Emergency Vehicle Preemption

Executive Leadership

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Appendices D and E Not Included. Please visit the Learning Resource Center on the Web at http://www.lrc.dhs.gov/ to learn how to obtain this report in its entirety through Interlibrary Loan.
ABSTRACT

The problem for the Orange County Fire Authority (OCFA) was the lack of direction and standards for implementing Emergency Vehicle Preemption (EVP) within OCFA. Action research was the method used to answer the following questions:

1. What types of EVP are available to OCFA and what are the advantages and disadvantages of each?
2. How are other fire departments using EVP?
3. Which EVP system should be used by OCFA and its member agencies and how should that technology be deployed?

The purpose was to establish the standard for EVP to be used by the member agencies of the OCFA. The procedures used included a review of data sources, surveys of fire departments in the 50 largest cities in the United States, and a survey all current traffic signal and EVP installations within Orange County. The procedures used formulated a baseline on the issues and established the OCFA needs/status for EVP standards.

The results of this research indicated that the use of standardized EVP had not been accomplished with any large degree of success within OCFA, Orange County fire departments or for that matter most large fire department in the United States. This research provided a standardized platform for the OCFA EVP implementation and started a roadmap for the future of EVP in Orange County. The research also provided data, factual information and elevated the issue of EVP standardization to a level in the organization and County of Orange to a point of building a consensus on the issue and adopting a standard.

Recommendations of this research project included the validation the existing
technology, the development of the standard for future projects and improvements, and the implementation of a process to find consensus for this issue. The data also led to the conclusion that Opticom is the most viable system for Orange County at this time. The work product of this effort produced an inventory of all traffic signals in the entire county, including EVP status, standardization of EVP standards within OCFA and a matrix of advantages and disadvantages for each type of EVP to be used in the future consensus process.
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Vehicle priority and signal pre-emption are becoming necessary functions for any sophisticated transportation management network. These systems are widely deployed around the world, and offer greater efficiencies for the movement of traffic. (ITSQ, 2004) The Orange County Fire Authority (OCFA) has been involved in planning, research and feasibility discussion with Emergency Vehicle Preemption (EVP) for over 20 years. The department has tested several different EVP units over this timeframe. Member agencies that merged with the OCFA over the past few years, have been using EVP for many years. The city of Buena Park was the third city in the nation to use this technology (Opticom) beginning in 1968. (Al Valdez, 2004)

OCFA is now faced with establishing how it will implement this technology on a system-wide basis. EVP as a technology has begun to expand greatly. Ads for all types of systems can be found in fire department trade magazines and on fire related Internet sites. These technologies employ various methods to achieve the same basic result. All of the systems on the market today attempt to capture the traffic signal and provide a safe controlled path for the emergency vehicle through the intersection. The intended result is to allow the emergency unit to travel safely through the signal with a green light while holding all side traffic, including other emergency units, with red lights. How does an organization establish, validate or standardize EVP? Are there national standards or resources that will assist in this effort? Where do we find the best data? This research will attempt to address these issues.

The problem to be specifically addressed by this study is the lack of any real direction in the implementation of the technology in Orange County and OCFA. Finding the right system for Emergency Vehicle Preemption (EVP) within OCFA is the desired result of this research. A consensus needs to be built within the agencies in Orange County to allow for an integrated
approach to this effort. This research effort should result in the establishment of standardized requirements for EVP system within the OCFA. In an effort to determine the EVP system that should be used within the OCFA, this research has set out to answer the following questions:

1. What types of EVP are available to OCFA and what are the advantages and disadvantages of each?
2. How are other fire departments using EVP?
3. Which EVP system should be used by OCFA and its member agencies and how should that technology be deployed?

The purpose of this research is to establish the standardized system for EVP to be used by the member agencies of the OCFA by providing a standardized EVP platform for the OCFA and other Orange County agencies, and to provide a roadmap for the future. Action research is the method that will be used to establish the EVP standard for the OCFA. This work could provide guidance for any other fire department with a similar problem.
BACKGROUND AND SIGNIFICANCE

In 1997, the Orange County Grand Jury Report stated, “Rapid population growth in Orange County has increased the demand for emergency services. This same growth has increased the number of vehicles on the streets that affect the delivery of emergency services. Traffic congestion increases the potential for accidents at intersections that is compounded when emergency vehicles must cross against traffic. The response time for emergency vehicles is increased. These problems can be alleviated with the use of traffic signal preemption systems.” (Orange County Grand Jury Report, 1997)

Several efforts at implementation of standardized EVP had failed between 1989 and 1995. The Grand Jury went on to recommend to the County Board of Supervisors, the OCFA Board of Directors and City Councils of all cities in Orange County, that a Traffic Signal Preemption Master Plan be developed on a countywide basis. The entire report is provided in Appendix A.

This research is intended to complete the process started many years ago. It will establish both the process and standards to be used by OCFA and its member agencies in the implementation of the preemption technology. It is intended to provide closure to this issue by fully implementing the EVP technology for the members of the Orange County Fire Authority.

Present Impact

The Orange County Fire Authority is a very large organization. It serves over 1.2 million people and over 500 square miles. The County of Orange has over 6,000 miles of roadways (California Department of Transportation, 2003). Signal preemption will assist the Orange County Fire Authority in reducing response times and increasing firefighter safety. The improvement will occur immediately as the systems are activated. The “risky” practice of emergency vehicle having to “break” intersection and drive on the wrong side of the road will be
significantly reduced if not eliminated at traffic signal controlled intersections with EVP. Traffic accidents caused by emergency vehicles approaching or entering intersections, whether or not the unit is involved, will be reduced. Finally, traffic will have a safe method (green light) of moving out of the way when an emergency vehicle approaches from the rear and they are stopped at the traffic light.

Several of the OCFA member agencies are in the process of installing EVP. To date, no coordinated effort has succeeded in establishing a standard for these installations. The technology continues to develop and become more sophisticated. Standards must be established before conflicts are present and scarce revenues expended on system that may not be compatible with the overall system. Without coordinated systems, installations may not have all of the features/capabilities needed to address current and future issues.

**Future Impact**

While it is impossible to predict the future, it is possible to project or forecast trends in the future. These projections are based on historical data and assumptions about the future. In neighboring Los Angeles County, the Los Angeles Metropolitan Transportation Authority (MTA) stated in its recent publication *State of Traffic 2003*, “Average freeway speeds during morning peak have declined to 37 mph and unless additional funding for transportation improvements is secured beyond what we anticipated to be available to MTA over the next two decades, by 2025 freeway speeds will fall to 19 mph. The average speed on surface streets will decline from 25 mph to 16 mph.” (MTA, 2003). New or wider roads are costly and problematic in most existing communities; they are not a realistic alternative. Moving traffic effectively within these crowded areas requires a better use of technology. Signal preemption is a method that works today and could be integrated into future systems such as AVL/ITS applications like
dynamic route clearance. This future technology will have the ability to monitor vehicle locations, calculate optimal response routes and proactively change traffic patterns in advance of the emergency vehicle (Intelligent Transportation Systems Institute, 2004). The future for preemption looks very bright and beneficial to the emergency service providers.

