STATE OF CALIFORNIA

PEACE OFFICER STANDARDS AND TRAINING

COMMAND COLLEGE CLASS 11

# MANAGING EMERGENCY RESPONSE ON URBAN FREEWAYS IN CALIFORNIA BY THE YEAR 2000 - A LAW ENFORCEMENT PERSPECTIVE



by

CAPTAIN ROGER B. NEWQUIST

CALIFORNIA HIGHWAY PATROL

DECEMBER, 1990

**This Command College Independent Study Project is a FUTURES study of a particular emerging issue in law enforcement. Its purpose is NOT to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.**

**Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.**

**Managing the future means influencing the future--creating it, constraining it, adapting to it. A futures study points the way.**

**The views and conclusions expressed in this Command College project are those of the author and are not necessarily those of the Commission on Peace Officer Standards and Training (POST).**

PART I - INTRODUCTION

A discussion of related background data and the scope/limitations of the study.

PART II - FUTURES STUDY

What impact will future traffic volumes and freeway designs have on law enforcement response to emergency incidents on urban freeway systems in California?

PART III - STRATEGIC MANAGEMENT

A plan for urban law enforcement agencies in general, with freeway management responsibilities, and the California Highway Patrol in particular.

PART IV - TRANSITION MANAGEMENT

A description of a management structure for a planned transition from one set of emergency incident response strategies to a new set.

PART V - FUTURE IMPLICATIONS

A discussion of the study's conclusions, recommendations, and future implications.

PART IV - APPENDIXES

Reference material, charts, and selected supporting data.

**Abstract**

# MANAGING EMERGENCY RESPONSE ON URBAN FREEWAYS IN CALIFORNIA BY THE YEAR 2000 - A LAW ENFORCEMENT PERSPECTIVE

by
CAPTAIN ROGER B. NEWQUIST

COMMAND COLLEGE CLASS 11
PEACE OFFICER STANDARDS AND TRAINING (POST)
SACRAMENTO, CALIFORNIA
1990

Managing Emergency Response On Urban Freeways In California By The Year 2000 - A Law Enforcement Perspective.

R. B. Newquist. Sponsoring Agency: California Commission on Peace Officer Standards and Training. 1990. 88 pp.
Availability: Commission on POST, Center for Leadership Development, 1601 Alhambra Blvd., Sacramento, CA 95816-7053.
Single copies free; Order number 11-0208.
National Institute of Justice/NCJRS Microfiche program, Box 6000, Rockville, MD 20850.
Microfiche free. Microfiche number NCJ _____ (NCJRS assigns).

## Abstract

This study examines the future traffic demands on urban freeway systems and the methods that law enforcement agencies can implement to manage response to emergencies. The author has included a review of relevant literature, an examination of significant trends and events, three possible future scenarios, and suggested strategic and transition management plans. The data analysis reveals a continually growing traffic congestion problem that is further compounded by the delayed response of law enforcement personnel to lane blocking incidents. The study shows that the adverse consequences of delayed response are significant on public safety, as well as on the socio-economic system. Although the suggested strategies are designed to address urban freeway problems they will also have some application to non-freeway transportation systems. Trend and event evaluations; forecasts'; figures and graphs; appendixes; bibliography.

# MANAGING EMERGENCY RESPONSE ON URBAN FREEWAYS IN CALIFORNIA BY THE YEAR 2000 - A LAW ENFORCEMENT PERSPECTIVE

by

CAPTAIN ROGER B. NEWQUIST
COMMAND COLLEGE CLASS 11
PEACE OFFICER STANDARDS AND TRAINING (POST)
SACRAMENTO, CALIFORNIA

1990

## Executive Summary

Order Number 11-0208

This study examines the growing traffic congestion problem on urban freeway systems and how California law enforcement will manage response to emergency incidents by the year 2000. In order to logically present the data and study findings, the report is divided into five major parts, plus a final part for appendixes.

### Part I - Introduction

The study's issue question, "How Will California Law Enforcement Effectively Respond To Emergencies On Congested Urban Freeways By The Year 2000?", is presented along with a discussion of the literature review associated with this study. The scope and limitations of the study are also defined. The following adverse consequences of traffic delays on society are presented:

1. Increased response times by fire suppression personnel and equipment.
2. Increased response times by emergency medical service providers.
3. Delayed law enforcement response to emergencies.
4. Decreased employee productivity.
5. Delayed delivery of needed supplies and equipment.
6. Increased pollution and its attendant health risks.

Part II - Futures Study

The primary issue question is further structured by identification of the following sub-issues:

1. What methods will law enforcement departments employ to expeditiously transport resources to freeway emergency incidents?
2. How will future freeway designs impact law enforcement emergency service response time?

Significant trends and events that will shape the future, as well as the alternative response strategies are identified. In addition, the effects of these trends and events on each other are analyzed and three possible future scenarios are developed. The forecasts derived from this effort include:

1. Traffic volumes on freeways will increase.
2. Vehicle registration in California will increase.
3. The cost of new transportation system facilities will increase.
4. Vehicle pollution levels will increase.
5. Public interest in mass transit alternatives will not be high enough to reduce freeway congestion.

Part III - Strategic Management Plan

A strategic management plan is presented which incorporates five individual strategies that will assist in reducing response times to emergencies. The strategies are:

1. Develop a public education program describing recommended actions when confronted with freeway lane-blocking incidents.
2. Develop an integrated traffic management system to electronically monitor and route traffic.
3. Assure future freeways include paved areas adjacent to traffic lanes for lane-clearing operations during emergencies.

4. Create specialized emergency response units that are prepositioned along urban freeways for rapid emergency response.
5. Increase the utilization of motorcycles as initial response vehicles during high congestion periods.

Part IV - Transition Management Plan

In order to successfully implement the strategic plan, a transition management plan is developed. It includes a discussion of the roles, responsibilities, and commitment necessary of all the key players concerned with the implementation of the proposed strategies. The actual management structure proposed to implement the strategies involves a combination project manager and advisory team approach.

Part V - Future Implications

A summary of the conclusions and five recommended strategies is presented. Areas of further application of the study's findings and future additional study are also included.

## Epigraph

Every start upon an untrodden path is a venture which only in unusual circumstances looks sensible and likely to be successful.

– Albert Schweitzer

Table Of Contents

## Illustrations

Figures:

# PART I: INTRODUCTION

## Section I: Background

### The Problem In General

Since the invention of the automobile in the late 1800's, America's thirst for a wide variety of vehicles and a transportation system that can take people anywhere has grown rapidly. As the most populous state in the Nation, California has been no exception and today, according to the Department of Motor Vehicles and the Department of Transportation, it boasts a vehicle population of 23,158,857[1] and 162,562 miles of roadway.[2] These indicators of the size of California's transportation system are incredible and are growing rapidly. For example, California's vehicle population has grown approximately 180 percent between 1960 and 1988, and a closer examination of traffic volumes reveals a high concentration of vehicles and travel within urban cities.[3]

For the purpose of this discussion, urban areas can be defined as population centers of 50,000 or more people.[4] Within California, the two largest urban centers are Los Angeles and the San Francisco Bay Area. The roadway demands in these areas appear to be growing at a much greater rate than in other places. This is due to increases in the general population and workforce. These transportation systems are approaching maximum lane capacity and possible gridlock. Gridlock results when traffic volumes exceed lane capacity and when accidents or other incidents block lanes.

In an effort to keep pace with these growing transportation demands, the highway system is undergoing a major reconstruction effort designed to add lane capacity within the boundaries of existing state-owned right-of-way property. To accomplish this, existing center divider and paved right-hand

shoulder areas are being converted to full use traffic lanes. This eliminates all available emergency stopping or emergency vehicle access locations for highway patrol, ambulance, fire and towing vehicles.

On an urban freeway, it is estimated that every minute of lane blockage results in 5 minutes of delay time.[5] Consequently, only quick response to freeway incidents by emergency service providers can minimize delays. These delays result in adverse impacts on our society. Some of these include the following:

- Increased response times by fire suppression personnel and equipment, resulting in increased property loss due to delayed containment of fires.
- Increased response times by emergency medical service providers, reducing their ability to save lives and minimize long-term adverse effects from injuries and illnesses.
- Delayed law enforcement response to emergencies, resulting in longer delays in providing services, such as clearing the road.
- Decreased employee productivity resulting from lengthened commute times to work.
- Delayed delivery of needed supplies and equipment to businesses, residences, and public institutions.
- Increased pollution and its attendant health risks by vehicles standing idle for long periods of time in traffic.

The management of the freeway systems in California is a dual responsibility of the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans). The primary responsibility of Caltrans is the

design, construction, and maintenance of the system. The CHP's primary role is to assure the safe and efficient movement of people and property on the system. This includes, but is not limited to, traffic law enforcement, accident investigation, and removal of congestion-causing impediments. Successful accomplishment of these tasks requires expeditious response to traffic incidents.

The most frequent cause of lane blockages has historically been traffic accidents. For example, in the Southeastern part of the San Francisco Bay Area (Alameda County), the CHP averages approximately 264 accidents investigated per month on the freeway system. Based on a review of CHP accidents over several years, the vast majority of these generally occur during the major peak traffic periods of the day (6-9 a.m. and 3-6 p.m.).[6]

In summary, gridlock and other types of excessive delays will have a substantial negative effect upon our socioeconomic system. Given the nature and dynamics of this problem, what future state might be envisioned with conservative estimates of a worsening transportation environment?

## Section 2: Issue

The objective of this research project is to examine future system demands in urban areas and their possible consequences upon emergency response. Based on these findings, this paper specifically proposes to answer the question, "How Will California Law Enforcement Respond to Emergencies On Urban Freeways By the Year 2000?"

## Section 3: Scope and Limitations

Although the issue of future traffic demands and their impact on our society is an area of national concern and applicability, I intend to focus upon California's urban transportation system. I have selected this approach because California is the most populous state and I believe it has historically led the Nation in the growth of its transportation systems. Further, urban freeway systems are the most likely to experience the major consequences of transportation system growth. The main focus of this study is the identification of operational strategies that law enforcement might employ, in the future, to facilitate response to incidents on highly-congested urban freeways. It is recognized that there will be other social and/or legislative remedies attempted by government as well.

## Section 4: Use of Study

It is expected that the results of this study will enhance the ability of all law enforcement departments having traffic management responsibilities to deal with future transportation needs. In addition, this study might provide information about the future to enable local law enforcement agencies to develop their own strategic plans to cope with their growing transportation systems.

## Section 5: Literature Review

A wide variety of literature was reviewed during the research portion of this

study. The literature included studies prepared at the Federal, State and local levels, government memoranda, news articles, and previous Command College papers. None of the available literature provided potential solutions to the issue of this study. These studies did, however, provide information to assist in predicting the future demands on the transportation system and the consequences of heightened traffic congestion upon our society.

With regard to the question of whether or not highway use demand or congestion will increase by the year 2000, there was overwhelming affirmative consensus. For example, a 1989 United States General Accounting Office report on traffic congestion stated "...transportation experts generally agree that traffic congestion is an escalating problem."[7] In addition, the Institute of Transportation Engineers also concluded in their study on the future of urban traffic that: "Urban congestion is a current and worsening problem of significant dimension."[8] Finally, the issue of increasing traffic congestion in the future, especially for California, can be summarized by the following statement by the California Assembly Office of Research (AOR) in 1988:

> The warning signs on our road to the 21st century are everywhere. Traffic delay in our central cities, suburbs and rural areas is expected to increase eight to 11 percent each year through the year 2000.[9]

The AOR study also stated:

> This staggering growth in congestion and delay in large metropolitan areas is borne out by state figures which indicate that traffic congestion in the Bay Area grew 25 percent per year from 1982 to 1984 and in Los Angeles by 15 percent annually during the same period. Projections for the future indicate that congestion will only get worse.[10]

A key factor highlighted in the literature was that the major consequences of increased congestion will be geometrically escalating periods of delay.

According to a Caltrans study in 1989 entitled, Trends Affecting Caltrans, population will increase at a 2 percent per year rate, vehicle miles traveled (VMT) will increase at a 5 percent rate, and delay time will increase at a 15 percent rate. [11]

This conclusion was supported and expanded upon by the U.S. Department of Transportation in its study entitled, Moving America - New Directions, New Opportunities, which stated:

> Transportation touches the lives of all Americans-it affects their economic well-being, their safety, their links to other people and other places, the quality of their environment, their access to education and cultural activities, and their security at home and abroad. When transportation does not work well, it can be a source of great personal frustration and economic loss. Safe and efficient transportation, by contrast, supports the freedom and opportunity Americans have always cherished. [12]

## Section 6: Summary

In summary, all the sources reviewed confirmed that increasing congestion will occur in the future and longer delays will result. The effects of both will be extremely crucial to America's future quality of life. This is a major social and economic problem. Law enforcement's ability to quickly respond to emergencies in highly-congested urban transportation systems will be critically important to the future well-being of our Nation.

