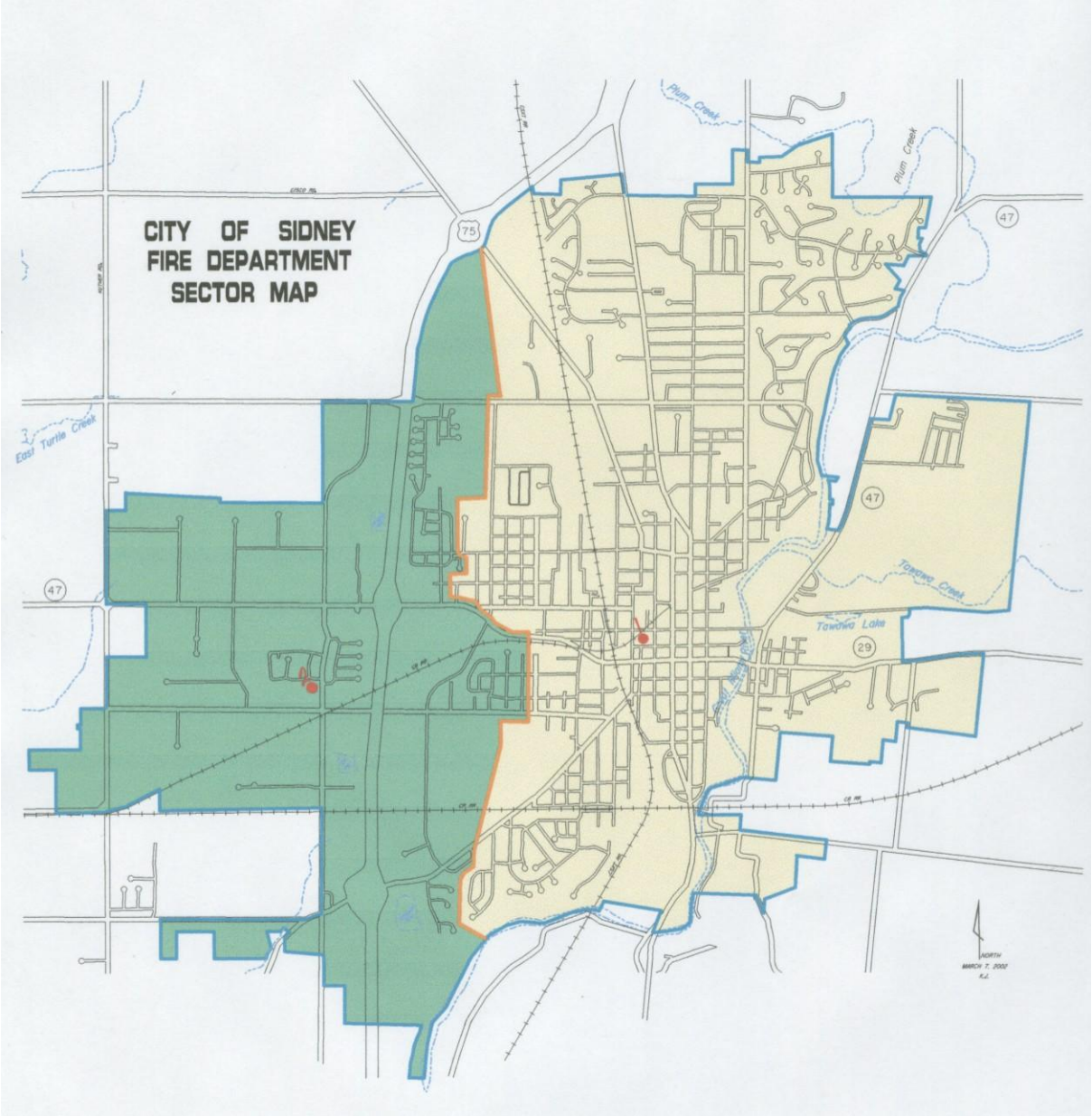
Appendix D


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
TOTAL FIRE RESPONSES
1998 to 2001
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
14
10
33
9
21
26
8
0
38
9
9
44
3
31
45
29
22
7
4
16
47
6
55
54
33
16
45
53
14
35
59
146
15
8
118
27
16
306
59
34
23
73
25
70
30
79
53
30
28
0
40
15
10
0
NORTH
MARCH 7, 2002