**Relevancy to the Executive Development Class**

This research project was completed in accordance with the applied research requirements of the National Fire Academy’s Executive Fire Officer Program. The problem addressed by this research paper is related to the operational objective of the U. S. Fire Administration in the implementation of multi-hazard risk reduction plans in local fire jurisdictions and more specifically found in Unit 10, Networking, page 10-7. It states that networking is “the ability to create and maintain an effective, widely based system of resources that works to the mutual benefit of oneself and others.” This research embodies the very basics of networking. Traffic signal preemption is outside of the fire services realm of responsibility. In order to be successful, the fire service must network with many stakeholders and present a solid, accurate and fact-based plan of action to be successful. Regardless of the emotion that can be raised on the issue of safety, working relationships and the track record of past performance will have a significant impact on the probability of success for this issue. Networking effectively is crucial to success.
LITERATURE REVIEW

The literary review conducted in this study provided a considerable amount of information pertaining to the issues of EVP. The majority of this information was found to be from three basic sources: trade publications, studies and internet sites. These sources have been used, but an extra effort was made to find materials from other sources as well. It should be noted that a great deal of the information that can be found is from the suppliers of the systems or the traffic engineers who employ them. Only a very limited amount of literature can be found from the Fire Service Community on this issue. The review of literature focused around the following questions:

1. What types of EVP are available to OCFA and what are the advantages and disadvantages of each?

   In general, signal preemption identifies a vehicle requesting priority treatment using either optical, acoustic, special inductive loop technology or global positioning system (GPS) technology (Nelson, 1999). Within these categories, several specific providers can be found. ITS America (ITSA, 1998) provides a fact sheet on its website with lists:

   - Opticom Priority Control System
   - EPS-II
   - STROBECOM
   - SONEM 2000
   - E-ViEWS21

   Further review of the literature shows additional systems such as:

   - MIRT
   - STREAMS
   - BLISS
   - Several vendors can be found for radio frequency devices
Each of these systems is slightly different and offer subtle differences or in some cases major differences, in how they operate. Each has advantages and disadvantages. We will discuss them by type:

**OPTICAL SYSTEMS**

All optical systems have three basic components: 1) Emitters that send the signal from the emergency vehicle to request the preemption; 2) Detectors that receive the signal and send it to the controller; and 3) Controller cards that process the signal, determine its validity and initiate the preemption of all other signal functions. Various vendors have differing methods to complete this process.

**OPTICOM**

The Opticom system utilizes coded infrared and visual light transmissions to provide the directional precision of optical, line-of-sight communication. This assures precise control over signalized intersections in the emergency vehicle’s direction of travel. Parallel and following intersections are not affected. (ITS America, 2004) During most emergency runs, an Opticom system can reduce response times.

Between 1977 and 1978, the City of Denver evaluated changes in response times as a result of signal preemption using the Opticom system. The collected data showed a 14-23% decrease (improvement) in response times and saved an average of 70 seconds on a typical response with three to six signalized intersections (City of Denver, 1978). In 1969, the City of St. Paul, Minnesota, began installing Opticom preemption devices at selected intersections. Between 1969 and 1976 the accident rate for emergency vehicles in this city decreased by 70.8%. During this same time, the number of traffic signals increased from 274 to 308 and ultimately 285 of these signal were equipped with Opticom. By the end of the study period, the
Fire and Safety Services in the City of St. Paul were making approximately 13,000 responses per year. (City of St. Paul, 1977)

In 1991 and 1992, the City of Houston, Texas, evaluated the Opticom preemption system. Field tests were conducted to measure the travel time for emergency vehicles before and after the installation of twenty-two Opticom devices. After a year of operation, the average emergency vehicle travel time had decreased (improved) 16% to 23% depending the area of the city analyzed. (Houston Metropolitan Transit Authority, 1991). In July 1999, the U.S. Department of Transportation funded a study of preemption using real world traffic data from Leesburg Pike (Route 7) in Virginia. The results showed that the impact on other traffic was an increase in travel time of approximately 2.4% when priority is exercised on the traffic network (Bullock, 1999)

According to Advanced Traffic Products, Inc., the Opticom system has a range of up to 2,500 feet but can be adjusted to each signal’s needs. Opticom has an encoded infrared signal with an overlay signal ID code. This feature allows the device to document individual units in the activity log. This log can identify up to 20,000 individual units. It also can be used to confirm that only authorized users access the system. The activity log also keeps data on the time, duration, status of the signal and direction of priority to each event. (Advanced Traffic, 2004) Opticom offers both a five-year and ten-year warranty option. (3M, 2004)

**STROBECOM/TOMAR**

STROBECOM uses highly tuned, selective pulse shape recognition to eliminate all light sources other than short rise-time xenon pulses. Any light pulses with rise times more than 10 microseconds, such as halogen, warning lights, street lights or solar fluctuation, are highly attenuated by the analog section of the detector and never even reach the digital signal
processing center of the system. The digital signal processor requires that a very precise signal pattern be present for a minimum period of time before preemption will be initiated. (ITS America, 2004)

Some STROBECOM systems are capable of identifying up to 65,000 vehicles and recording up to 14,000 events before downloading is required. The system has the ability to define user within 17 classes in each signal band capable of functions from vehicle logging to preemption. The TOMAR Optical Signal Processing system engages Active Reflection Suppression features to prevent or reduce reflected emitter energy from activating signals not intended to be activated. TOMAR products are encapsulated to protect them from the elements. TOMAR warranty is for 10 years with no fees or charges after the fifth year like other manufacturers. (Fortran, 2004)

**MIRT**

"MIRT" (MOBILE INFRARED TRANSMITTER) can be securely positioned on the dash or inside windshield and moved from vehicle to vehicle with no installation required. Its infrared technology emits no visible light, making it discrete and eliminating any distraction to the driver. It is powered by a standard 12volt plug (cigarette lighter or vehicle accessory outlet). The MIRT has a range of 1,500 feet. The MIRT is compatible with all 3M Opticom and TOMAR Strobecom preemption detectors systems. The system has a ten year warranty. It is by far the most price-efficient emitter available, costing less than half of any competing product. MIRT must be used with either 3M Opticom or Tomar Strobecom detection equipment to function. (www.mirtstore.com)
ACOUSTIC SYSTEMS

All acoustical systems function in the same way. They detect the sound from a siren on the emergency vehicle. This is done with the use of directional microphones to determine the direction of travel to the intersection. Profiling of the sound energy can be used for verification or validation.

SONEM 2000

SONEM 2000 Digital Siren Detection System detects the sirens of emergency vehicles up to one-half mile away. Although various types of preemption systems are used throughout the United States, SONEM 2000 represents a low-cost alternative that requires minimal additional equipment to implement. Vehicles do not need to be equipped with any additional equipment, assuming they are fitted with a siren. (Inform, 2004) The SONEM system is capable of logging up to 4,000 vents by date, time, direction, siren type and elapsed time. Sirens used on the system must meet the “Class A” Federal Regulations and State Statues for activation to occur. (Traffic Systems LLC, 2004). As no special equipment is needed, units from other jurisdictions or private parties may activate the system without authority to do so. In Guam, shortly after implementing a siren-activated signal preemption system manufactured by a vendor other than SONEM, found that 0drivers activating their car alarms were able to activate the preemption system. (Inform)

EPS-II

Emergency Preemption Systems EPS-II preemption system is a direct signal processor (DSP) based, siren (wave form) activated traffic signal preemption system. When an emergency vehicle approaches an intersection, the system using microphone detectors, feeds the siren signal to the EPS-II microcomputer to digitally match the incoming siren waveform with prerecorded
waveforms stored in the system. If there is a match, preemption occurs. Any unit equipped with a federally approved electronic siren can activate the system. This system can log activities and unit information (up to 5,000 units) and carries a five-year warranty. (ITS America)