It is my intent to conduct a futures study next in order to obtain a clearer vision of how the transportation system will look throughout the next decade. Development of significant events and trends that will impact on the issue of this project will be necessary key elements of the futures study.

# PART II: FUTURES STUDY

## Section 1: Issue and Sub-Issues

### Issue

How can California law enforcement effectively respond to emergencies on congested urban freeways by the year 2000?

### Sub-Issues

1. What methods will law enforcement departments employ to expeditiously transport resources to freeway emergency incidents?

2. How will future freeway designs impact on law enforcement emergency service response time?

## Section 2: Sub-Issue Selection Criteria

Although many sub-issues could be identified in a study of this issue, I selected these two because they most directly addressed the key variables of the issue.

Because the focus is upon law enforcement operational issues, other applicable issues such as vehicle types, driver profiles of freeway users, legislation related to controlling freeway systems, and major funding mechanisms will not be included as an area of study in this report.

## Section 3: Operationally Defined Concepts

In an effort to assure a common understanding of the key concepts contained in this study, the following definitions are provided for the terms I use:

- o Law Enforcement – A law enforcement agency with traffic management responsibilities on freeway systems.

- o Response Time – The period of time it takes for a law enforcement officer to arrive at the scene of an emergency incident after the agency has received notification.

- o Refuge Area – Paved areas adjacent to freeway traffic lanes of sufficient width to stop and park vehicles during emergencies or enforcement stops, including both center dividers and right-hand shoulders.

- o A.D.T. – Annual Average Daily Traffic (ADT) is the total traffic volume for the year, on a specific section of roadway, divided by 365 days.

- o Emergency Incident – An unplanned event that negatively impacts the efficient flow of traffic on a freeway. These include such incidents as disabled vehicles, traffic accidents, spilled loads, fires, and medical emergencies.

- o Incident Management - The coordination of the efforts of personnel in identifying, verifying and clearing incidents.

- o Congestion - A condition caused by an increase in the number of vehicles attempting to use a roadway beyond the ability of the roadway to carry the additional volume. Congestion can also result from reduced speeds of traffic on a roadway.

- o Gridlock - A condition on a roadway that occurs when traffic volume exceeds roadway capacity to such a degree that traffic cannot move.

- o Freeway - A divided highway for through traffic with full control of access and with all crossings separated.

## Section 4: Data Interpretation

In the data gathering and analysis portion of this project a number of techniques were used to study the general issue and related sub-issues. First, background information and future projections were obtained through interviews and a Modified Conventional Delphi. The individuals used in these processes (see Appendix A) were provided with advanced project objectives and questions prior to the personal interviews (see Appendix B).

The participants identified several trends and events that might impact on the issue (see Appendixes C and D). All of the trends and events were defined for clarity prior to follow-up discussions with a group of panel participants. The panel rank ordered and selected the 5 most important trends and 6 events. A Trend Screening Table (Appendix E) was utilized in the selection process. The events were rank ordered based on the order of greatest possible impact and likelihood of occurrence. The highest were selected for further analysis.

Selected Trends

Trend #1 - Traffic Volumes On Freeways

The number of vehicles using the freeway system at various times of the day will be an important indicator of potential congestion problems, and the number of emergency incidents (i.e. accidents, disabled vehicles) that might be expected.

Trend #2 - Number of Registered Vehicles in California

The number of registered vehicles in California can reveal future demand on the freeway system. An increase in vehicles may be a strong indicator that mass transit systems are not favorably impacting future congestion. A decline in registrations may indicate a decline in future congestion.

Trend #3 - Cost of New Transportation System Facilities

This trend will reflect the cost of building new highways or modifying existing ones. If costs rise, less improvements can be made and vice-versa. How well an expanded highway system can effectively minimize congestion and delay is dependent upon how much the Department of Transportation can accomplish with available funding.

Trend #4 - Pollution Levels

Health hazards posed by pollution of all types is a growing concern. If vehicle emissions increase to a level posing unacceptable health risks, then strict controls on travel may occur.

Trend #5 - Public Interest in New Transportation Alternatives

The trend relates to the public's attitude toward the use of other transportation methods, such as mass transit systems. If the public moves more toward mass transit, then the freeway system will experience some level of congestion relief.

Selected Events

Event #1 - Middle East War Causes Gas Price Increase

If a war starts in the oil-rich middle east, then oil supplies may be reduced significantly to the United States. An event such as this would result in

higher gas prices and less fuel. The consequences would be numerous, including reduced travel by car and expanded utilization of mass transit systems.

Event #2 - A Major Earthquake Destroys Portions of Freeway System

If a major earthquake occurs in a major urban city in California, the damage to major freeway systems could be monumental and long-lasting. Travel methods and patterns could significantly change instantly.

Event #3 - EPA Restricts Travel Due to High Pollution Levels

If vehicle emissions rise to a level that poses significant health concerns, then regulatory or legislative action may be taken to limit vehicle usage. An event such as this could have a definite effect on future congestion.

Event #4 - Mass Transit Systems Are Expanded

If mass transit systems expand their routes and stations, they will increase ridership. This will have a positive effect on future efforts to reduce traffic congestion on freeway systems.

Event #5 - Integrated Traffic Management Systems Are Significantly Instituted

In the future, new technology utilizing such equipment as computers, traffic sensors, visual display boards, remote-controlled traffic lane delineators, and the like, may dramatically impact traffic and the demands upon law enforcement officers.

Event #6 - Gridlock Occurs On Urban Freeway Systems

If traffic volumes grow to exceed lane capacity, traffic may become so congested it cannot move. Should this occur, the movement of emergency vehicles on the highway may become virtually impossible.

## Section 5: Forecasting

After the trends and events were selected and reduced to the five most important, a group of panel members were asked to forecast the future of each of the trends and events. Their forecast focused on the panel's best estimate of how the level of each trend might change and what the probability of occurrence of each event might be throughout the next ten years.

### Trends

The following are the results of the trend forecasts. Each trend was charted and discussed individually and then compared to an assumed level of 100 today. The panel members estimated the level of the trend as follows:

- What it was five years ago.
- Where it "will be" (nominal forecast) in five and ten years from now.
- Where it "should be" (normative forecast) in five and ten years from now.

These estimates were based on the expectation that events and other factors evolved the way the panel members wanted (see Appendix F). The median value of the groups estimates are found in figures 1 to 5.

Trend #1 (T1) - Traffic Volumes On Freeways

Traffic volume on urban freeways has steadily increased. Since 1985, the growth trend has been approximately 25 percent and conservative simple extrapolation suggests that this figure might increase by 75 percent by 2000. Properly designed and implemented policies/procedures should strive to maintain traffic volumes at today's level (See Figure 1).

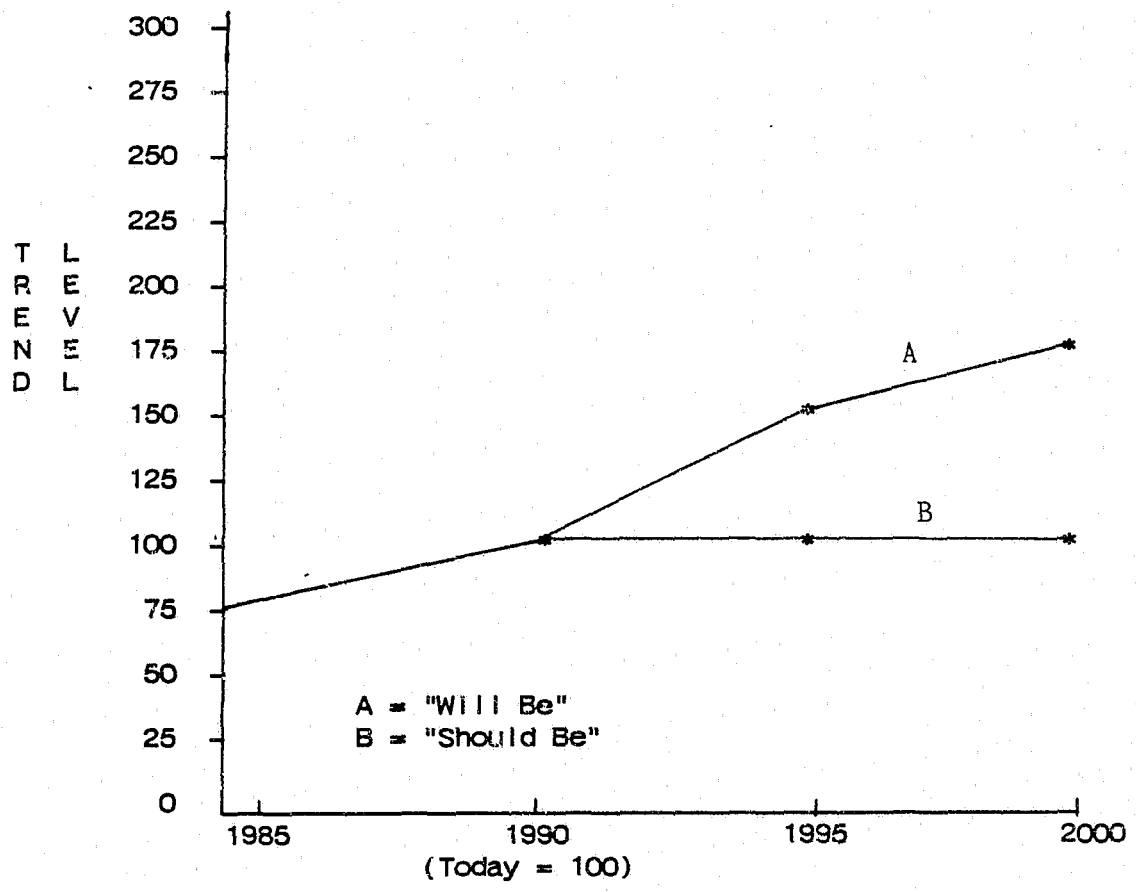


Figure 1: Trend 1 Forecast

Trend #2 (T2) - Number Of Registered Vehicles In California

The number of registered vehicles in California is projected to continue its increasing trend through the year 2000. The anticipated growth is expected to be approximately 50 percent more than today. This trend needs to be slowed as more registered vehicles translates to more volume. Slowing growth to not more than 25 percent by 2000 will help control congestion (See Figure 2).

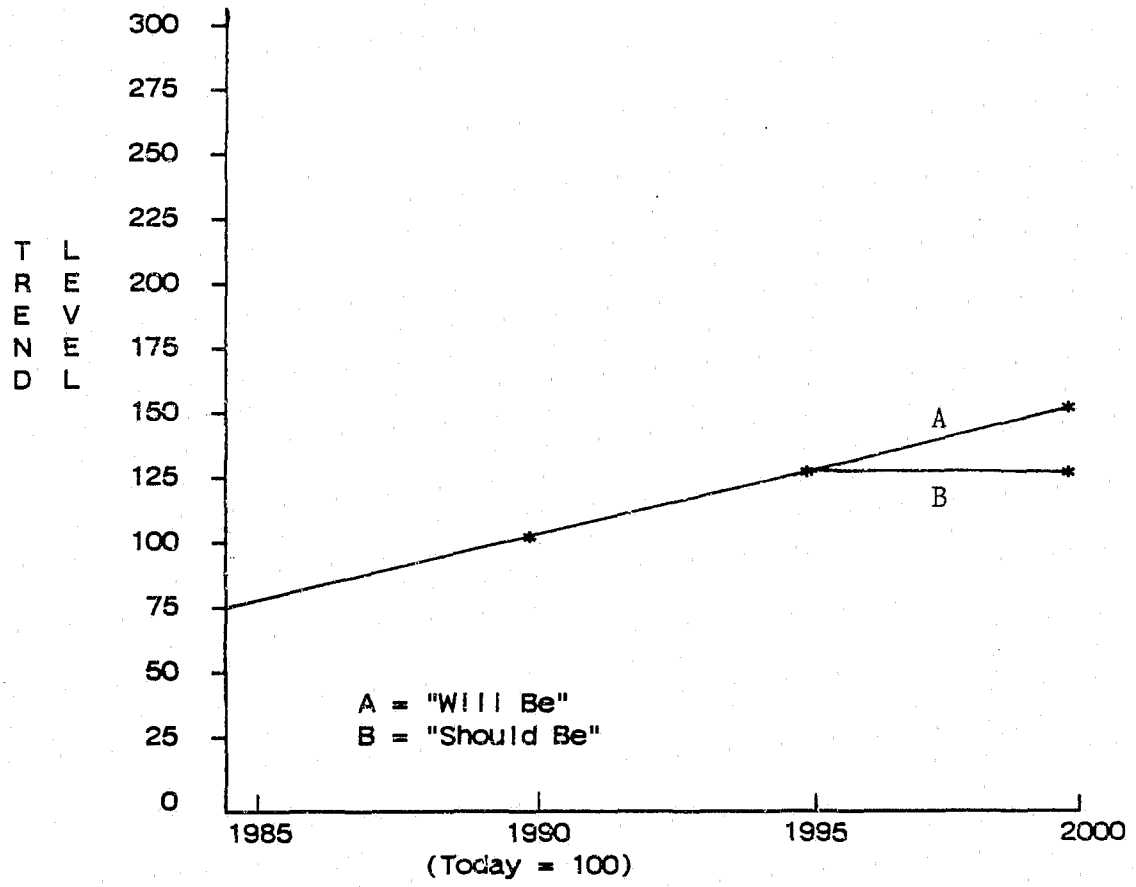


Figure 2: Trend 2 Forecast

Trend #3 (T3) - Cost Of New Transportation System Facilities

The cost of developing new transportation related facilities has always been high and will continue to increase at a high rate through the year 2000. Current trend projections suggest a 100 percent increase in costs. The cost of needed new construction, as well as necessary maintenance to existing facilities should be restricted to a growth level of not more than 75 percent (See Figure 3).