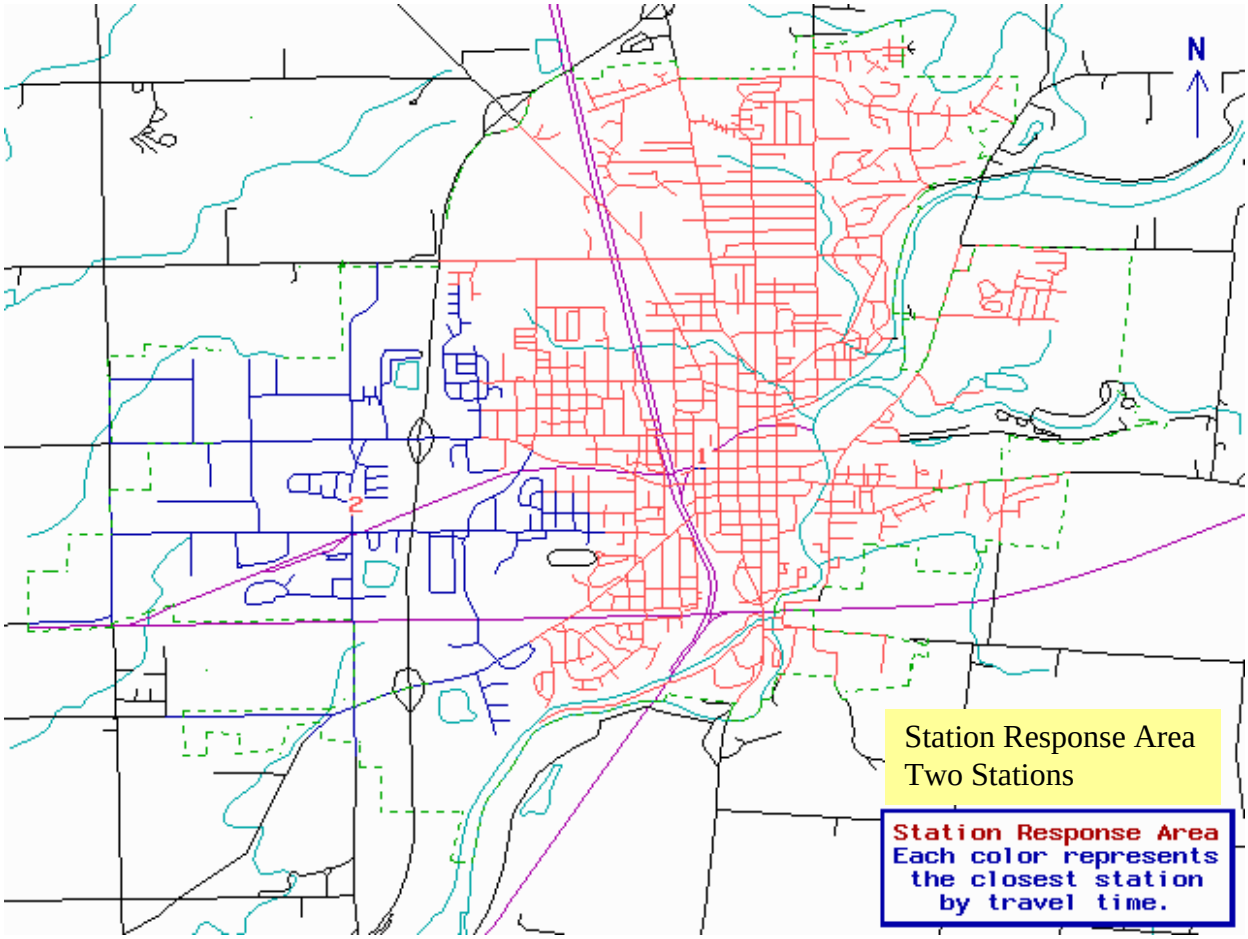
Appendix E


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
AVERAGE DRIVE TIMES
FIRE RESPONSES
1998 to 2001
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
6:21
5:15
4:33
5:47
3:50
3:51
4:42
3:20
5:05
3:10
4:22
3:15
2:32
3:04
4:38
3:48
2:32
2:49
3:20
2:28
2:49
1:40
1:44
2:35
2:53
2:12
2:48
2:47
1:48
2:34
2:12
0:55
2:49
1:28
1:28
1:51
1:55
2:32
2:55
2:31
1:58
2:43
2:30
2:51
2:14
1:41
3:23
3:11
3:51
N.A.
NORTH
MARCH 7, 2002