**INTELLIGENT TRAFFIC SYSTEMS**

**E-ViEWS**

The Emergency Vehicle Early Warning Safety System is designed to reduce emergency vehicle accidents, reduce response times (improve performance) to emergency calls and provide corridor clearance ahead of the emergency vehicle. This is accomplished using long-range preemption and visual notification. Requirements include minimum ½ mile detection of an emergency vehicle approaching any equipped intersection, regardless of terrain or weather. Also, the system must provide adequate visual warning (via LED signs) to all motorists at each equipped intersection, indicating both location and direction of an approaching emergency vehicle. Sensors mounted on the emergency vehicle and in fixed locations near an intersection alert emergency vehicle drivers (and other motorists) of approaching traffic (cross traffic). (Byrd, 2003) The components communicate via a real-time, mobile, wireless data network allowing several intersections in sequence to be cleared. This advanced form of preemption allows vehicles to clear the roadway before the emergency vehicle arrives and is much more effective than a single-signal preemption. The system provides fully autonomous traffic signal preemption, visual warning of approaching emergency vehicles, and state of the art communications technology (Byrd)
For specialized applications, existing traffic loops can be used for enhancing preemption performance. Advanced warning systems for the handicapped (hearing and visually impaired) can be installed at each intersection. The system has also been expanded for installation into civilian motorist cars, providing simple dash-based indicators for approaching emergency vehicles. (Byrd)

STREAMS

STREAMS is the Queensland Department of Main Roads integrated Intelligent Transport System (ITS). It is installed throughout Queensland. STREAMS is developed and maintained by Intelligent Transport Systems Queensland (ITSQ), a company owned by the Queensland Department of Main Roads. STREAMS manages both freeway and surface street traffic, and presently operates roughly 1,200 signalised intersections. STREAMS provides the following services:

- Freeway Traffic Management - on-ramp metering and control of off-ramp traffic
- Traffic Signal Management - adaptive selection of coordination plans on routes, adaptive movement control, public transport priority and VIP and emergency vehicle priority
- Incident Management - incident detection, verification and logging, and incident response
- Passenger Information - public transport timetable management and real-time passenger information
- Driver Information - incident reports, traffic conditions and travel times, and parking guidance

STREAMS runs on an ITS Intranet using a distributed computing and communications platform. STREAMS has been designed to allow integration of all intelligent transport applications in a region to improve efficiency and reliability of systems. STREAMS is also able
to interface with third party systems, for example, Tunnel Management Systems.

Vehicles are fitted with a Global Positioning System (GPS) or transponders to allow STREAMS to determine their location on the network. If the vehicle is close to a traffic light that is about to change, the green time can be extended to allow the vehicle to pass through the intersection. For public transport vehicles, this system can be linked to the timetable so that the system only activates when the vehicle is behind schedule. Signal pre-emption is set up to change the signal for a vehicle that is approaching the light, regardless of which traffic movement has the green light. This system is only to be used in emergencies. (ITSQ, 2004)

RADIO CONTROLLED SYSTEMS

BLISS

The original BLISS (Brisbane Linked Intersection Signal System) gave priority to emergency vehicles without using any vehicle detection information. In an emergency, a control button on the emergency unit was press to initiate the special timing plan for signals along a selected route. Up to ten intersections could be specified for delay and timing. Each pre-determined route had a specific button to activate it. The introduction of VID tags in the bus system allowed the emergency vehicle priority strategy to changes as well. Emergency units had VID tags installed to give them priority over the buses and signals and initiate the sequence as the unit left the station. (Fox, 1998)

While still more system are present in the world, these represent the leaders and /or good examples of the technology that is available in the area of emergency vehicle signal preemption today.

2. How are other fire departments using EVP?
Emergency Vehicle Preemption is in place in many parts of the world. Leeds, England commissioned a review of research and user needs for traffic signal priority concluding that more than twenty different SVP (Selected Vehicle Priority) systems have been developed and implemented worldwide. (Jones, et al, 1998) But how are they being employed by fire departments? Here are some examples.

The Virginia Department of Transportation reviewed preemption systems in Virginia. This study found that use of preemption in the state was widespread in terms of the number of jurisdictions using them, but the actual number of signals in Virginia jurisdictions with preemption was low. The survey generated responses from 50 agencies in 17 states. The largest group of the responses, 16 in all, came from Virginia. Over ninety percent of the agencies participating in the study had preemption of some type. About one-third (36%) of those surveyed felt that signal preemption disrupts the operation of coordinated signals, while 22% indicated it did not, and the rest either did not answer the question or were uncertain. (Asmussen, et. al, 1997),

The City of Phoenix evaluated emergency vehicle preemption systems in a survey similar to Virginia's that accompanied a number of local field tests. Their national survey queried 10 cities to which Phoenix compares itself for such studies and eight local jurisdictions. The survey asked questions about the technology, its use, and institutional issues such as happiness with the warrantee, funding sources, unwarranted use and the criteria used for locating the equipment. Fifteen of the 18 responding cities and jurisdictions used signal preemption. The funding for the programs was mixed. While most used the operating budget, a wide range of bonds, grants, and state funds were used particularly for purchasing and installation. Only one of the jurisdictions reported suspected abuse of the systems, but only three used "event logging" to track use of the
system. Most cities used some sort of interlocking method to disable the preemption device such as when the parking brake is engaged. Intersections were chosen primarily based either on the level of congestion or their designation as fire routes. Some of the cities and local jurisdictions also included state routes and arterials. (Gifford et al, 1997)

According the Tempe Fire Department Strategic Plan, all 185 signalized intersections in the City of Tempe, Arizona have signal preemption. The city feels that preemption allows for a reduction in response time, as emergency vehicles will not encounter red lights and cars will not "stack up" in intersections. Additionally, the city states that utilization of this technology improves emergency response safety for both Fire Department members and the public. Traffic signal preemption has also been added to Southwest Ambulance Vehicles. The City of Tempe concluded that after twelve years of history with traffic signal preemption, it is clear it accomplishes what it is intended to do. (www.tempe.gov/fire, 2004)

The U.S. Department of Transportation, Federal Highway Administration quotes Denver Fire Chief Richard Gonzales as follows, “We’ve had cases with six figure claims against us that we could successfully refute because we had the technology to prove that our drivers had the green light…. This translates into substantial savings in claims to the community.” (FHWA, 2004). Signal preemption provides more than physical safety to the vehicle, it provide fiscal security in the event of an accident where someone runs the red light and tries to blame the emergency vehicle for the accident.

Emergency Vehicle Preemption is used by many fire departments around the nation. These include not only the Opticom and Tomar systems found in most departments, but also siren activated by systems such as the system used in Brentwood, Tennessee. Almost all of the traffic lights within Brentwood are equipped with preemption systems that detect the sound of
the emergency equipments siren and automatically preempt the signal for the responding unit. (www.brentwood-tn.org, 2004). The city of Monrovia, California equipped 10 signalized intersections with E ViEWS in the spring of 2001. This installation included illuminated warning signs above each intersection showing the direction of travel for the emergency approaching the intersection. The system is used by fire, police and the local ambulance company. (Byrd, 2003). Each of the system detailed early has been employed in some fashion.

3. Which EVP system should be used by OCFA and its member agencies and how should that technology be employed?

In 1994-1995 the Orange County Grand Jury found promise in the use of Emergency Vehicle Preemption as a method of improving service delivery to the citizens of Orange County. It recommended that city/county traffic engineers and city/county fire officials explore traffic light preemption for fire, paramedic and battalion chief vehicles. The Grand Jury suggested that the Orange County Transportation Authority host meeting between the stakeholders. (O.C. Grand Jury Report, 1994-1995)

The Orange County Grand Jury 1996-1997, in its final report, indicated that the Orange County Board of Directors should:

1. Convene a “summit” of all fire chiefs within the county and the Fire Chief’s Association to complete the Traffic Signal Preemption Master Plan, with emphasis being limited to major congested intersections along the most frequently used fire response routes.