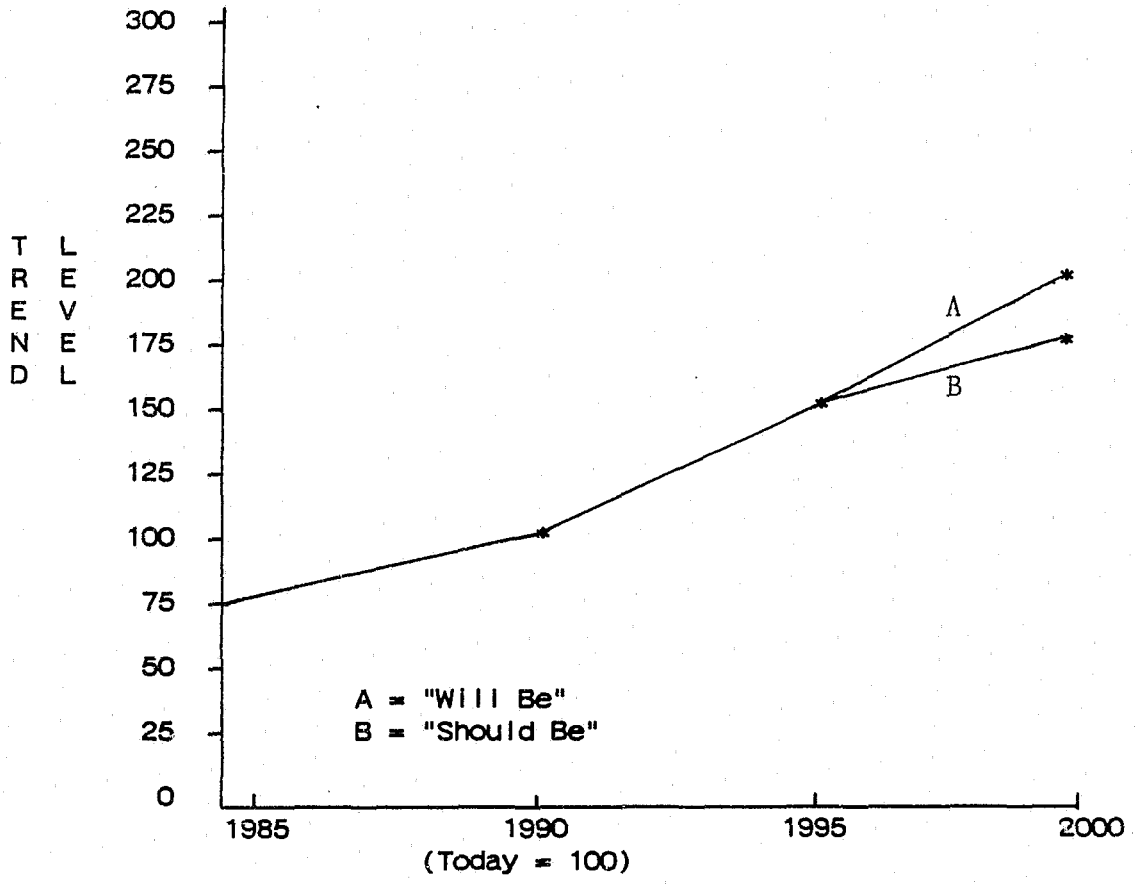


Figure 3: Trend 3 Forecast

Trend #4 (T4) - Pollution Levels

Air pollution in high quantities poses significant health hazards. Vehicle emissions contribute significantly to this problem. Trend projections suggest an increase by another 50 percent by 2000. Increased awareness and concern for public health should foster efforts that might lead to a 50 percent reduction (See Figure 4).

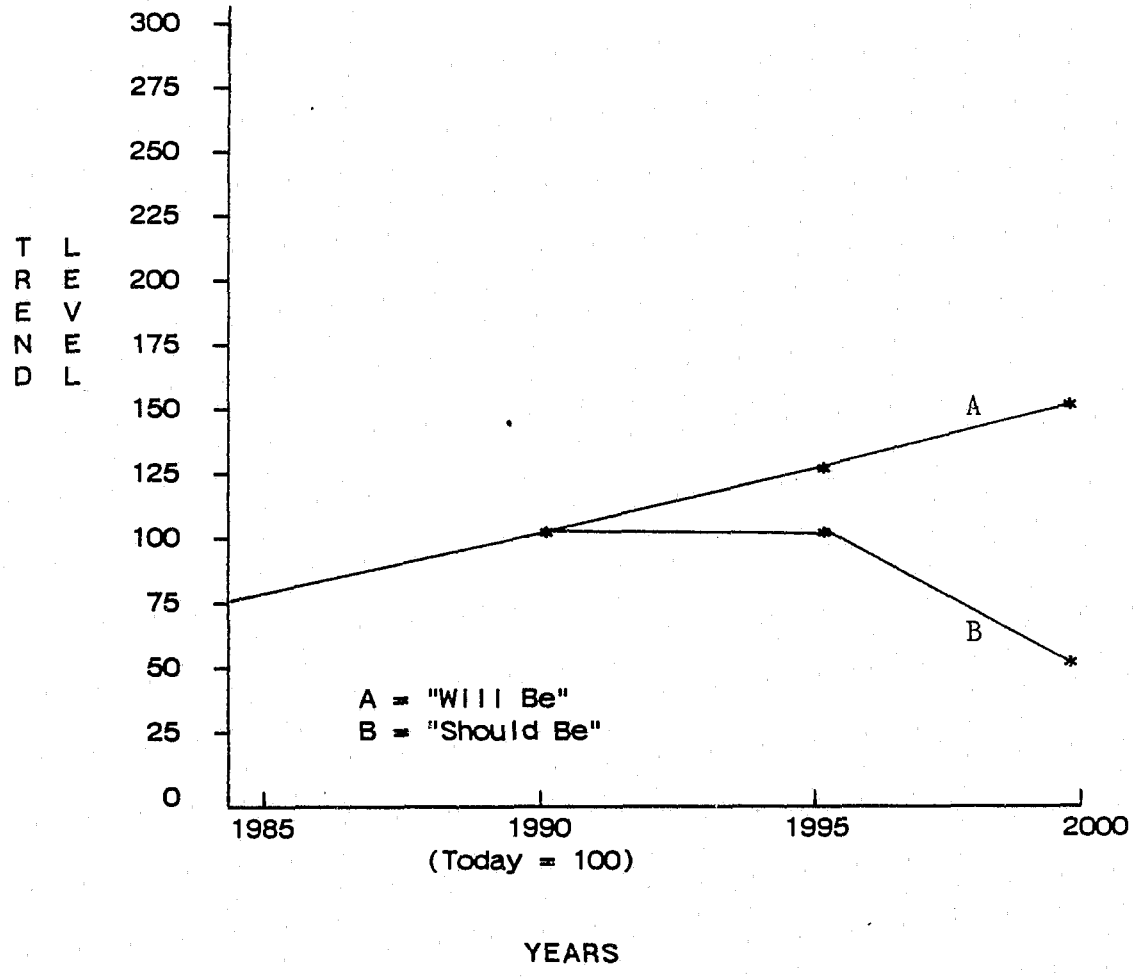


Figure 4: Trend 4 Forecast

Trend #5 (T5) - Public Interest in New Transportation Alternatives

Due to increasing congestion, there has been a steady growth in the interest of the public for alternative travel systems; especially commuting to work. While the level of interest trend is expected to grow 100 percent by 2000, it should be at least 200 percent by 1995 if there is to be a positive major impact (See Figure 5).

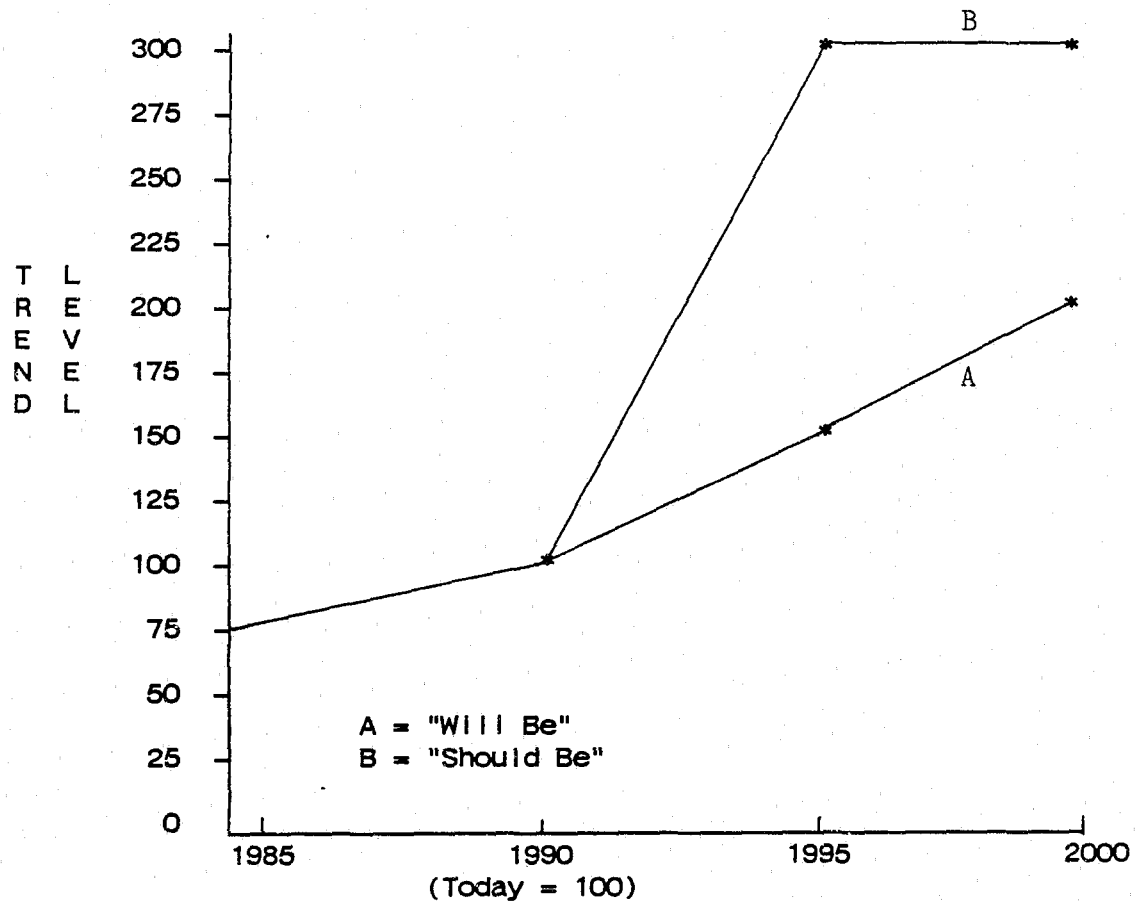


Figure 5: Trend 5 Forecast

Events

The six selected events were examined by the panel and a group consensus was used to determine the first year that the probability of occurrence might exceed zero (interval probability) and the actual probability of the occurrence of the event by the years 1995 and 2000 (cumulative probability). A scale of 0 to 100 was used in this effort.

In addition, the panel was also asked to forecast the impact upon the issue, Managing Emergency Response On Urban Freeways In California By The Year 2000 - A Law Enforcement Perspective. Specifically, they were asked to determine if the impact would be positive or negative and how strong on a scale of 0-10 (See Appendix G).

Event #1 (E1) - Middle East War Causes Gas Price Increase

The Modified Conventional Dephi Group identified this event prior to the occurrence of the Iraqi-Kuwait War in the Middle East. The group felt that a major, long-term war would adversely affect oil supplies and significantly increase gasoline prices. If an event such as this endures for an extended period, the public will be encouraged to turn to other modes of transportation, to reduce congestion. This event will make conventional emergency response methods easier. The group rated the positive impact of this event on the issue as a 10.

Event #2 (E2) - A Major Earthquake Destroys Portions Of Freeway

Several times throughout recent history, California freeways have been struck by major earthquakes. The last one occurred in the San Francisco Bay Area on October 17, 1989. The results were catastrophic to several highways, including total structure collapse. The group felt we have a 50 percent chance of another similar occurrence within 5 years and a 60 percent chance by 2000. If this occurs again, it will have a high negative impact level of 8 on the issue. This is because reduced roadways and lane capacity, along with continuing traffic volumes will result in increased congestion. Consequently, emergency response will be more difficult in many locations.