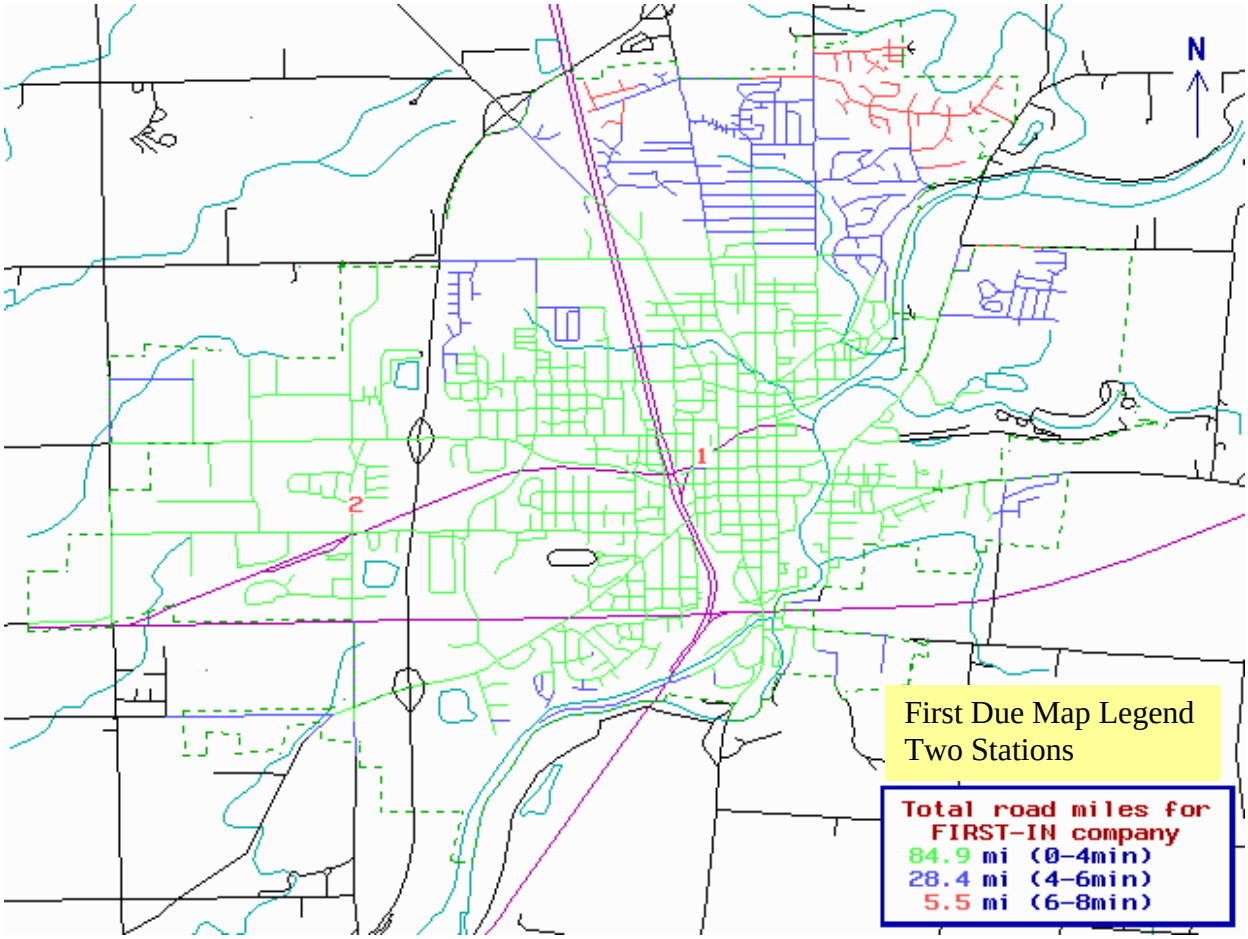
Appendix F


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
Plum Creek
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
75
47
47
47
29
NORTH