2. Resume dialogue with independent cities and the city councils of contract cities to establish a compatible county-wide traffic signal preemption system.
3. Work with the Orange County CEO and city managers to develop an acceptable financing plan.

4. Complete the installation of transmitters on all OCFA vehicles and encourage the independent fire departments who have not installed transmitters to do so.

As is shown in Appendix A (Grand Jury Report), meetings were held and efforts made but no progress was made on the subject of a countywide master plan for preemption.

In addition to the concerns traffic professionals in Orange County, any system that the Orange County Fire Authority would choose to employ would have to meet the requirements of the California Department of Transportation Traffic Manual, which states in Chapter 9 - Traffic Signals and Lighting, Section 9-03.30 Emergency Vehicle Preemption:

Traffic signals on State highways may be preempted by authorized emergency vehicles. The purpose of such preemption is to provide the right of way to the emergency vehicle as soon as practical. The preemption may be controlled by one of the following means:

1. By direct wire, modulated light or radio from a remote location such as a fire house; and
2. By modulated light or radio from an emergency vehicle.

Emergency vehicle preemption should provide the following sequence of operation:

1. A yellow change interval and any required red clearance interval for any signal phase that is green or yellow when preemption is initiated and which will be red during the preemption interval. The length of the yellow change and red clearance intervals shall not be altered by preemption. Phases which are in the green interval when preemption is initiated and which will be green during the preemption period shall remain green. Any pedestrian walk interval in effect when preemption is initiated shall be immediately terminated. The normal pedestrian clearance interval may be abbreviated.
2. An all-red intersection preemption display shall not be used.
3. The traffic signal shall return to normal operation upon termination of the demand for preemption or the termination of the assured green interval.

At a traffic signal provided with both emergency vehicle preemption and railroad preemption, the railroad preemption shall have priority. In the event of a demand for an emergency vehicle preemption during the time that the intersection is operating on railroad preemption, the railroad preemption sequence shall continue unaffected until completion. In the event of a demand for railroad preemption during emergency vehicle preemption operation, railroad preemption shall immediately assume control of the intersection.

When control of emergency vehicle preemption is by means of a radio or modulated light source, the following shall apply:

1. The transmitter shall be permanently mounted on the emergency vehicle or building and shall operate at a range sufficient to permit a normal yellow change interval and any required clearance intervals to take place prior to the arrival of the emergency vehicle. The normal pedestrian clearance interval may be abbreviated.
2. The preemption system may provide an indication (such as a special signal) to the driver of an emergency vehicle that preemption of the traffic signal has been effected. If a special signal light is used, the color shall not be red, yellow, or green.
3. The system shall be designed to prevent simultaneous preemption by two or more emergency vehicles on separate approaches to the intersection.

While a great deal of effort has been made on the issue of traffic signal preemption in Orange County, not a great deal of information has been published. This limits the amount of literature review that can be conducted on the subject.

**Literature Review Summary**

A review of the literature on the subject showed that there are many type of preemption in use around the world. Some are simple, some extremely complicated. Each of these system attempts to achieve the same basic result of allow an emergency vehicle to pass through an intersection safely by controlling the traffic in all directions. The activation of these systems can be as simple as using the siren on the unit or as complex as integrated computer systems that
track the location of emergency units, interfaced with traffic network computers which have been

given the location of the unit and emergency so that it can generate the best route and clear

traffic ahead of the responding unit.

Emergency Vehicle Preemption systems are generally accepted as beneficial to the
emergency responders. Some traffic professionals and politicians have concerns about the
impact of preemption on the overall traffic network. In Orange County, the Grand Jury has
supported EVP on two occasions but the system has still not been developed or implemented at a
countywide level. Overall, there is still a professional difference of opinion between traffic
engineers and fire personnel on the cost/benefit impacts of preemption.

PROCEDURES

The action research method was utilized to gather information related to Emergency
Vehicle Preemption. Information was acquired through surveys, searches for databases and
discussions with users/suppliers of this technology. The process was as follows:

1. Conduct a search for any materials in books, periodicals, Executive Fire Officer
   Applied Research Papers, codified references and on the Internet.
2. Survey the fire departments of the 50 largest cities in the United States.
3. Survey the member agencies within the OCFA.
4. Survey all other agencies in Orange County with traffic signal responsibility.
5. Interview technology providers.
6. Identify stakeholders in preemption issue.
7. Complete a detailed search of information sources on the Internet related to emergency vehicle preemption using standard search engines.

8. Assimilate the information from all sources, eliminate duplication and where conflicts exist, use the most comprehensive or conservative sources.

9. Develop a decision matrix with advantages and disadvantages of each system type.

10. Organize data and findings with a proposed standard for the utilization of preemption within the OCFA and Orange County.

11. Prepare documentation for consensus process with all stakeholders.

**Survey Parameters**

The rationale for selecting the particular survey groups that were used in this research project is as follows:

Fire Departments serving the 50 largest cities and counties in the United States were surveyed. The list includes the 50 largest cities, as defined from the United States Census Bureau. This was the only focus group of fire departments that the researcher could find that were capable of being validated by larger research projects.

The final survey group was the end users of EVP within Orange County. This included both OCFA and non-OCFA agencies. These agencies were surveyed for the number of traffic signals they have, EVP systems and signals if they had them. Finally, they were asked for future plans on the issue of EVP. An ad hoc committee, comprised from the various agency traffic sections and emergency responders will review the work when completed to insure the opinions for each of the sections were represented.
**Limitation and Assumptions**

This is preliminary research, designed to initiate the process of consensus building to an adopted standard for emergency vehicle signal preemption. This research is not intended to establish the standard unilaterally. The research is in response to a specific need. Proper evaluation of the data and integration into each of the member agencies specific needs will need to occur as the standard moves through the consensus process. A final standard would take more time and expertise than is available for this study.

It is assumed that all responses to survey and interview questions were answered honestly and that the person had the knowledge to answer the questions being asked. This research has made no effort to check the validity of statements made in the surveys returned. All information has been taken at face value. Since the criteria will be applied to specific projects or reports, the user will need to determine the usefulness and accuracy of the criteria at the time of use.

**Definition of Terms**

**EVP** – Emergency Vehicle Preemption. Systems that interrupt the normal traffic signal cycle to provide a green light for the emergency vehicle and a red light for all other traffic at or approaching the signal so the emergency vehicle can pass through the intersection safely.

**ITS** – Intelligent Traffic Systems. Systems that manage traffic by modifying the timing and/or cycle of traffic in order to have an effect on the movement of overall traffic flow.

**Preemption** – Same as EVP but may be applied to railroad crossing, runaway trucks, VIP or transit units within the network.
Priority – Similar to preemption but these systems can only extend or shorten existing signal cycles rather than change the pattern. Used mostly by transit systems for buses on a networked system.

RESULTS

The research for this project produced a variety of results, some disappointing, others refreshing. The overall results of the survey responses received were good. In most cases, the respondent took a great deal of time and energy to provide the most amount of information they could on the subject. The instruments are included in Appendix B.

Research Question 1: What types of EVP are available to OCFA and what are the advantages and disadvantages of each?

In order to answer this question, a search for any and all EVP systems was made using the materials found in the literature as a basis. Information was requested from vendors or providers of the systems. Inquiries were made to traffic professionals and transportation designers. Efforts were made to find out as much as possible about each type of preemption and the specifics of each variation.