Event #3 (E3) - EPA Restricts Travel Due to High Pollution Levels

Pollution levels are posing increased health concerns each year. When they reach a level of intolerable risk, the government may institute measures to reduce traffic volume, such as mandatory carpools or restricted hours/days of vehicle operation. Such actions have a 20 percent chance of occurrence within 5 years and a 25 percent chance by 2000. If they do occur, the group believes it will have a high positive 7 impact on the issue, as it will result in reduced congestion.

Event #4 (E4) - Mass Transit Systems Are Significantly Expanded

Mass transit systems have long been thought of as a critical element of any freeway congestion relief plan. To date, in my opinion, mass transit has not had a significant effect upon reducing congestion. This is due to limited

routing and boarding stations. The group felt that there was a 70 percent chance of a significant system expansion that could lead to increased mass transit use by 1995, and a 90 percent chance by 2000. Because such an event would result in less vehicular travel on freeways during peak commute periods, the group thought this event would have a moderately high positive impact of 6.

Event #5 (E5) - Integrated Traffic Management Systems Are Instituted

Integrated traffic management systems involve the use of such new technology as advanced computers, remote-controlled, changeable message boards, lane sensors, and video cameras. This equipment, linked to central traffic operations centers, can monitor traffic and expeditiously reroute vehicles as needed. The chances of this consolidated system being operational within 5 years is projected to be 80 percent. By 2000, it has a 100 percent chance of occurrence. Because traffic can be monitored at all times, incidents will be detected immediately and emergency equipment can be deployed by the quickest available routing. An event like this will have a positive impact level of 7 on the issue.

Event #6 (E6) - Gridlock Occurs On Urban Freeway Systems

Gridlock can occur whenever traffic volume exceeds lane capacity or when an accident or other lane-blocking event occurs. Although there have been periods of heavy congestion and momentary gridlock, major gridlock has not occurred. The group felt, based on past and present trends, that this event has a 70 percent chance of occurrence by 1995, and a 75 percent chance by

2000. The impact is believed to be a highly negative one at a level of 9. If this occurs, transportation by any motor vehicle, including emergency vehicles, will be very difficult.

## Section 6: Cross-Impact Analysis

Following the identification of the five trends and six events of most significance to the issue, a Cross-Impact Matrix Evaluation was prepared (See Appendix H). The following is an analysis of the data contained in the Matrix. The impact of an event on another event can either increase, decrease, or have no effect on the probability of the event occurrence. The impact of an event on a trend can affect the strength and/or direction of the trend.

Events On Events (Probability Changes)

1. If a middle east war causes a gas price increase (E1) then:

   - o A major earthquake (E2) will have no change.
   - o EPA restricts travel (E3) will decrease from 25 percent to 12 1/2 percent.
   - o Mass transit system expansion (E4) will increase from 90 percent to 112 1/2 percent.
   - o Integrated traffic management systems (E5) will have no change.
   - o Gridlock (E6) will decrease from 75 percent to 47 1/2 percent.

2. If a major earthquake destroys portions of the freeway system (E2) then:

- o A middle east war (E1) will have no change.
- o EPA restricts travel (E3) will have no change.
- o Mass transit system expansion (E4) will increase from 90 percent to 112 1/2 percent.
- o Integrated traffic management systems (E5) will increase from 100 percent to 105 percent.
- o Gridlock (E6) will increase from 75 percent to 97 1/2 percent.

3. If the EPA restricts vehicles on freeways due to high pollution levels (E3) then:

- o A middle east war (E1) will have no change.
- o A major earthquake (E2) will have no change.
- o Mass transit system expansion (E4) will increase from 90 percent to 135 percent.
- o Integrated traffic management systems (E5) will have no change.
- o Gridlock (E6) will increase from 75 percent to 112 1/2 percent.

4. If mass transit systems are significantly expanded (E4) then:

- o A middle east war (E1) will decrease from 100 percent to 90 percent.
- o A major earthquake (E2) will have no change.
- o EPA restricts travel (E3) will decrease from 25 percent to 18 3/4 percent.

- o Integrated traffic management systems (E5) will decrease from 100 percent to 95 percent.
- o Gridlock (E6) will decrease from 75 percent to 37 1/2 percent.

5. If integrated traffic management systems are instituted (E5) then:

- o A middle east war (E1) will have no change.
- o A major earthquake (E2) will have no change.
- o EPA restricts travel (E3) will decrease from 25 percent to 23 3/4 percent.
- o Mass transit system expansion (E4) will decrease from 90 percent to 85 1/2 percent.
- o Gridlock (E6) will decrease from 75 percent to 52 1/2 percent.

6. If gridlock occurs on urban freeway systems (E6) then:

- o A middle east war (E1) will have no change.
- o A major earthquake (E2) will have no change.
- o EPA restricts travel (E3) will increase from 25 percent to 37 1/2 percent.
- o Mass transit system expansion (E4) will increase from 90 percent to 135 percent.
- o Integrated traffic management systems (E5) will increase from 100 percent to 170 percent.

Events On Trends (Amount of Direct Impact)

1. If a middle east war causes a gas price increase (E1) then:

   - o Traffic volumes (T1) will decrease by 10 percent.
   - o Number of registered vehicles (T2) will decrease by 10 percent.
   - o Cost of new transportation system facilities (T3) will have no change.
   - o Pollution levels (T4) will decrease by 10 percent.
   - o Public interest in new transportation alternatives (T5) will increase by 25 percent.

2. If a major earthquake destroys portions of the freeway system (E2) then:

   - o Traffic volumes (T1) will have no change.
   - o Number of registered vehicles (T2) will have no change.
   - o Cost of new transportation system facilities (T3) will increase by 25 percent.
   - o Pollution levels (T4) will have no change.
   - o Public interest in new transportation alternatives (T5) will increase by 30 percent.

3. If EPA restricts travel due to high pollution levels (E3) then:

   - o Traffic volumes (T1) will increase by 25 percent.
   - o Number of registered vehicles (T2) will increase by 25 percent.
   - o Cost of new transportation system facilities (T3) will have no change.
   - o Pollution levels (T4) will decrease by 25 percent.

- o Public interest in new transportation alternatives (T5) will increase by 40 percent.

4. If mass transit systems are significantly expanded (E4) then:

- o Traffic volumes (T1) will decrease by 10 percent.
- o Number of registered vehicles (T2) will decrease by 10 percent.
- o Cost of new transportation system facilities (T3) will have no change.
- o Pollution levels (T4) will decrease by 15 percent.
- o Public interest in new transportation alternatives (T5) will decrease by 25 percent.

5. If integrated traffic management systems are instituted (E5) then:

- o Traffic volumes (T1) will have no change.
- o Number of registered vehicles (T2) will have no change.
- o Cost of new transportation system facilities (T3) will increase by 10 percent.
- o Pollution levels (T4) will decrease by 5 percent.
- o Public interest in new transportation alternatives (T5) will have no change.

6. If gridlock occurs on urban freeway systems (E6) then:

- o Traffic volumes (T1) will decrease by 10 percent.
- o Number of registered vehicles (T2) will decrease by 10 percent.
- o Cost of new transportation system facilities (T3) will have no change.

- o Pollution levels (T4) will increase by 25 percent.
- o Public interest in new transportation alternatives (T5) will increase by 40 percent.

Summary

Based on the number of times an event impacts on other events and trends, the following is an order-ranked list of the events:

- o E4 - 8 impacts
- o E1 - 7 impacts
- o E6 - 7 impacts
- o E3 - 6 impacts
- o E5 - 6 impacts
- o E2 - 5 impacts

Event #4, The Expansion of Mass Transit Systems, seems to be the most vulnerable to the effects of other events and trends. A Middle East War (E1), restrictions on travel imposed by the E.P.A. (E3), gridlock (E6), increased traffic volumes (T1), increased vehicle registrations (T2), and air pollution (T4) will all increase the likelihood of an expansion in the mass transit system.

Event #1, A War In The Middle East, will impact several other events as a consequence of increased gasoline prices. As costs of operating single occupant vehicles increase so will the desire to utilize other mass transit alternatives.

Event #6, Gridlock, will increase demands for improved traffic management systems, as well as increased mass transit alternatives.

Event #3, Restrictions On Travel By The E.P.A., will require more efficient transportation systems and will force controls on the number of vehicles utilizing the system.

Event #5, Implementation Of An Integrated Traffic Management System, will lead to a better managed transportation system. The negative consequences of several other events and trends will increase the need for this type of system.

Event #2, A Major Earthquake, will result in a major traffic congestion problem. Based on past experiences the need to establish an adequate alternative transit system to freeways is absolutely critical.

## Section 7: Scenarios

From the data that has been acquired and analyzed, three futures scenarios have been developed. Scenarios provide a means whereby possible pictures of the future can be viewed. Scenarios are based on trend and event data previously developed by the Conventional Delphi Group and my own analysis. In order to scan the range of possible futures, exploratory, hypothetical, and normative scenarios are presented.

The "exploratory" (most likely) scenario is one which will occur if there are no intervening policies and events to alter the cause of the forecasted trends. The "hypothetical" (what if) scenario is characterized by a chaotic future in which events occur with surprising consequences. The "normative" (desired and attainable) scenario is one in which policies and actions are adopted and implemented to achieve a desired future.

Scenario #1 - Exploratory

The year is 2000. A law enforcement administrator gazes out her office window. She sees the freeway system packed with vehicles and a constantly present haze of pollution. Reflecting back on the last ten years, she recalls a number of occurrences that have steadily led the way toward this deplorably inefficient transportation system called an urban freeway.

In spite of a major Middle East War in 1991 and rising gasoline prices, the love Americans have for their automobile still prevails. The total number of registered vehicles has risen by approximately 50 percent and increased traffic volume has out-paced the addition of freeway lane capacity. Even though this trend was identified in 1990, the cost and time involved in constructing new highways exceeded revenue available for expansion. As a short-term and immediate remedy, California Transportation Planners converted all available center divider and right-hand shoulder areas to traffic lanes in 1995. This effort, was slow and barely managed to keep up with demand.

By 1995, all available space was already utilized for lanes. The system began to steadily decline due to overload--gridlock was quickly approached. This

was the beginning of the real nightmares for law enforcement administrators. Emergency personnel found it increasingly more difficult to respond to emergency incidents. Although a high technology system of freeway lane monitoring and traffic routing was implemented in the early 1990's, it has not been able to solve all the problems that continued emergency response delays have been causing for her departmental personnel and society, in general.

Scenario #2 - Hypothetical (Worst Case)

The year is 2000. The freeway system is a disaster. Throughout the last 10 years, the transportation systems' ability to keep pace with increasing user demands has been inadequate. Gridlock and extensive delays are a common daily problem. This has come about due to the occurrence of several events and trends that have had negative impacts on the system.

While traffic volumes increased, the highways were not expanded to meet the increased vehicle use. Constant debates went on between pro-freeway groups and mass transit supporters during the early 1990's, causing delay. In order to placate these two opposing groups, funds were divided between these competing interests, making neither system workable. As if this weren't bad enough, a major earthquake struck the San Francisco Bay Area along the Hayward Fault in July of 1995. The damage was extensive with approximately 30 percent of the freeway system destroyed.

The last five years have been a nightmare for everyone. The lack of adequate alternative systems and the sudden far-reaching damage of the earthquake required extreme measures. Mandatory car pooling and reduced work weeks

designed to reduce traffic volume have not helped much. The system is now approximately 50 percent over capacity and gridlock occurs during every commute period. Law enforcement officials, fire department administrators and emergency medical care providers are experiencing response delays that are 3 times as long as those in 1990.

Scenario #3 - Normative

The last ten years have been challenging for transportation planners, as well as law enforcement officials. Traffic volumes steadily increased by 75 percent in spite of a major effort to expand the mass transit system.

In order to keep up with the increasing highway demands, all highway right-of-ways were converted to traffic lanes by 1995. The first critical areas converted were all the existing center dividers and paved right-hand shoulders. This construction modification was extremely unpopular with law enforcement personnel having emergency responsibilities on freeways. It left them without their normal emergency access routes. The benefits derived from this change were short-lived, and by 1997, heavy congestion exceeded the added lane capacity. Law enforcement and other emergency providers experienced major response problems when lanes became blocked by accidents.

Between 1997 and 2000, new techniques and strategies were employed to cope with these problems. These included the establishment of an integrated traffic management system involving video-monitoring and remote-controlled traffic routing systems to immediately identify the occurrence of freeway emergency incidents and to re-route traffic as necessary. In addition,

special law enforcement response strategies were developed and implemented which enabled Highway Patrol officers to maintain acceptable response times that were equal to or better than those in 1990.

These strategies, as well as a change in highway designs in 1997 that provided for refuge areas placed at intervals along the freeways for removal of incident involved vehicles, has successfully kept the transportation system functional through the year 2000.