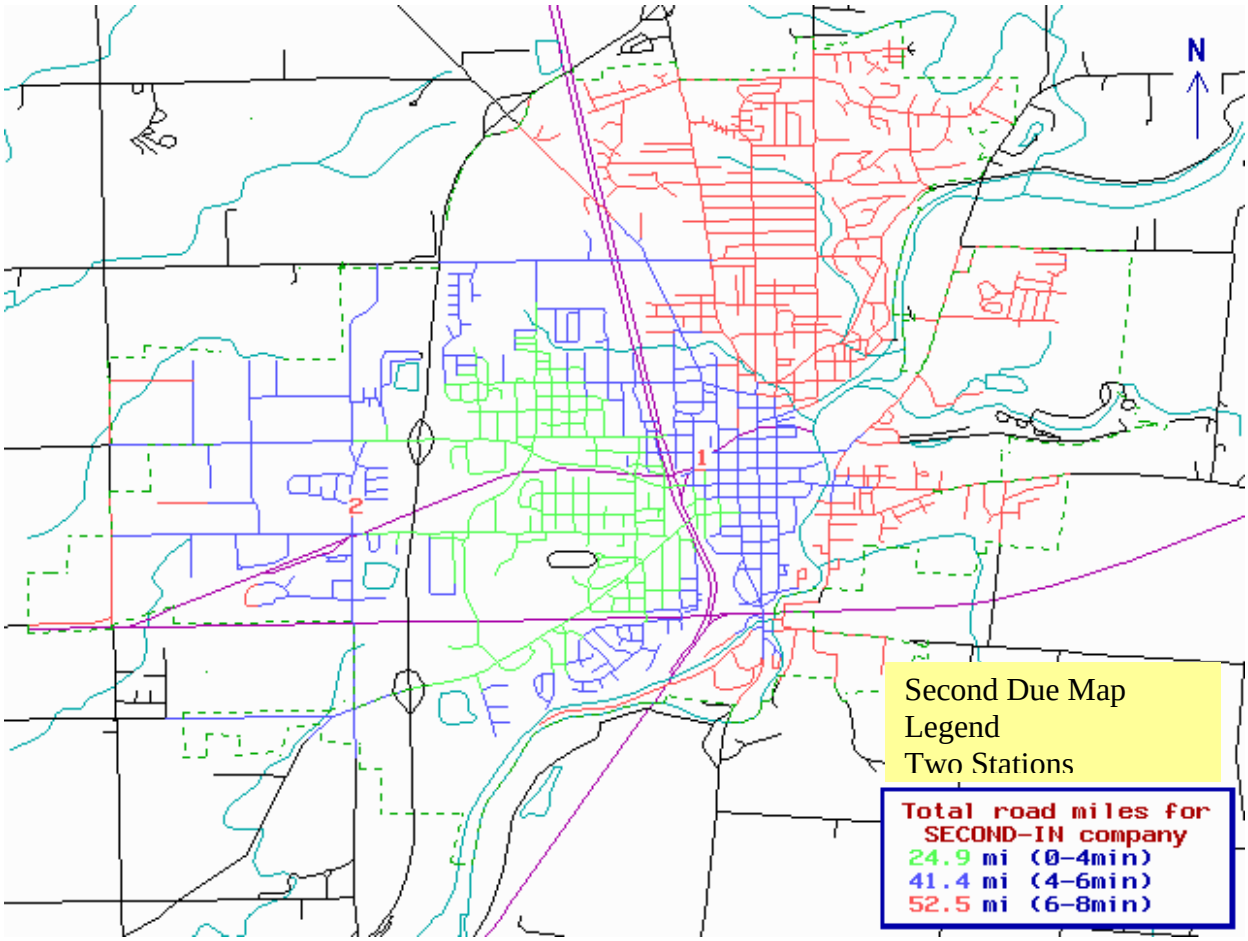
Appendix G


N
1
2
Station Response Area
Two Stations
Station Response Area
Each color represents
the closest station
by travel time.