OPTICAL SYSTEMS

OPTICOM

Opticom representative, Al Valdez, indicated that 3M has been manufacturing optical preemption systems since 1968. In fact, he indicated that Buena Park was the third installation of the technology and was one of the original test sites for this technology. The 3M company has installations of this technology in 2,500 cities using Opticom in over 75,000 intersections worldwide. In fact, an internal survey found that OCFA uses only Opticom emitters on its emergency fleet. Mr. Valdez provided OCFA with a copy of the $5,000,000 dollar liability
policy provided with Opticom installations. (Valdez, 2003)

STROBECOM/TOMAR

Tomar representative, Bill Taylor, indicated that the product has a low power option to extend the service life of the emitter lamp where the distance is not needed but the product is designed to function at 2,500 feet in both the preemption and priority mode. Tomar also offers a coded system for unit identification. Bill Taylor points out that this system is not compatible with 3M due to patient restrictions that he says will expire in December 2009. He further adds that Tomar can be installed with a 12-volt accessory plug for easy installation and transfer from one unit to another. Additionally, the point was made that Tomar product will work seamlessly with all other optical systems on the market today that use the 14 mhz standard without proprietary coding. Finally, Bill indicated that the product carries a five-million dollar product liability insurance policy for its equipment in the event of failure or malfunction similar to that carried by 3M. (Talyor, 2003)

ALL OTHER SYSTEMS

After several attempts to speak/communicate with vendors on other preemption systems, no contact was made. No additional information was obtained on any other delivery system. Vendor input was requested for the SONEM siren system, E ViEWS GPS/ITS interface system and Priority Green (optical) systems. ITS/AVL interconnect technology is site specific and while promising, is not possible within Orange County due to the variation of traffic control systems and technology. In speaking to traffic engineers for every city in Orange County, no two situations were alike. An effort to coordinate systems would need to be undertaken separately and be successful before a preemption interface could be considered. For this reason, no additional research was performed on these systems.
Research Question 2: How are other fire departments using EVP?

In order to see which systems were being used and how, a survey of the 50 largest cities in the United States was conducted. Response to the survey was done telephonically and only two cities did not respond to inquiries. The cities are detailed in Appendix C. The results are shown in detail in Appendix D and summarized in Table 1 below:

Table 1
Preemption Use by Type

<table>
<thead>
<tr>
<th>Preemption Used</th>
<th>Cities Using Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opticom</td>
<td>33</td>
</tr>
<tr>
<td>Tomar</td>
<td>7</td>
</tr>
<tr>
<td>Hardwired</td>
<td>4</td>
</tr>
<tr>
<td>ITS</td>
<td>3</td>
</tr>
<tr>
<td>None</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: It should be noted that some cities use more than one technology and thus the total response will equal more than 50.

By far, the most used system in the survey was 3M Opticom by a ratio of almost 5 to 1 over the next system (Tomar). Of interest was the fact that seven cities have no preemption of any kind and no real plans in the future.
The breakdown of the usage as a percentage of the whole gives 3M Opticom almost 2/3 of the market. This compares with the 70% share claimed by the manufacturer. The breakdown is shown in the Figure 1 below:

![Pie chart showing emergency vehicle preemption in the largest cities]

**Figure 1**

When we examine where EVP is being used we find that the use of preemption technology is not necessarily happening in the larger cities. In fact only two cities, of the ten largest cities in the United States, have implemented EVP technology in more than 10% of the signalized intersection in that city. Of the remaining eight cities, none have over 5% of their intersection preempted. Each of these cities has nearly 1,000,000 in population or more and over 900 traffic signals in their inventory. Within the top twenty-five largest cities, only six exceed the 20% level of intersection preemption. Fifteen cities do pass this 20% mark in the top 50
In addition to the 50 largest cities, a survey of local traffic data was undertaken. All agencies (cities, the county and California Department of Transportation also called CalTrans) were surveyed in Orange County. The results of the survey are shown in Table 2. Seventeen
percent of the signals in the non-OCFA cities have signal preemption. Eight of the thirteen agencies employ the technology at some level.

---

### Table 2

Preemption Use by Non OCFA Cities/Agencies

<table>
<thead>
<tr>
<th>Non OCFA Cities</th>
<th>Total Signals</th>
<th>EVP Signals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CalTrans</td>
<td>503</td>
<td>53</td>
<td>11%</td>
</tr>
<tr>
<td>Anaheim</td>
<td>334</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Brea</td>
<td>50</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Costa Mesa</td>
<td>115</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Fountain Valley</td>
<td>47</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Fullerton</td>
<td>144</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Garden Grove</td>
<td>106</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Huntington Beach</td>
<td>126</td>
<td>122</td>
<td>97%</td>
</tr>
<tr>
<td>Laguna Beach</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>La Habra</td>
<td>33</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>Newport Beach</td>
<td>86</td>
<td>51</td>
<td>59%</td>
</tr>
<tr>
<td>Orange</td>
<td>147</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Santa Ana</td>
<td>262</td>
<td>104</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Non-OCFA Subtotal</strong></td>
<td><strong>1,953</strong></td>
<td><strong>340</strong></td>
<td><strong>17%</strong></td>
</tr>
</tbody>
</table>

Note: Many signals are shared between agencies. Signal above were assigned to only one agency and may not be the same number of signals in the individual agencies inventory.

Currently 17% of the signals in non-OCFA agencies have signal preemption. All use Opticom systems. Tomar was installed in three location in San Clemente and then removed due to issue with the liability policies for preemption. The cities of Huntington Beach (97%), Newport Beach (59%) and Santa Ana (40%) have aggressive programs to provide traffic signal preemption as a part of the response system. All other agencies have limited usage. Most of CalTrans preemption is a result of city programs.
Research Question 3: Which EVP system should be used by OCFA and its member agencies and how should that technology be employed?

Surveys of each city within Orange County provided a detailed look at the state of signal preemption today. Within the 23 member agencies of the Orange County Fire Authority, twelve agencies use preemption to some degree. The OCFA protection area has approximately 1,270 traffic signals, of which 197 are already preempted. Another 268 signals are proposed to be preempted in the cities of Irvine, Lake Forest, and Dana Point. Details are provided in Table 3.

Table 3

Preemption Use by OCFA Member Cities

<table>
<thead>
<tr>
<th>OCFA Member Cities</th>
<th>Signals</th>
<th>EVP</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aliso Viejo</td>
<td>41</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Buena Park</td>
<td>64</td>
<td>64</td>
<td>100%</td>
</tr>
<tr>
<td>Cypress</td>
<td>60</td>
<td>3</td>
<td>5%</td>
</tr>
<tr>
<td>Dana Point</td>
<td>21</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Irvine</td>
<td>275</td>
<td>24</td>
<td>9%</td>
</tr>
<tr>
<td>La Palma</td>
<td>15</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Laguna Hills</td>
<td>46</td>
<td>19</td>
<td>41%</td>
</tr>
<tr>
<td>Laguna Niguel</td>
<td>48</td>
<td>5</td>
<td>10%</td>
</tr>
<tr>
<td>Laguna Woods</td>
<td>13</td>
<td>3</td>
<td>23%</td>
</tr>
<tr>
<td>Lake Forest</td>
<td>79</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Los Alamitos</td>
<td>15</td>
<td>6</td>
<td>40%</td>
</tr>
<tr>
<td>Mission Viejo</td>
<td>109</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>ORCO</td>
<td>50</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Placentia</td>
<td>52</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Rancho Santa Margarita</td>
<td>44</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>San Clemente</td>
<td>58</td>
<td>46</td>
<td>79%</td>
</tr>
<tr>
<td>San Juan Capistrano</td>
<td>29</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>Seal Beach</td>
<td>23</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Stanton</td>
<td>7</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Tustin</td>
<td>101</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Villa Park</td>
<td>4</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Westminster</td>
<td>70</td>
<td>20</td>
<td>29%</td>
</tr>
<tr>
<td>Yorba Linda</td>
<td>46</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td><strong>OCFA Subtotal</strong></td>
<td><strong>1,270</strong></td>
<td><strong>197</strong></td>
<td><strong>16%</strong></td>
</tr>
</tbody>
</table>
As shown in Table 4, a great deal of work on preemption implementation still needs to be done in Orange County. Without agreement on standards and response corridors, it is difficult to determine how many signals will ultimately need preemption.