## Section 8: Summary

After an indepth examination of several significant events and trends, three possible future scenarios were developed. Based upon these efforts, we now have a clearer vision of a likely future. In Part III I will undertake the critical task of developing a strategic management plan.

# PART III: STRATEGIC MANAGEMENT PLAN

## Section 1: Overview

The objective of this part of the report is to develop a strategic plan that will enable the California Highway patrol (CHP) to expeditiously respond to urban freeway emergencies by 2000. Specifically, this plan will focus on achieving the "most desired and attainable" future described in Scenario #3 in part II. This effort will include the development of a mission statement, a situational analysis, identification of policy alternatives, and development of a structure for implementation.

## Section 2: Mission Statements

### Macro-Mission

The primary mission of the California Highway Patrol is the management and regulation of traffic to achieve safe, lawful and efficient use of the highway transportation system.

### Micro-Mission

The mission of the CHP includes the specific responsibility for efficiently managing traffic on urban freeway systems in a manner that provides expeditious response and mitigation of congestion-causing events.

## Section 3: Situational Analysis

A situational analysis was conducted using the WOTS-UP methodology. The Department's internal capability and its external environment were examined. Specifically, this process focuses on the Weaknesses, Opportunities, Threats, and Strengths related to the Department. The weaknesses and strengths apply to the internal operation of the Department and the opportunities and threats address the external environment. The following are the findings of that analysis.

### Strengths

The California Highway Patrol is one of the largest traffic law enforcement agencies in the Nation, if not the world. Because of its size, as well as a vast amount of traffic management experience since its inception in 1929, the Department has an outstanding reputation for competence. In a survey of several CHP personnel, conducted by Captain Michael Garver in 1989, the following were found to be Departmental strengths:[13]

- Community Support
- Political Support
- Accident Investigation Skills
- Specialized Traffic Tasks
- Training
- Skill Levels of Managers
- Skill Levels of Supervisors
- Skill Levels of Officers

- Level of Training in General

In addition, the Department has taken a proactive role in providing input into highway design prior to construction. Through experience in major urban areas throughout California, the Department has learned the importance of maintaining the necessary operational space needed for patrol officers to perform their duties. Failure to provide for these needs can prevent the Department from achieving maximum safety results (i.e., alternative routes for emergency incident response, space to make safe traffic enforcement stops).

Weaknesses

Like other organizations, the CHP also has its share of weaknesses. Some are the result of internal factors and some from external. Some of the weaker areas identified in Captain Garver's survey are as follows:

- Inadequate Staffing
- Inadequate Incident Response Time
- Inadequate Acquisition and Utilization of Technology and Equipment
- Managers' Inability to Deal With Change
- Officers' Inability to Deal With Change

Many of these findings will have a direct effect on the issue of this report. For example, if CHP personnel believed response time was a problem in 1989, what will be our real inadequacies by 2000? Also, in order for organizations to successfully cope with future events, they must be flexible and adaptable. This survey identified, however, that both managers and officers have problems dealing with change.

Threats

Threats are forces that have a negative impact on an organization from external sources. Obviously, budget cuts resulting from declines in revenues are always a threat. Although the CHP is funded from motor vehicle revenues and not from the State's general funds, there are some risks. Often, when general funded departments experience reduced funding, they turn to the use of specialized funds. When this occurs to the Motor Vehicle Fund, it jeopardizes the CHP's ability to maintain adequate staffing and equipment.

Currently, the Commissioner (Chief Executive Officer) of the CHP is appointed by the Governor. In the past, the commissioner was changed every time the Governor changed. This creates a situation of instability which results in organizational stagnation until a new commissioner is appointed. With each change, the organization must often adopt new philosophies, strategies and goals. Previously established policies may be discarded in a moment after much work and effort. Both of these threats can adversely affect the Department's ability to conduct meaningful long range planning (5-10 years).

Opportunities

With its vast traffic management experience, indepth understanding of highway design considerations, and transportation systems management, the CHP should actively help shape the future of tomorrow's transportation system. The CHP's excellent reputation with community groups, transportation advisory boards, and the legislature can result in even more opportunities for the CHP to express its views and recommendations before a variety of different forums.

## Section 4: Stakeholder Analysis

Any affected individual group, or those who might attempt to influence the issue or law enforcement's approach to it are often referred to as stakeholders. A "snaildarter" is a non-obvious group of stakeholders who might cause a serious problem with the implementation of any part of the program.

A committee of law enforcement professionals developed a list of possible stakeholders (See Appendix I). The five most important stakeholders and three snaildarters are as follows:

| Stakeholders | Snaildarters (SD) |
|---|---|
| 1. CHP Commissioner | 1. Private Highway Investors |
| 2. CHP Road Patrol Personnel | 2. Environmental Protection Advocate Groups |
| 3. Commuters | 3. Real Estate Developers |
| 4. State Department of Transportation | |
| 5. Emergency Service Providers | |

### Strategic Assumption Surfacing Technique (SAST)

In order to develop and implement effective policies, it is important to assess the concerns of the stakeholders involved. The following will include a discussion of how each stakeholder may feel about the issue of managing emergency response to incidents on urban freeways in the future. Overall, stakeholders will either support, oppose, or have mixed feelings regarding an

issue or proposed strategy. To assist in later strategic and transition management planning, their anticipated overall position is also included.

Assumptions

1. CHP Commissioner - Support

   A. Has a strong interest in maintaining an expeditious response time to freeway emergencies.
   B. Supports innovative approaches to accomplishing tasks.
   C. Public and allied agency relations are a high priority.

2. CHP Road Patrol Personnel - Mixed

   A. Desire to be involved in strategy development process.
   B. Supports efforts to improve status and methods to perform responsibilities.
   C. Are opposed to any concepts that significantly require more work without necessary additional personnel resources.

3. Commuters - Support

   A. Expect quick response by emergency personnel to freeway-blocking incidents.
   B. Support any reasonable efforts that reduce delay time.
   C. Are willing to contribute financially to implement strategies that reduce their commute time.

D. Expect the CHP to respond quickly to and expeditiously mitigate traffic problems on roadways.

4. State Department of Transportation - Mixed

A. Supports technological solutions to highway congestion problems.

B. Strongly desires to be primary coordinator of traffic management efforts.

C. Supports highway designs/modifications that utilize existing right-of-way rather than purchasing additional property.

D. Supports mass transit system solutions to increasing traffic volumes.

5. Emergency Service Providers - Support

A. Desire to maintain quick response times to emergencies.

B. Will support strategies that assist them in getting to and from freeway incidents.

C. Oppose highway designs that eliminate shoulders and center divider areas.

6. Private Highway Investors - Snaildarters

A. Opposed to tax increases that fund public highway expansion.

B. Support private management of transportation system.

C. Support CHP traffic enforcement on private roads at public tax expense.

7. Environmental Protection Advocate Groups - Snaildarters

A. Oppose new highway construction.

B. Support mass transit systems.

C. Support improving emergency response times or existing transportation facilities.

D. Oppose efforts that result in continued utilization of freeway system.

8. Real Estate Developers - Snaildarters

A. Support improving existing transportation system.

B. Opposes acquisition of additional right-of-way in urban areas unless property values enhanced.

C. Support efforts that reduce negative effects of increasing congestion on real estate housing market.

Strategic Assumption Surfacing Technique (SAST) Plot

The following chart (Figure 6) plots each stakeholders assumption in two ways; first by its level of certainty and second by its level of importance.

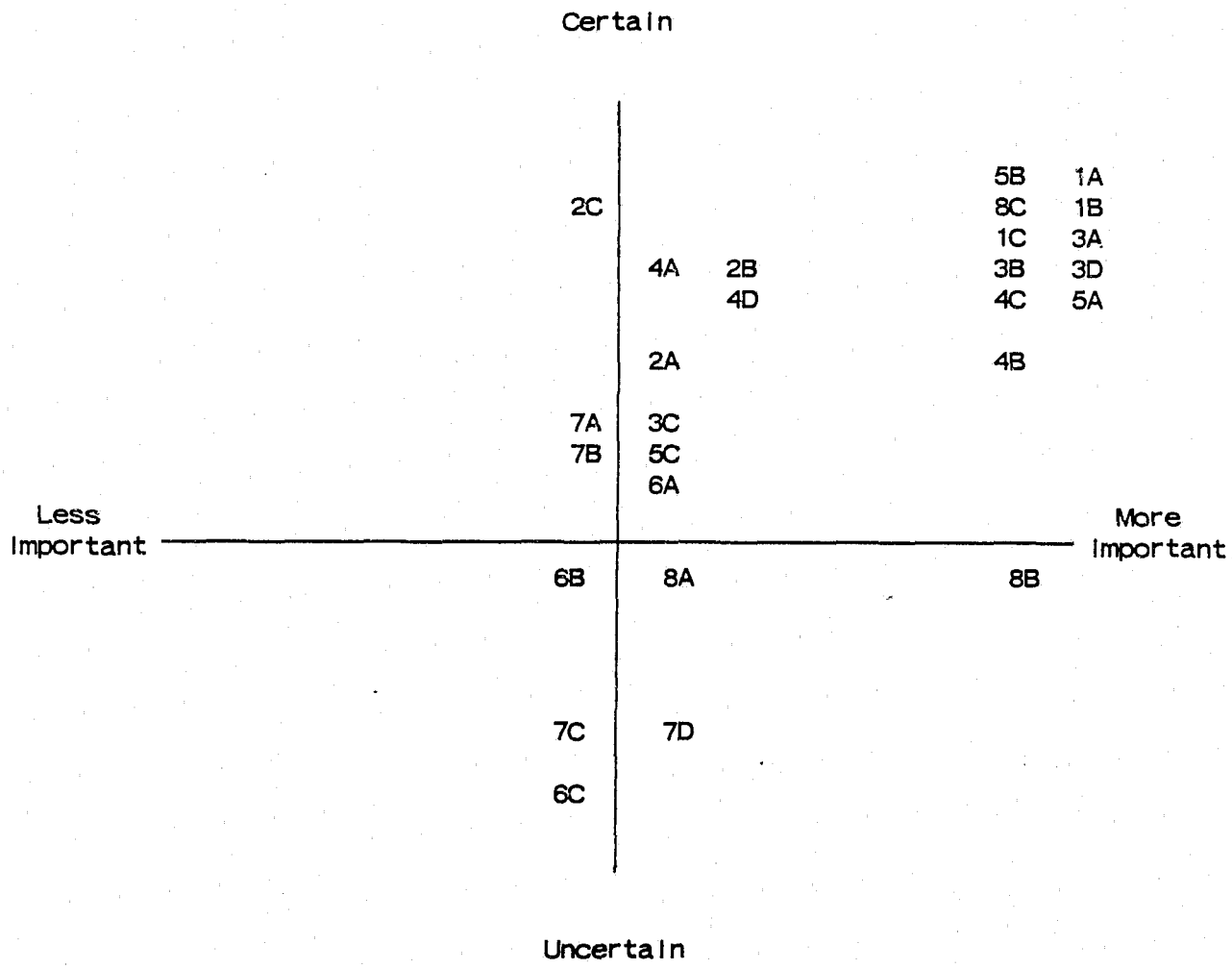


Figure 6: SAST Plot

When examining the results detailed on the SAST plot you can readily see that the CHP Commissioner's strong interest and support in maintaining expeditious response times to emergencies, and the expectations of commuters and other emergency service providers, that rapid response will be achieved, are the most important assumptions of those identified.

## Section 5: Execution Of Alternative Strategies

### Modified Policy Delphi

After detailed discussions of the issue, a group consisting of several in-house CHP personnel developed a list of alternative strategies. The modified policy technique that was utilized allowed each member to contribute suggested strategies to a list for further consideration. They then rated the various strategies and selected the following five based on their level of desirability and feasibility:

1. Develop a public education program describing recommended actions when confronted with freeway lane-blocking incidents.
2. Develop an integrated traffic management system to electronically monitor and route traffic.
3. Assure future freeways include paved areas adjacent to traffic lanes for lane-clearing operations during emergencies.
4. Create specialized emergency response units that are pre-positioned along urban freeways for rapid emergency response.
5. Increase the utilization of motorcycles as initial response vehicles during high congestion periods.

Other strategies, such as helicopter removal of hazards and major redesign of freeways, were also discussed. However, the group believed these strategies to be too expensive and therefore improbable within the next 10 years.

### Selected Strategy Analysis

The following is a brief discussion of each of the five proposed strategies.

1. Develop A Public Education Program

The public has a direct impact on how quickly emergency incidents are cleared in several ways. They are either directly involved when they block a lane after an accident/mechanical breakdown or when their curiosity causes them to look at the activities at an accident. In the past, people were educated and conditioned not to move their vehicles after an accident until a law enforcement officer arrived. In the future, they should be advised to clear the lanes immediately when there are no injuries. A public education program will encourage this, as well as the need to stay alert and not to succumb to their natural curiosity and hold up traffic. This concept might have to be extended to include the requirement that involved parties go to CHP business offices for accident reporting when minor non-injury accidents occur and their vehicles are not disabled. Time-consuming, on-scene investigations may not serve the best interests of the public in general due to the extensive traffic delays they cause.