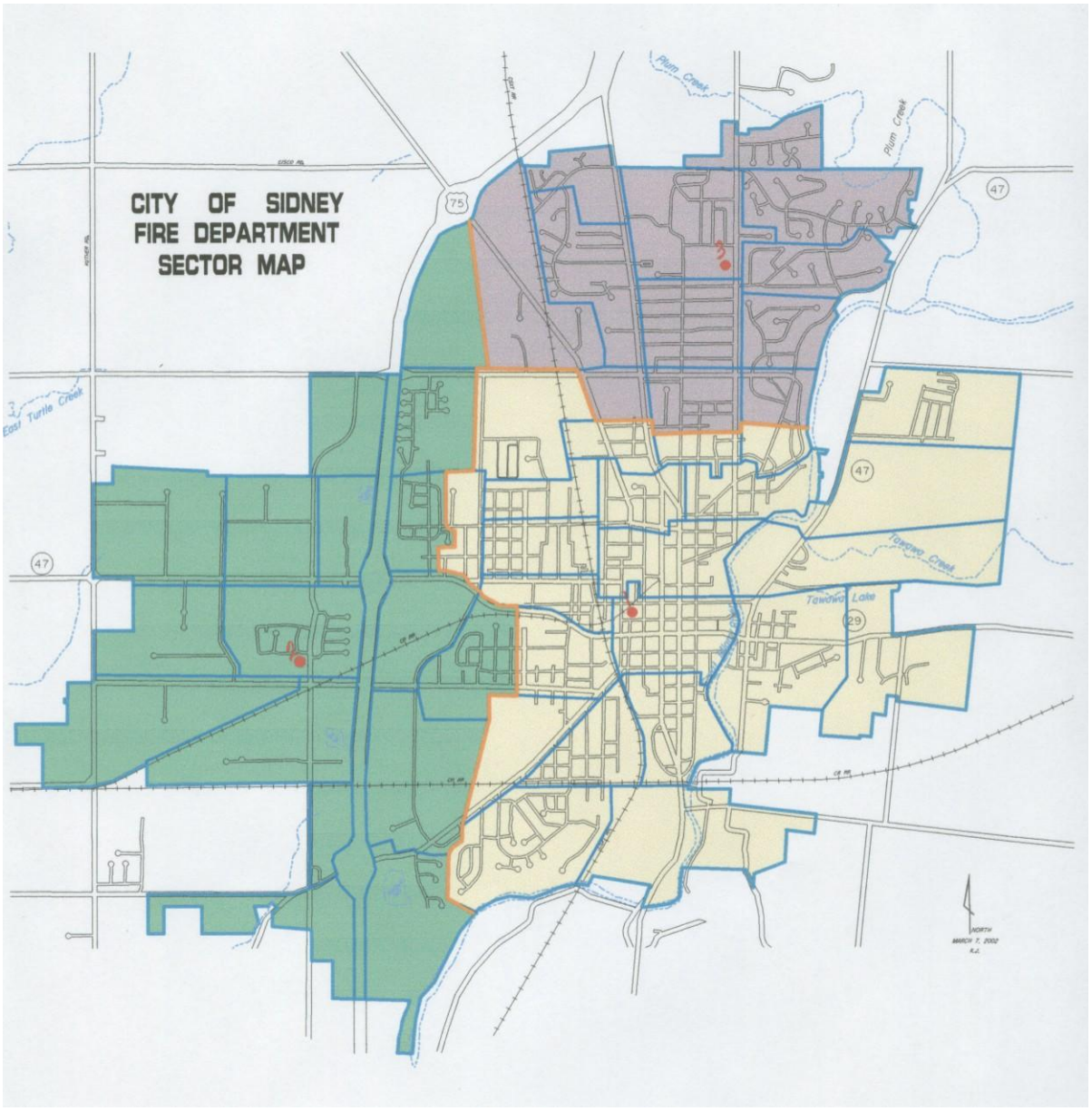
Appendix H


N
1
2
First Due Map Legend
Two Stations
Total road miles for
FIRST-IN company
84.9 mi (0-4min)
28.4 mi (4-6min)
5.5 mi (6-8min)