Table 4

Preemption Use in Orange County

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>OCFA</th>
<th>NonOCFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preempted</td>
<td>537</td>
<td>197</td>
<td>340</td>
</tr>
<tr>
<td>Proposed Preemption</td>
<td>268</td>
<td>268</td>
<td>none</td>
</tr>
<tr>
<td>Needing Preemption</td>
<td>2,418</td>
<td>805</td>
<td>1,613</td>
</tr>
<tr>
<td>Total</td>
<td>3,223</td>
<td>1,270</td>
<td>1,953</td>
</tr>
</tbody>
</table>

Results Summary

From a traffic signal count, preemption is only about 16% implemented in Orange County. From an agency standpoint, we find the number is over 50% as shown in Figure 3.

![Use of Emergency Vehicle Preemption in Orange County](image)

**Figure 3**

Of most note within the survey finding is that all agencies in Orange County that are using preemption utilize the same system (Opticom). Within the national survey, Opticom
commands three-quarters of the marketplace. Also, of note is that mixing optical system in the same network will remove the ability to utilize coding features until the patent restriction is removed in December of 2009. Using one system (either Tomar or Opticom) exclusively or using a system of duel emitters would solve this issue.

Another finding within the survey was that in very large cities, with over 700,000 population, the are not making the same progress as other large and medium sized cities are on this subject. Only three of the fifteen cities, over 700,000 population, have implemented preemption to the 5% level or above. Two of those cities (Houston and Indianapolis) are at the 25% mark and San Diego is at the 75% mark. This is especially important to OCFA as they represent a service area of 1,200,000 population and other factors may causing this fact.

Additional research may be needed.

DISCUSSION

The literature review provided the basic framework of issues. The survey added to this body of knowledge and reinforced the ideas. Emergency Vehicle Preemption is being used throughout the world but in a much larger way in North America from the results that were found. EVP has been an accepted technology for implementation within Orange County by over half of the agencies that have control of traffic signals. It is not a matter of “if” but a matter of “how” and “when”. The direction of the Grand Jury in 1996 was to formulate a master plan, but the implementation to date has been ad hoc.

An assimilation of the materials gathered in the literature review combined with the information from the surveys, has been compiled into a matrix showing the Advantages/Disadvantages of the various systems. The matrix is included in Appendix E and will not be discussed in detail here. The most notable fact to be found within the research were that all
agencies in Orange County that currently have signal preemption are using the same system. That system is Opticom. While the Tomar system is compatible with the Opticom systems (Tomar), in order to provide added security to keep out unauthorized user, it is necessary to use the coding system provided by Opticom (Opticom). While it is possible to run a “duel emitter” system as suggested by the Tomar representative, this would require extra cost to the users and may not be practical. The City of Denver had good results with signal preemption using the Opticom system. Using the system provided a 14-23% decrease (improvement) in response times and saved an average of 70 seconds on a typical response in 1978 and they indicate that they had similar success with the system which in now implemented in 28.5% (350) signals city-wide. (City of Denver, 1978) No comparable study has been conducted on the Opticom installations in Orange County but similar results are likely according to the research found.

Tomar systems are viable alternatives to Opticom systems. The company spent a great deal of time and money to perfect the product according to the vendor. They are half the cost of the 3M systems and have their own coding system for security reasons. Unfortunately, they will not be able to be compatible with the 3M coding until December 2009 (Tomar, 2004). Tomar has suggested running duel emitters to give cities the choice of detection system they want to have. This is possible but would increase costs to the OCFA.

Siren activated systems are in place in many locations nationwide. They are low cost alternatives to optical or AVL/ITS interconnects. Orange County is an urban community for the most part and this technology is better in the rural environment. This is not to say that they could not be used, the technology is solid. The largest issue is that we simply have none of these systems in place in Orange County or like communities. The only systems found in the research were in rural and suburban settings.
ITS/AVL interconnects are likely to be the future of preemption. E-ViEWS is a good example. Great technology but before it can be interfaced with a traffic system, standardization would need to occur. Byrd indicated in his description of E-ViEWS that it could be used to for specialized warning to the hearing and visually impaired and can even indicated on the dashboard of civilian cars, the direction of the approaching emergency vehicle. (Byrd) They work very well, but in Orange County, we have 35 agencies with different management systems and philosophies. Much of the materials found showed complexity in interconnecting one or two Intelligent Traffic Systems to an Automatic Vehicle Locating system that can preempt signals prior to the arrival of the emergency unit let alone integration of 35 systems.

Research indicated that while radio controlled systems, siren activated systems, ITS/AVL interconnects and hardwired or fixed traffic pattern/loop controlled system are all physically possible in Orange County. Significant issues make these unlikely technologies for use here. The Orange County Grand Jury recommended an optical system as a standard and the Orange County Board of Supervisors made optical system the standard in the county areas. (OC Grand Jury, 1996). This being the case and Opticom being the only system in use, Opticom as become the standard for this County by default. Tomar system emitters can be used on the Opticom network but only is the detector system is set to class “0”. Tomar and MIRT systems will not work when Opticom systems are set to Class 1 or higher. (Valdez, 2004) Digital coding systems are used in Class 1 or greater and 3M has the patent on this system until December 2009. (Tomar, 2004). This bring us to a point where Opticom is the only viable alterative at this time.
RECOMMENDATIONS

The results of this research indicated that Orange County Fire Authority should use the following as a proposed draft standard for consensus building:

1. In keeping the Board of Supervisors decision, signal preemption in Orange County should be optically based. In particular, the standard should require systems to be able to utilize the existing emitter in use by over 50% of the fire agencies in the county.

2. In order to restrict unwanted usage, the detector system provided for intersections should be capable of using advanced coding to identify specific users and deny access to unauthorized users.

3. The system selected must provide liability insurance for malfunction or system failure and identify circumstances that would void this coverage such as mixing system components with different manufacturers.

4. Participation in the preemption system is voluntary.

5. OCFA will develop response corridors for emergency vehicle in cooperation with local law enforcement and other fire department in Orange County.
REFERENCE LIST


Fox, Ken, Chen, Haibo, Montgomery, Frank, Smith, Mike, and Jones, Simon, Selected Vehicle Priority in the UTMC Environment (UTMC01), October 27, 1998, page 34-36


MTA, State of the Traffic – 2003, Los Angeles County Metropolitan Transportation Authority, Los Angeles, CA, 2003


APPENDIX A

APPENDIX A


TRAFFIC SIGNAL PREEMPTION IN ORANGE COUNTY

INTRODUCTION

Rapid population growth in Orange County has increased the demand for emergency services. This same growth has increased the number of vehicles on the streets which affects the delivery of emergency services. Traffic congestion increases the potential for accidents at intersections which is compounded when emergency vehicles must cross against traffic. The response time for emergency vehicles is increased. These problems can be alleviated with the use of traffic signal preemption systems.

A traffic signal preemption system provides right-of-way access to controlled intersections for emergency vehicles. A transmitter in the vehicle allows the operator to alter the pattern of the traffic signals. Preemption systems increase safety for both emergency responders and civilians while accelerating the emergency response time.