2. Develop An Integrated Traffic Management System

In order to accelerate our ability to know when emergency incidents occur on freeways and to immediately send appropriate equipment, a consolidated video monitoring and control center should be created. Systems similar to this have been tested in Los Angeles and have proven feasible. In an expanded version, the system should include monitoring of the entire freeway system through the use of video cameras and roadway-imbedded sensors in traffic lanes. This information can be channeled to control centers operated by traffic management experts, who will, upon becoming aware of a lane blockage, call emergency equipment and begin traffic

routing via message display boards along the freeway. They can also coordinate the best routes for emergency response personnel.

3. Assure Future Freeway Refuge Areas

Due to the cost of right-of-way and increasing demands on existing freeway capacity, the transportation system is beginning to lose its center dividers and paved right-hand shoulder areas. This area has historically been critical to emergency incident responders as alternative response routes and for lane-clearing operations. In the future, urban freeways should at least include paved areas, to be used for lane clearance, spaced at least every 1/2 mile. These 1/2 mile intervals will hold vehicle removal distances to a maximum of 1/4 mile in either direction of an incident, which is blocking lane(s).

4. Create Specialized Emergency Response Units

Given the probability of future gridlock-type traffic conditions or at least close to it, previous methods of personnel deployment and equipment response will not be as effective by the year 2000. Acceptable response times will depend upon personnel and lane-clearing equipment being in close proximity to incidents when they occur. To accomplish this, the CHP should pre-position specialized response teams, consisting of one law enforcement officer and one civilian employee in an emergency response vehicle capable of pushing or towing cars and medium trucks. A unit like this should be located adjacent to the freeway approximately every five miles. These units could be dispatched by the traffic control centers. The CHP officer could provide medical aid and scene management while the civilian employee coordinates lane clearance. Because of the pre-positioning, response times should frequently be under 5 minutes.

5. Increased Utilization of Motorcycles

Due to the anticipated growth in congestion, it is highly likely that conventional type patrol cars will have difficulty responding to incidents. Therefore, increased deployment of motorcycles in high congestion areas during peak congestion periods will significantly improve response capability. Their ability to drive between vehicles (lane splitting) allows them to move through stopped traffic when a car cannot.

Recommended Strategy

As previously indicated, the best approach would involve a combination of all five of the previously described strategies. However, depending on the specific traffic problem being faced and the resources available, any of the strategies could be deployed singularly or in combination.

## Section 6: Implementation

The successful implementation of any new strategy requires careful planning. The following is a brief description of the various planning steps necessary to implement the five previously identified strategies, including estimated time tables. In some cases, the steps of one strategy could be combined with those of other strategies. A further discussion of this implementation process will also follow in Part IV of this report, entitled Transition Management Plan.

Strategy #1 - Develop A Public Education Program

- o Present concept to CHP Executive Management for approval (1 month).
- o Establish a Public Awareness Campaign Advisory Committee (1 month).
- o Submit recommended committee plan, including cost analysis, to CHP Executive and Top Management for approval (3 months).
- o Assign statewide program coordination to CHP Office of Public Affairs (1 week).
- o Conduct pre-campaign training of field command, public affairs officer, and general orientation of all other CHP personnel (1 month).
- o Implement feedback and evaluation process.
- o Resources will include funding for development of public affairs materials (i.e, television and radio spots, etc).

Develop A Public Education Program

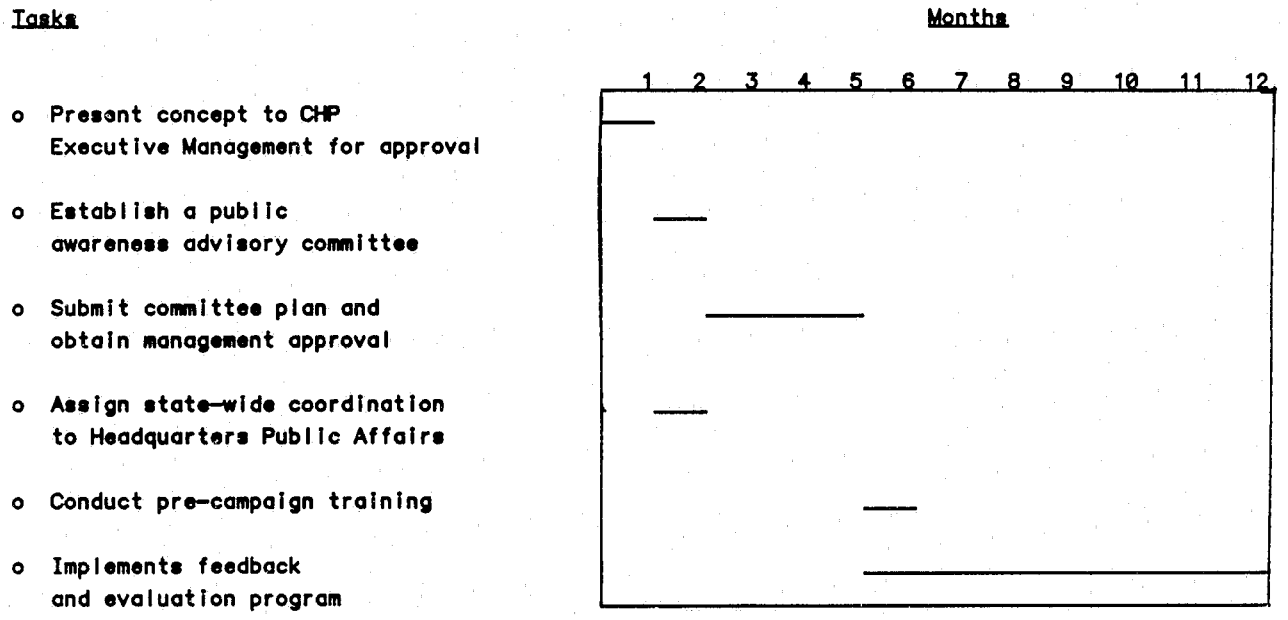


Figure 7: Strategy #1 Timetable

Strategy #2 - Develop An Integrated Traffic Management System

- o Present to CHP and Caltrans Executive Management for approval (1 month).
- o Establish a joint planning group consisting of CHP, Caltrans, and other traffic management experts to develop framework of proposal (6 months).
- o Present proposal to legislature and Governor for approval (3 months).
- o Establish joint project oversight committee to coordinate implementation of system (1 month).
- o Select and train personnel to staff traffic operations center and procure equipment (3 months).
- o Conduct public and law enforcement awareness program (6 months).
- o Establish feedback and evaluation process (6 months).
- o Resources will include funding for development acquisition, and installation of necessary high-tech monitoring and control equipment.

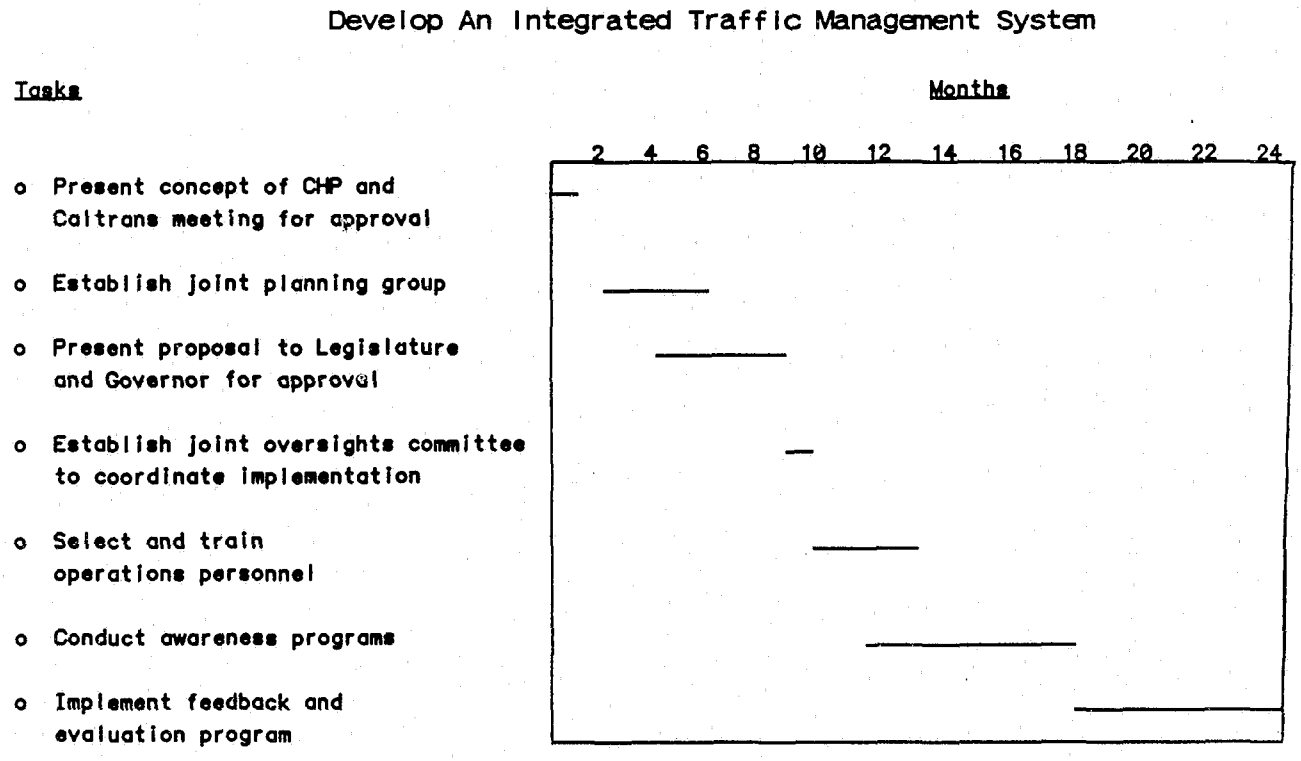


Figure 8: Strategy #2 Timetable

Strategy #3 - Assure Future Freeway Refuge Areas

- o Present concept to CHP Executive Management for approval (1 month).
- o CHP Executive management meets with Caltrans Executive Management for presentation of concept and development of joint position (1 month).
- o Joint presentation by CHP and Caltrans to other principal approval parties (2 months).
  - California Business, Transportation and Housing Agency
  - Legislature
  - Governors Office
  - Federal Highway Administration
- o Caltrans establishes new freeway design specifications (3 months).
- o Establish feedback and evaluation process (6 months).
- o Resources will include design engineer time and construction costs.

Assure Future Freeway Refuge Areas

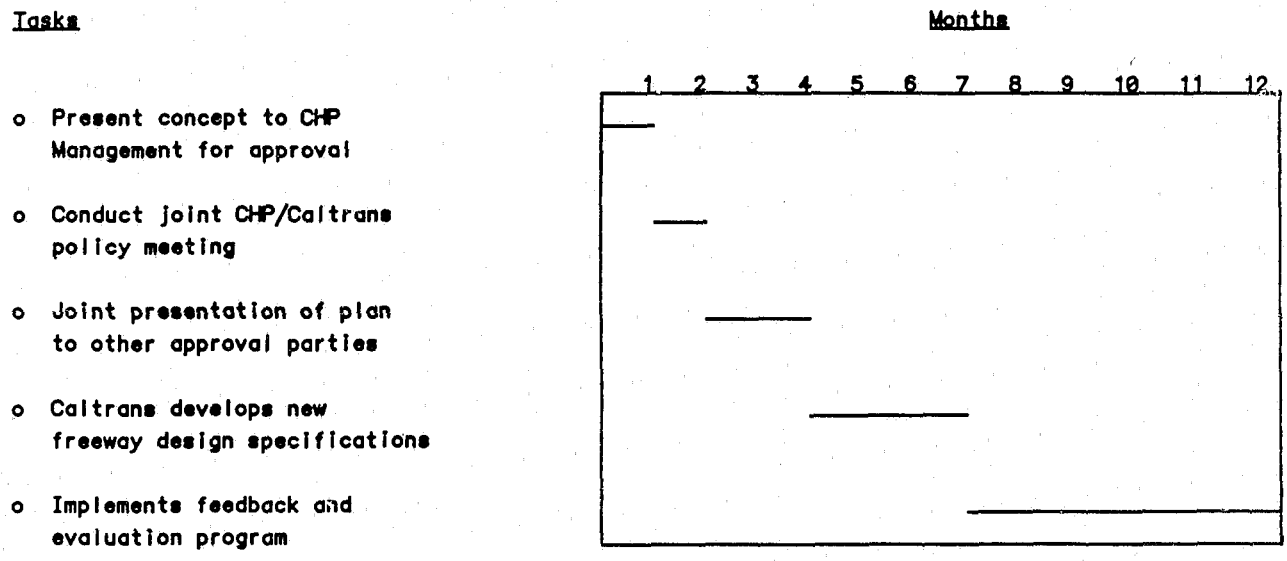


Figure 9: Strategy #3 Timetable

Strategy #4 - Create Specialized Emergency Response Units

- o Present concept to CHP Executive Management for approval (1 month).
- o Establish project development committee including management, supervisors, patrol officers, and traffic officer's association representative (1 month).
- o Develop final program policies/procedures and vehicle equipment specifications (3 months).
- o Acquire equipment and staging locations (7 months).
- o Select a pilot test area and conduct field training (2 months).
- o Conduct field test of concept (1 year).
- o Provide test results to CHP Executive Management for review and modifications before future expansion.
- o Resources will include vehicles, personnel, and staging facilities.