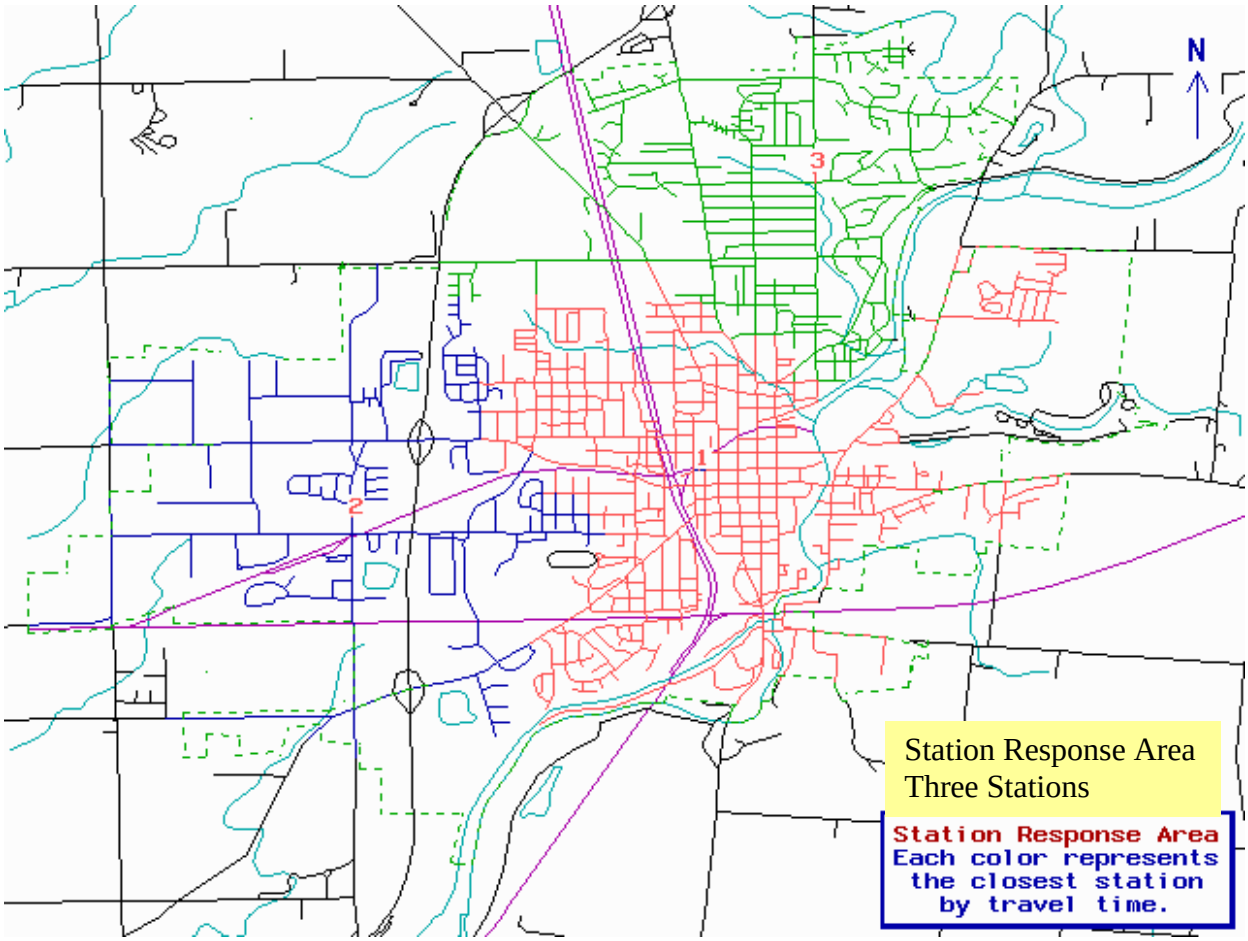
Appendix I


N
1
2
Second Due Map
Legend
Two Stations
Total road miles for
SECOND-IN company
24.9 mi (0-4min)
41.4 mi (4-6min)
52.5 mi (6-8min)