Traffic preemption is currently operating on a limited basis throughout the county. Despite the acceptance of preemption by the Board of Supervisors and the stated goals of the Orange County Fire Authority (OCFA), the system has not been fully implemented.

PURPOSE

This study is a review of the progress made since the Orange County Board of Supervisors adopted the Orange County Fire Department's report on a Traffic Signal Preemption System.
APPENDIX A


METHODS

Members of the Grand Jury:

Interviewed city managers, traffic engineers, fire chiefs, fire fighters and other representatives from the following:

Anaheim
Buena Park
Huntington Beach
Irvine
Orange
Santa Ana
Office of the CEO

Caltrans, Orange County Region 12
Orange County Fire Authority
Orange County Traffic Engineering Dept.
Los Angeles Fire Department
Los Angeles Police Department
3M Company
Environmental Management Agency

Reviewed the minutes of the Orange County Board of Supervisors meetings and memos, letters, reports and other documents produced during 1990 through 1996 on the subject of preemption by the

Board of Supervisors
Chief Administrative Officer
Chief Executive Officer
Orange County Fire Dept.
Orange Co. Fire Authority

Cities of Orange County
Environmental Management Agency
Los Angeles Fire Department
Los Angeles Police Department
3M Company

Toured selected OCFA installations throughout Orange County

Attended a demonstration by the Fourth Street Emergency Vehicle Preempt Study in the City of Santa Ana.

Participated in a ride-along demonstration of the preemption system by personnel of the Gothard Station of the Huntington Beach Fire Department.

BACKGROUND

In 1989 and 1990, the Orange County Fire Department (OCFD) tested two types of preemption systems, (1) radio-controlled and (2) strobe light activated, under actual emergency conditions and concluded the strobe light system to be more reliable.
APPENDIX A


In 1989 a survey by battalion chiefs identified all potential traffic corridors in need of preemption devices. In 1991 the OCFD selected two hundred and thirty installation sites at a projected cost of 2.1 million.

The OCFD submitted a report to the Orange County Board of Supervisors in October, 1991. The Board adopted a report which concluded that traffic signal preemption would promote a more efficient and safer response of emergency fire vehicles in Orange County and took the following actions:

- Selected strobe light-activated technology as the preemption standard in unincorporated Orange County.
- Directed the OCFD to work with EMA to develop a preemption master plan for the unincorporated county areas and to incorporate the feature on new replacement traffic signals on selected roadways.
- Directed the OCFD to work with contract cities and EMA to ensure compatibility of preemption standards.
- Directed the OCFD to work with the Orange County Fire Chiefs Association to establish a compatible county-wide system.
- Directed the county's Chief Administrative Officer (CAO), now the Chief Executive Officer (CEO) to work with the OCFD, EMA, and city managers to explore long range funding alternatives and return to the Board of Supervisors with a financial plan.

In December 1991, the Orange County Fire Department drafted an implementation plan. The Traffic Signal Preemption Master Plan's stated goal was to select a traffic signal preemption system, obtain the approval of all jurisdictions, and develop a master plan for preemption installation which included a financing plan. The plan also called for equipping approximately one hundred and forty four of OCFD's emergency vehicles with transmitters.

In early 1992, the Environmental Management Agency (EMA) began requiring that new traffic signals in unincorporated county areas be fitted with the ability to preempt (cabled), although no receivers have been installed.
APPENDIX A


At the same time the OCFD, in collaboration with EMA, began requiring that developers put up a bond or security to pay for preemption systems at intersections impacted by their projects.

In July 1992, the CAO released the results of a survey of city managers that showed little support for the selected preemption system countywide.

The Orange County Transit Authority (OCTA) hired a consultant to conduct yet another study (Intelligent Vehicle Highway System). The consultant’s report, issued November 1992, indicated that city traffic engineers, city managers, and fire chiefs had been interviewed and thirteen cities were in favor of the system, twelve gave mixed responses, four were against, one took no position and one believed the system was not relevant. The report concluded that there was a lack of support for a county-wide policy for emergency and transit vehicles.

Subsequently in November 1993, the OCTA Board of Directors requested that staff research the potential implementation of a countywide signal preemption system. A survey was conducted regarding:

- Developing a countywide signal preemption system
- Allowing Measure M funds to pay for such a system

The results were inconclusive so a special signal preemption committee was formed. The special committee was composed of the following representatives:

Two members from the Technical Advisory Committee
Two members from the Signal Roundtable
One member from the City Managers Association
One member from the Orange County Chiefs of Police
and Sheriff’s Association
One member from the Fire Chiefs’ Association
One member from Emergency Services
APPENDIX A


These deliberations resulted in recommendations which were presented to the OCTA Board on March 28, 1994. The committee’s recommendations were that implementation of signal preemption be left to the discretion of each city and to have OCTA serve as the regional coordinator. At the same time it was determined that Measure M funds could be used.

Progress on the Master Plan has been delayed because of the reorganization of the OCFD to OCFA. At this time, the Grand Jury supports the implementation of the Board approved Master Plan in its entirety.

FINDINGS

1. The Traffic Signal Preemption Master Plan has not been implemented.

2. At present, the county is not working with city managers or the OCFA on a financing plan for a traffic preemption system.

3. Measure M funds are not being used to finance the preemption system.

4. Currently the county policy to collect fees from developers for installation of preemption equipment has been suspended.

5. Twenty-nine out of 230 identified installation sites in county areas have been provided cabling for preemption.

6. Twenty-four emergency vehicles of OCFA are equipped with transmitters.

7. The majority opinion of the agencies interviewed would restrict traffic preemption to fire department vehicles.
APPENDIX A


RECOMMENDATIONS

The 1996-97 Orange County Grand Jury makes the following recommendations:

To the Orange County Board of Supervisors

1. Instruct the Chief Executive Officer to work with city managers and the OCFA to develop an acceptable financing plan.
2. Utilize Measure M funds for the installation of preemption systems.
3. Reinstate developer fees to pay for preemption systems at intersections impacted by developers.
4. Provide for future installation (cabling) for those identified signal locations.

To the Board of Directors of the Orange County Fire Authority

1. Convene a “summit” of all fire chiefs within the county and the Fire Chiefs’ Association to complete the Traffic Signal Preemption Master Plan, with emphasis being limited to major congested intersections along the most frequently used fire response routes.
2. Resume dialogue with independent cities and the city councils of contract cities to establish a compatible county-wide traffic signal preemption system.
3. Work with the Orange County CEO and city managers to develop an acceptable financing plan.
4. Complete the installation of transmitters on all OCFA vehicles and encourage the independent fire departments who have not installed transmitters to do so.
APPENDIX A


To the City Councils in Orange County

1. Instruct fire chiefs to participate in a summit with the Fire Chiefs' Association to complete the Traffic Signal Preemption Master Plan, with emphasis being limited to major congested intersections along the most frequently used fire response routes.

2. Resume dialogue with the OCFA to establish a compatible county-wide traffic signal preemption system.

3. Instruct city managers to work with the Orange County CEO and the OCFA to develop an acceptable financing plan.

4. Utilize Measure M funds for the installation of preemption systems.

5. Plan for future installation (cabling) for the identified signal locations.

Note: 1 Orange County Local Transportation Authority, Measure M, Ordinance No. 2
APPENDIX B

Survey Instruments

External Survey – Used for Orange County agencies and 50 Largest Cities surveys.

Question 1 – Does your city use EVP?

If not, do you have plans to do so.

Question 2 – Which EVP system(s) are you using?

Question 3 – How many traffic signals are in your city?

Question 4 – How many traffic signals have EVP?