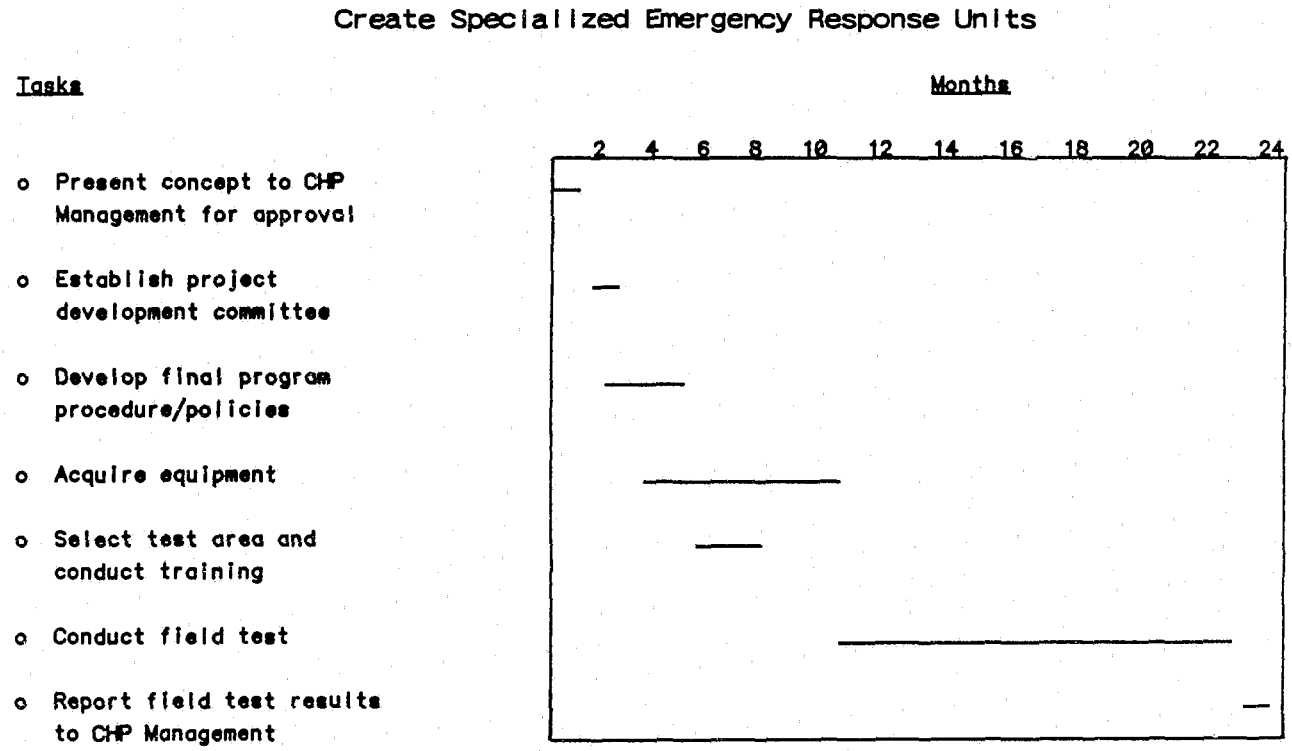


Figure 10: Strategy #4 Timetable

Strategy #5 - Increased Utilization Of Motorcycles

- Present concept to CHP Executive Management for approval (1 month).
- Select test area and expand the number of motorcycles for deployment (3 months).
- Establish feedback and evaluation process to test strategy (6 months).
- Report findings to Executive Management for future statewide application (1 month).
- Resources will include exchange of cars for motorcycles.

Increased Utilization of Motorcycles

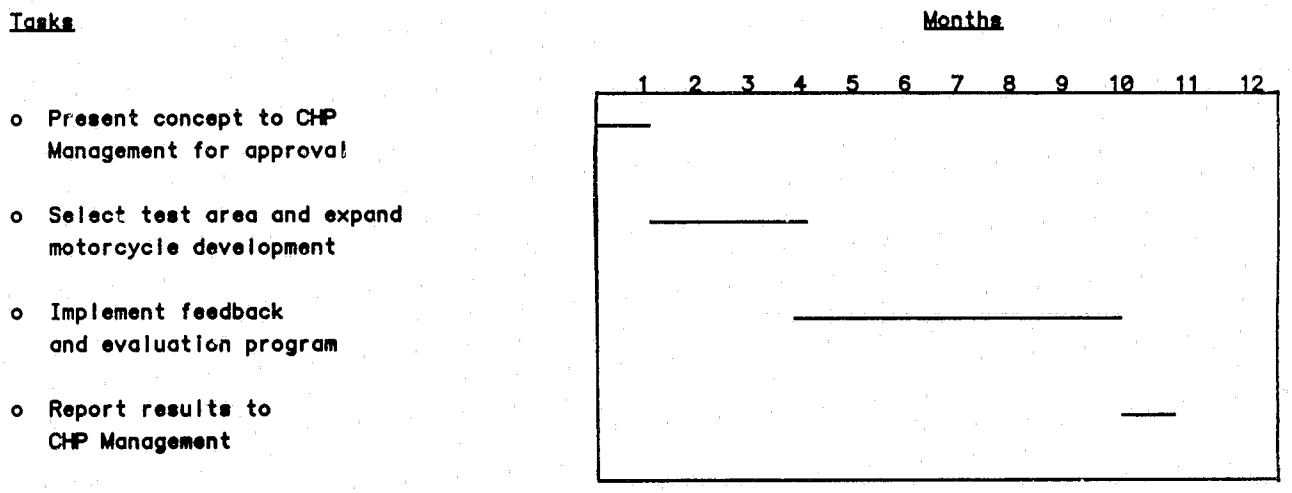


Figure 11: Strategy #5 Timetable

## Section 7: Summary

In this part a strategic management plan was developed that includes five separate strategies that can be implemented individually or in conjunction with one or more of the others. In Part IV of the report a transition management plan will be developed that will serve as a guide through the implementation process.

# PART IV: TRANSITION MANAGEMENT PLAN

## Section 1: Overview

The objective of Part IV is to develop a transition management plan that will guide a law enforcement department through the complex task of implementing the strategic plan identified in Part III. This part focuses upon critical mass analysis, the commitment plan, responsibility charting, and transition management structures.

## Section 2: Critical Mass Analysis

As a continuation of the stakeholder analysis discussed in part III, the critical mass was identified. The critical mass can be defined as the key individuals or groups whose support is essential to the successful implementation of the strategic plan. The following are the individuals/groups that make up the critical mass:

- o CHP Executive Management

  The support of CHP Executive Management is absolutely essential if any of the elements of the strategic plan are to be implemented. Although the Department's Executive Management Team consists of four members, the approval and support of the Commissioner is the key.

- o Caltrans Executive Management

  The support and direct involvement of Caltrans is vital as they are responsible for the highway infrastructure and control the funds needed to develop the technology necessary to implement the

strategic plan. The department's Director is the key, as well as their district directors in the large urban areas.

- CHP Officers Association

  Several elements of the strategic plan will require a redefinition of the officers' job duties and, to some degree, changes in working conditions. The support of the association in the development of these changes is very important to "selling" this strategy to those people who will be required to carry it out.

- Freeway Commuters

  These are the citizens most impacted by successful or unsuccessful congestion relief strategies. If things work well, they respond by supporting the policies and any needed funding. Conversely, if things do not operate well, they pressure politicians and department administrators to make changes. Therefore, their support of this strategy will significantly impact whether administrators will or will not approve of its implementation.

## Section 3: Commitment Plan

A commitment plan is a strategy, described in a series of steps, designed to secure the support of the key people identified as critical to accomplishing the desired change. Having a clear idea of where the critical mass will stand on the strategic plan is an important part of the commitment planning. Commitment charting is one technique that can be used to assist in this

diagnosis (see Figure 12). In the chart, an "X" is first placed at the group's current position of commitment and then an "O" is used to indicate the minimum level of commitment needed for success. The critical mass individual/groups can either block change, let change happen, help change happen, or make change happen.

Type of Commitment

| Critical Mass | Block Change | Let Change Happen | Help Change Happen | Make Change Happen |
|---|---|---|---|---|
| CHP Executive Management | | | X | O |
| Caltrans Executive Management | X | | | O |
| CHP Officer Association | X | O | | |
| Freeway Commuters | | X | O | |

Figure 12: Commitment Chart

Commitment Analysis

The following is a discussion of the assumptions contained in the previous commitment chart:

- CHP Executive Management

  The primary responsibility of the CHP is traffic management; therefore, CHP Executive Management has always had a high level of interest and commitment in pursuing strategies that improve traffic conditions. However, due to limited personnel and fiscal resources the Commissioner must be selective in which strategies are approved

for implementation. Because of this necessity, the basic position is help change happen, usually through encouragement of new ideas. Actual implementation will require his movement to make it happen.

- o Caltrans Executive Management

  Caltrans also has a major interest in assuring efficient traffic flow as they are responsible for designing and maintaining the actual freeway system. They have most of the fiscal resources and generally view the system primarily from an engineering perspective. If a new strategy doesn't fit into their previously developed plans they are often reluctant to change or expend funds on non-engineering type items. Consequently, they may be a block to some aspects of the proposed strategy initially. To assure adequate funding and the technological changes identified in the strategy are provided they must be moved to make it happen.

- o CHP Officers Association

  The proposed strategy will result in some new job descriptions, as well as deployment times. Typically, the association will not support any changes unless they are convinced that the changes will not adversely affect their membership. The strategy will work most effectively if they enthusiastically support it. Therefore, a move to a position of help change happen would be desirable.

- o Freeway Commuters

  Freeway commuters want the freeway system to operate with minimal delay. Although a large group they are generally quiet and unified

In their efforts to initiate new strategies. They will usually just let transportation authorities do what they want unless they become significantly dissatisfied. Because they represent such a large group, they do get the ear of both politicians and administrators when they decide to voice their opinions about issues. Therefore, if they could be moved to help change happen by voicing support for the strategies as they are being implemented, the program's continuation will be more assured.

Readiness/Capability

Once the critical mass individuals/groups were identified, an analysis was conducted to determine those actions necessary to change or influence the positions held by those members. A readiness/capability analysis was used for this purpose (see Figure 13). The chart rates the readiness/capability of the critical mass and identifies the best prepared to lead the change effort.

| Critical Mass | Readiness | | | Capability | | |
|---|---|---|---|---|---|---|
| | High | Medium | Low | High | Medium | Low |
| CHP Executive Management | X | | | X | | |
| Caltrans Executive Management | | | X | X | | |
| CHP Officer Association | | X | | | X | |
| Freeway Commuters | | | X | | X | |

Figure 13: Readiness/Capability Chart

The only area for concern in the readiness/capability scores is the low readiness score for Caltrans. Their full support and expeditious action in implementing the strategy is vital. The score would indicate that while they are fully capable, they may be slow in providing the support and resources necessary.

## Section 4: Responsibility Charting

Another key step in transition management involves the assignment of responsibilities to the appropriate people. A technique called responsibility charting has been developed to assist in that effort. It clarifies behavior that is required to implement important changes, tasks, actions, or decisions. It also helps reduce ambiguity, wasted energy, and adverse emotional reactions between individuals or groups. For project purposes, charts were developed depicting the responsibilities associated with each of the five previously discussed strategies in Part III (See Appendixes J-N).

## Section 5: Transition Management Structure

In order to assure that implementation of the new strategic plan is properly carried out, a carefully developed management structure must be established. As this strategic plan incorporates five separate strategies, a combination project manger and advisory team will be used.

The project manager should be a captain appointed by CHP Executive Management. The captain should have a good working knowledge of transportation management and planning. His role will be to function as a liaison officer with Executive Management and to coordinate the execution of the many responsibilities identified in the responsibility charts (See Appendixes J-N). The project manager will also chair the advisory committee.

In addition to the project manager, an advisory committee will be established to assist in the final planning and procurement of resources, as well as the development of needed policies and procedures. The committee should include the following:

- Commander of the CHP Office of Public Affairs
- Commander of the CHP Traffic Operations Planning Unit
- Commander of the CHP Office of Special Projects
- Caltrans Representative
- CHP Area Commander
- CHP Officers Association Representative

As most of the advisory committee members also have primary responsibility for various tasks within the five strategies, they should be able to resolve unforeseen problems quickly during committee meetings. Through the development of a greater knowledge of all the strategies, they should be able to arrive at workable compromises faster when the need arises. They will also gain the knowledge necessary to "sell" the changes to their respective constituencies.