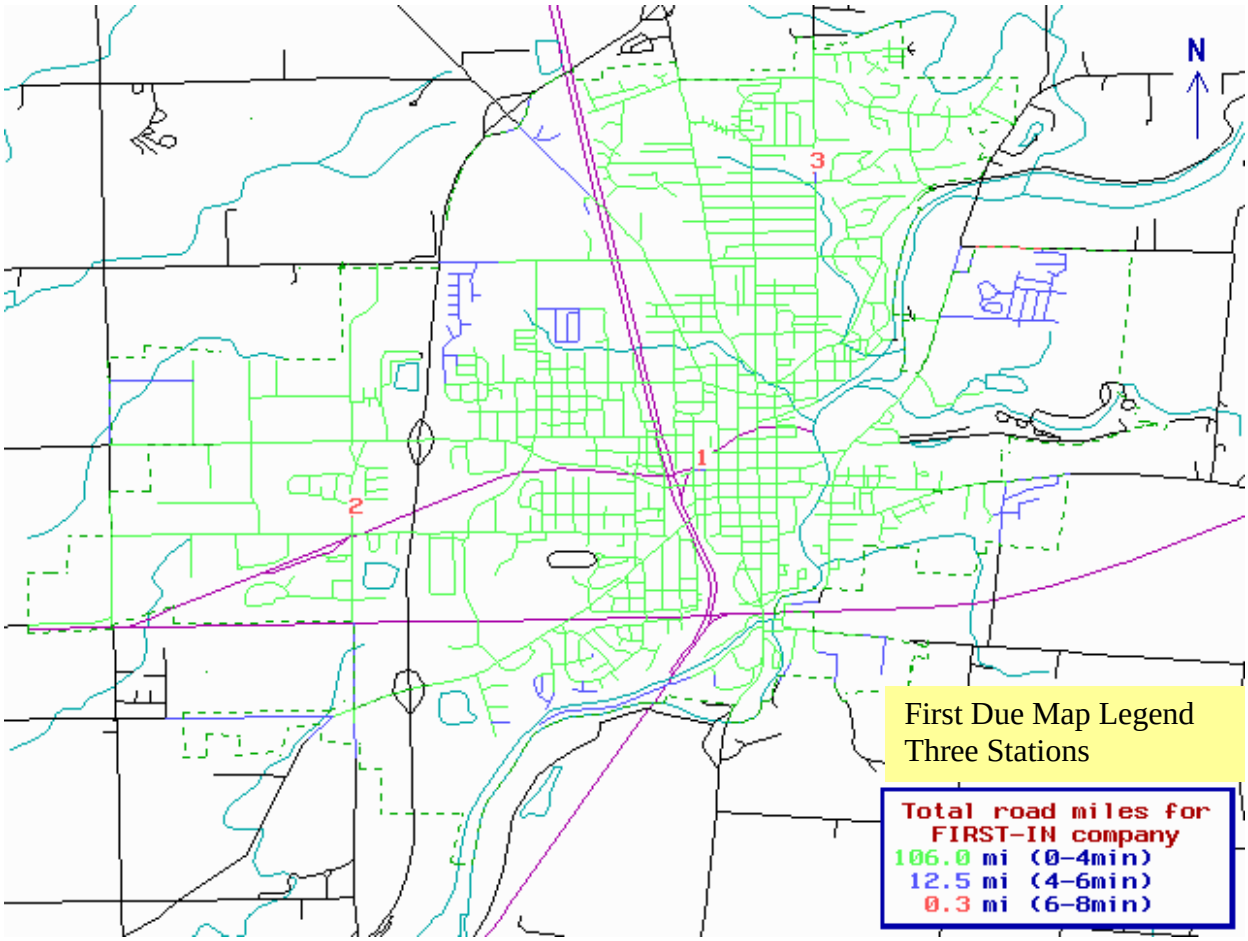
Appendix J


CITY OF SIDNEY
FIRE DEPARTMENT
SECTOR MAP
Plum Creek
Plum Creek
East Turtle Creek
Tawawa Creek
Tawawa Lake
75
47
47
47
29
NORTH