Question 5 – Do you plan to increase the number of signals that have EVP?

Question 6 – Do you have a plan for increasing EVP in the near future?

Question 7 – Are you satisfied with EVP as you have employed it?
APPENDIX C

List of Survey Recipients

Profiles of the 50 Largest Cities of the United States *(According to Census 2000 data)*
Data supplied by U.S. Census Bureau and by the cities in response to questionnaires. Per capita personal income data are given for the Metropolitan Statistical Area (MSA), the Primary Metropolitan Statistical Area (PMSA), the New England County Metropolitan Area (NECMA), or the Consolidated Metropolitan Statistical Area (CMSA), as noted.

<table>
<thead>
<tr>
<th>City</th>
<th>Fire Department Address</th>
<th>Fire Chief Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuquerque Fire Department</td>
<td>11510 Sunset Gardens SW</td>
<td>Robert E. Ortega, Fire Chief</td>
</tr>
<tr>
<td>City of Atlanta/Department of Fire</td>
<td>675 Ponce de Leon Avenue, 2nd Fl</td>
<td>Winston L. Minor, Fire Chief</td>
</tr>
<tr>
<td>Austin Fire Department</td>
<td>1721-A Wilshire Blvd</td>
<td>Gary Warren, Fire Chief</td>
</tr>
<tr>
<td>Baltimore Fire Department</td>
<td>414 N. Calvert St.</td>
<td>William J. Goodwin Jr., Fire Chief</td>
</tr>
<tr>
<td>Boston Fire Headquarters</td>
<td>115 Southampton Street</td>
<td>Paul A Christian, Commissioner</td>
</tr>
<tr>
<td>Charlotte Fire Department</td>
<td>228 East 9th Street</td>
<td>Luther L. Fincher, Fire Chief</td>
</tr>
<tr>
<td>Chicago Fire Department</td>
<td>10 W. 35th Street</td>
<td>James T. Joyce, Fire Commissioner</td>
</tr>
<tr>
<td>Cleveland Fire Department</td>
<td>1645 Superior Avenue</td>
<td>Kevin G. Gerrity, Fire Chief</td>
</tr>
<tr>
<td>Colorado Springs Fire Department</td>
<td>375 Printers Parkway</td>
<td>Manuel Navarro, Fire Chief</td>
</tr>
<tr>
<td>Columbus Fire Department</td>
<td>3675 Parsons Avenue</td>
<td>Ned Pettus Jr., Fire Chief</td>
</tr>
<tr>
<td>Dallas City Hall</td>
<td>1500 Marilla St, Rm 7A South</td>
<td>Steve E. Abraira, Fire Chief</td>
</tr>
<tr>
<td>Detroit Fire Department</td>
<td>250 West Larned</td>
<td>Tyrone Scott, Fire Commissioner</td>
</tr>
<tr>
<td>El Paso, Texas 79925</td>
<td>William Gregersen Acting Fire Chief</td>
<td></td>
</tr>
</tbody>
</table>
Fort Worth Fire Department  
1000 Throckmorton  
Fort Worth, Texas 76102-6311  
H. L. McMillen, Fire Chief

Fresno Fire Department  
450 M St.  
Fresno, CA 93721  
Michael E. Smith, Fire Chief

Honolulu Fire Department  
3375 Koapaka Street, Suite H-425  
Honolulu, Hawaii 96819-1869  
Attilio K. Leonardi, Fire Chief

Houston Fire Department  
1205 Dart St  
Houston, TX 77007  
Chris Connealy, Fire Chief

Indianapolis Fire Department  
555 N. New Jersey St  
Indianapolis, Ind. 46204-1516  
Louis Dezelan, Fire Chief

Jacksonville Fire Department  
117 W. Duval Street  
Jacksonville, FL 32202  
Rayfield (Ray) Alfred, Fire Chief

Kansas City Fire Department  
414 E. 12th Street  
Kansas City, MO 64106  
Richard Dyer, Fire Chief

Las Vegas Fire Rescue Services  
500 N. Casino Center Blvd.  
Las Vegas, NV 89101  
David L. Washington, Director of Fire Services

Long Beach Fire Department  
925 Harbor Plaza Dr.  
Long Beach, CA 90802  
Anthon (Skip) Beck, Fire Chief

Los Angeles Fire Department  
200 North Main Street, Room 1020  
Los Angeles, CA 90012  
William R. Bamattre, Fire Chief

Tenn. Memphis Fire Department  
65 South Front Street  
Memphis, TN 38103  
Chester Anderson, Director

Mesa Fire Department  
PO Box 1466  
Mesa AZ 85211-1466  
Dennis Compton, Fire Chief

Fire Rescue Department  
9300 N.W. 41st Street  
Miami, Florida 33178-2414  
Charles U. Phillips, Fire Chief

Milwaukee Fire Department  
711 West Wells Street  
Milwaukee, Wisconsin 53233-1403  
Lawrence Gardner, Fire Chief

Minneapolis Fire Department  
350 S 5th St, Room 230  
Minneapolis, MN 55415  
Fire Chief

Nashville Fire Department  
500 2nd Ave.  
Nashville, TN 37201  
Stephen Halford, Fire Chief
New Orleans Fire Department
317 Decatur Street
New Orleans, Louisiana 70130
Warren McDaniels, Fire Chief

Fire Department New York
9 MetroTech Center
Brooklyn, NY 11201-3857
Nicholas Scoppetta, Fire Commissioner

Oakland Fire Department
150 Frank H. Ogawa Plaza, S-3354
Oakland, CA  94612
Gerald A. Simon, Fire Chief

Oklahoma City Fire Department
820 NW 5th
Oklahoma City, OK  73106
Alan Benson, Fire Chief

Omaha Fire Headquarters
1516 Jackson St
Omaha, NE  68102
Paul Wagner, Fire Chief

Philadelphia Fire Department
240 Spring Garden St.
Philadelphia, PA  19123
Harold B. Hairston
Fire Commissioner

Phoenix Fire Department
150 S. 12th St.
Phoenix, AZ  85034
Alan V. Brunacini, Fire Chief

Portland Fire Department
55 SW Ash
Portland, OR  97204
Fire Chief

Sacramento Fire Department
1231 I St, Suite 401
Sacramento, CA  95814
Dennis Smith, Fire Chief

St. Louis Fire Department
1421 N. Jefferson
St. Louis, MO  63106
Sherman George, Fire Chief

San Antonio Fire Department
215 S. San Saba
San Antonio, Texas 78207
Robert Ojeda, Fire Chief

San Diego Fire & Life Safety Services
1010 2nd Avenue, Suite 400
San Diego, CA  92101
Fire Chief

San Francisco Fire Department
698 Second Street
San Francisco, CA  94107
Fire Chief

San Jose Fire Department
4 N. 2nd St, Suite 1100
San Jose 95113-1305
Manuel Alarcon, Fire Chief

Seattle Fire Department
301 2nd Avenue South
Seattle, WA
Gary Morris, Fire Chief

Tucson Fire Department
265 South Church
Tucson, Arizona  85701
Dan Newburn, Fire Chief
Tulsa Fire Department
411 S. Frankfort
Tulsa, OK 74120
Allen LaCroix, Fire Chief

Virginia Beach Fire Department
2408 Courthouse Drive
Virginia Beach, Virginia 23456
Gregory B. Cade, Fire Chief

DC Fire/Emergency Medical Services
1923 Vermont Avenue, NW, S-102
Washington, DC 20001
Ronnie Few, Chief Fire/EMS

Wichita Fire Department
455 N. Main St.,
Wichita, KS 67202
Larry D. Garcia, Fire Chief