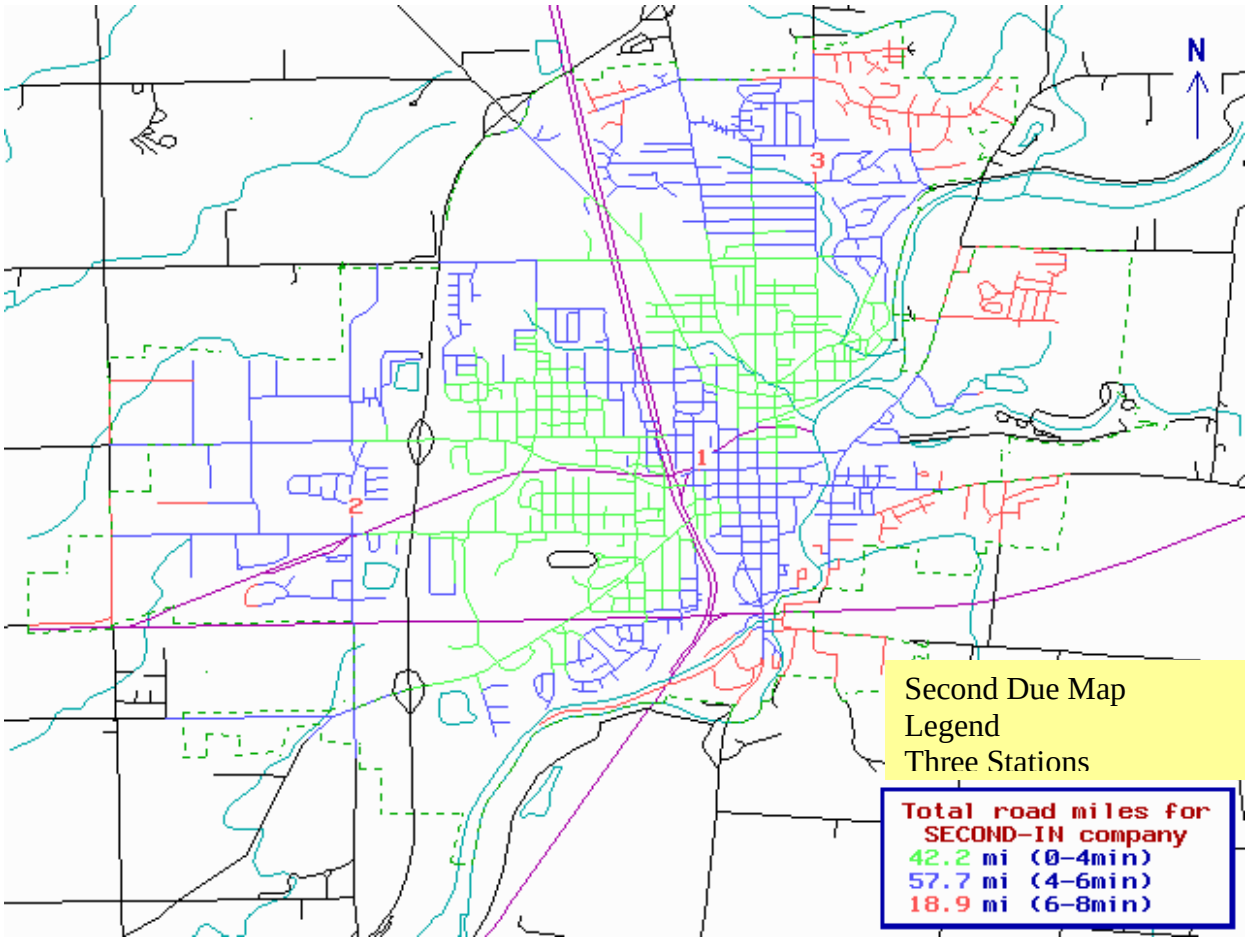
Appendix K


N
1
2
3
Station Response Area
Three Stations
Station Response Area
Each color represents
the closest station
by travel time.

Appendix L


N
3
1
2
First Due Map Legend
Three Stations
Total road miles for
FIRST-IN company
106.0 mi (0-4min)
12.5 mi (4-6min)
0.3 mi (6-8min)

Appendix M


N
1
2
3
Second Due Map
Legend
Three Stations
Total road miles for
SECOND-IN company
42.2 mi (0-4min)
57.7 mi (4-6min)
18.9 mi (6-8min)