## Section 6: Summary

In this part we examined the critical mass effected by the five alternative strategies and developed a transition management plan designed to implement the necessary changes as smoothly as possible. In Part V the overall conclusions and recommendations arising out of this study will be presented, as well as several future implications.

# PART V: FUTURE IMPLICATIONS

## Section 1: Overview

The final objective of this report is to summarize the conclusions and recommendations that have been developed through the various techniques discussed earlier in Parts I - IV. In addition, a discussion is also included relative to the future implications that this study may have.

## Section 2: Conclusions

The primary focus of the study was on urban freeway systems and how response to emergencies will be managed by the year 2000. As a necessary first step in this process, the future highway design and traffic demands on the transportation system were projected. This was accomplished through extensive literature review, interviews with subject matter experts, and the use of various analytical techniques. As a continuation of that analysis, the current and future levels of response to emergencies were also examined. The overall objective of this effort was to determine if there is a problem relative to emergency response to urban freeway incidents now and will there be one in the future. The following are the conclusions that were developed out of the research associated with this study:

1. Population is continuing to increase in the major metropolitan areas of the state.
2. Steadily increasing vehicle registration indicates that people have still not left their vehicles for mass transit systems in any appreciable numbers.

3. The overwhelming consensus in the data analyzed was that traffic congestion was a major problem and would get increasingly worse throughout the next decade.
4. Rapidly increasing traffic volumes and the high cost of freeway construction are making it necessary to convert existing center divider and emergency shoulder areas to traffic lanes.
5. Every minute of freeway lane blockage results in 5 minutes of additional traffic delay.
6. Rapid response by law enforcement and other emergency personnel to freeway incidents is critically important to the safe and efficient utilization of the freeway system.
7. The adverse consequences of delayed response by emergency service providers to emergency incidents are far reaching and include:
   - o Increased response times by fire suppression personnel and equipment, resulting in increased property loss due to delayed containment of fires.
   - o Increased response times by emergency medical service providers, reducing their ability to save lives and minimize long-term adverse effects from injuries and illnesses.
   - o Delayed law enforcement response to emergencies, resulting in longer delays in providing services, such as clearing the road.
   - o Decreased employee productivity resulting from lengthened commute times to work.
   - o Delayed delivery of needed supplies and equipment to businesses, residences, and public institutions.
   - o Increased pollution and its attendant health risks by vehicles standing idle for long periods of time in traffic.

8. Rapidly developing technology can be employed to assist in the rapid detection and management of emergency freeway incidents.

The future effectiveness of the freeway transportation system in urban areas is bleak, at best. Increased traffic leads to increased incidents which, in turn, lead to further traffic delay. The adverse consequences of traffic delay on society will be great if law enforcement departments and other highway transportation authorities fail to appropriately plan and implement rapid response strategies in the future. For example, if congestion is not managed effectively and increasing gridlock occurs, a major movement by companies to locations outside the city may occur. This will result in lost revenues to the city, which in turn will cause a further reduction in public services.

## Section 3: Recommendations

After examination and analysis of the available data, many alternative strategies were identified. However, it immediately became apparent that several would be cost-prohibitive and would require development and implementation times that would extend far beyond the year 2000 target date of this study. Also recognizing that the most effective approach to managing emergency response would be to employ several different strategies, either singularly or in concert with others, the following five strategies were developed:

1. Develop a public education program describing recommended actions when confronted with freeway lane-blocking incidents.

2. Develop an integrated traffic management system to electronically monitor and route traffic.
3. Assure future freeways include paved areas adjacent to traffic lanes for lane-clearing operations during emergencies.
4. Create specialized emergency response units that are pre-positioned along urban freeways for rapid emergency response.
5. Increase the utilization of motorcycles as initial response vehicles during high congestion periods.

Given the diversity of the five strategies, an overall plan should first be developed with the approval and funding authorities before proceeding on the implementation of any. That initial plan should indicate which strategies are to be implemented and what methods will be used to coordinate them. Obviously, this is a critical first step as it will determine at the onset the magnitude and complexity of the overall strategy plan.

## Section 4: Future Implications

This paper attempted to answer the question, "How will California Law Enforcement Respond to Emergencies On Urban Freeways By The Year 2000?" After analyzing and predicting the future state of the freeway system, a number of strategies were identified that significantly and positively impact on response times and lane clearance efforts. While this project only focused on urban freeways, many of the proposed strategies may also be applicable in other congested locations, including high-density city streets. Consequently, these strategies should not be viewed as all-inclusive solutions, but as the

first steps in a series of more and more progressive strategies that will assist law enforcement in their traffic management roles even beyond the year 2000.

Future studies related to this topic should also explore the specific impacts of each of these strategies on applicable budgets. In addition, researchers should also examine how cities can attract families and businesses into the inner city, as well as other methods to raise revenues in support of city services.

# PART VI: APPENDIXES

## APPENDIX A

### Interviewees and Modified Delphi Panel Members

The following is a list of the interviewees and modified conventional delphi participants by job title:

- Local City Manager
- Assemblymember, California Legislature
- Assistant Division Commander, California Highway Patrol
- Area Commander, California Highway Patrol
- Deputy District Director, California Department of Transportation
- Former Executive Secretary, California Transportation Commission
- Field Operations Officer, California Highway Patrol
- Transportation Planning Officer, California Highway Patrol
- Field Sergeant, California Highway Patrol
- Traffic Officer, California Highway Patrol
- Member, Metropolitan Transportation Commission

## APPENDIX B

### Interview Questions

A. Overview Of Research Paper

1. Title - "Managing Urban Freeways In California By The Year 2000 - A Law Enforcement Perspective."

2. General Issue - How will California law enforcement departments manage traffic on urban freeway systems in California by the year 2000?

3. Sub-Issues -

   - o Emergency transportation to emergency scenes.
   - o Future freeway designs.
   - o Cost of future emergency response strategies.

B. Questions

1. What population trends do you see in urban areas by the year 2000 (i.e. general population and workforce)?

2. What will freeway usage be by the year 2000 (i.e. gridlock or freeflow)?

3. From a design perspective - how do you think freeways will look by the year 2000?

4. What will be the source and adequacy of transportation system funding?

5. What problems will the freeway systems pose for law enforcement and/or emergency service providers?

6. List any possible major events that you think will have either a positive or negative affect on the freeway system and law enforcement?

7. List any trends affecting the freeway system that will continue through the year 2000 or beyond?

8. Describe one or more possible future scenarios on how the freeway system might look by the year 2000 and how emergency incidents may have to be handled?

9. What is the probability of each of your scenarios coming true?

10. What strategies would you recommend that law enforcement use to handle freeway incidents in the future?

## APPENDIX C

### List Of Trends

1. Traffic volumes on freeways.
2. Number of registered vehicles in California.
3. Cost of new transportation system facilities.
4. Pollution levels.
5. Public interest in new transportation alternatives.
6. Number of traffic collisions on urban freeways.
7. General population in California.
8. Number of transportation measures on ballots.
9. Cost of land for new highway construction.
10. Industry provided carpools
11. Public attitude regarding voluntary compliance with law.

## APPENDIX D

## List Of Events

1. Middle East war causes gas price increase.
2. A major earthquake destroys portions of freeway system.
3. The Environmental Protection Agency restricts travel due to pollution.
4. Mass transit systems are significantly expanded.
5. Integrated traffic management systems are instituted.
6. Gridlock occurs on urban freeway systems.
7. Major gasoline tax increase.
8. Privately constructed toll roads are opened.
9. Bridge tolls are increased based on time of day.
10. A new fuel source is developed.
11. Legislation is passed permitting traffic enforcement without vehicle stops.

## APPENDIX E

### TABLE 1. - Trend Screening

| CANDIDATE TREND in RANK ORDER | | FOR PURPOSES OF TOP-LEVEL STRATEGIC PLANNING HOW VALUABLE WOULD IT BE TO HAVE A REALLY GOOD LONG-RANGE FORECAST OF THE TREND? * | | | | |
|---|---|---|---|---|---|---|
| # | | Priceless | Very Helpful | Helpful | Not Very Helpful | Worthless |
| 1. | Traffic volumes on freeways. | X | | | | |
| 2. | Number of vehicles registered in California | | X | | | |
| 3. | Cost of new transportation facilities | | X | | | |
| 4. | Pollution levels | | X | | | |
| 5. | Public interest in new transportation alternatives. | X | | | | |
| 6. | Number of traffic collisions on urban freeways. | | | X | | |
| 7. | General population in California. | | | X | | |
| 8. | Number of transportation measures on ballot. | | | | X | |
| 9. | Cost of land for new highway construction. | | | X | | |
| 10. | Industry provided carpools. | | | | X | |
| 11. | Public attitude regarding law compliance | | | | X | |
| | | | | | | |

* Panel total for each estimate category.

TABLE 2. — Trend Evaluation

| Trend # | TREND STATEMENT (Abbreviated) | LEVEL OF THE TREND ** (Today = 100) | | | |
|---|---|---|---|---|---|
| | | 5 Years Ago | Today | * Five years from now | * Ten years from now |
| T1 | Traffic Volumes On Freeways | 75 | 100 | 150 / 100 | 175 / 100 |
| T2 | Number of Registered Vehicles In California | 75 | 100 | 125 / 125 | 150 / 125 |
| T3 | Cost of New Transportation System Facilities | 75 | 100 | 150 / 150 | 200 / 175 |
| T4 | Pollution Levels | 100 | 100 | 125 / 100 | 150 / 50 |
| T5 | Public Interest In New Transport Alternatives | 75 | 100 | 150 / 300 | 200 / 300 |
| | | | 100 | | |
| | | | 100 | | |
| | | | 100 | | |
| | | | 100 | | |
| | | | 100 | | |

** Panel Medians

* Five years from now: "will be" / "should be"

* Ten years from now: "will be" / "should be"

TABLE 3. - Event Evaluation

| Event # | EVENT STATEMENT | * YEARS UNTIL PROBABILITY FIRST EXCEEDS ZERO | * PROBABILITY | | IMPACT ON THE ISSUE AREA IF THE EVENT OCCURRED | |
|---|---|---|---|---|---|---|
| | | | Five Years From Now (0-100 %) | Ten Years From Now (0-100%) | * POSITIVE (0-10 scale) | * NEGATIVE (0-10 scale) |
| E1 | Middle East War Causes Gas Price Increase | 1 | 100% | 100% | 5 | |
| E2 | Major Earthquake Destroys Portions Of Freeway Systems | 1 | 50% | 60% | | 8 |
| E3 | EPA Restricts Travel Due To High Pollution Levels | 2 | 20% | 25% | 8 | |
| E4 | Mass Transit Systems Are Significantly Expanded | 1 | 70% | 90% | 6 | |
| E5 | Integrated Traffic Management Systems Are Instituted | 1 | 80% | 100% | 7 | |
| E6 | Gridlock Occurs On Urban Freeway Systems | 3 | 70% | 75% | | 9 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

* Panel Medians

TABLE 4. - Cross-Impact Evaluation

# MATRIX

Maximum Impact (% Change ±)

| ** | E1 | E2 | E3 | E4 | E5 | E6 | T1 | T2 | T3 | T4 | T5 | "IMPACT TOTALS" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E1 | X | ___ | -50 | +25 | ___ | -30 | -10 | -10 | ___ | -10 | +25 | E1 7 |
| E2 | ___ | X | ___ | +25 | +5 | +30 | ___ | ___ | +25 | ___ | +30 | E2 5 |
| E3 | ___ | ___ | X | +50 | ___ | +50 | +25 | +25 | ___ | -25 | +40 | E3 6 |
| E4 | -10 | ___ | -25 | X | -5 | -50 | -10 | -10 | ___ | -15 | +25 | E4 8 |
| E5 | ___ | ___ | -5 | -5 | X | -30 | ___ | ___ | +10 | -5 | ___ | E5 6 |
| E6 | ___ | ___ | +50 | +50 | +70 | X | -10 | -10 | ___ | +24 | +40 | E6 7 |

"IMPACTED" TOTALS

| E1 | E2 | E3 | E4 | E5 | E6 | T1 | T2 | T3 | T4 | T5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4 | 5 | 3 | 5 | 4 | 4 | 2 | 5 | 5 |

** Legend

E1 - Middle East War
E2 - Major Earthquake
E3 - EPA Restricts Travel
E4 - Mass Transit Expanded
E5 - Integrated Traffic Management
E6 - Gridlock

T1 - Traffic Volumes
T2 - Number of Registered Vehicles
T3 - Cost of New Transportation Facilities
T4 - Pollution Levels
T5 - Interest In Transportation Act

## APPENDIX I

### List of Stakeholders

(Note: Snaildarters are indicated by SD)

1. CHP Commissioner
2. Chief of Police Association
3. County Board of Supervisors
4. Highway Patrol Officers Association
5. Employers
6. Emergency Service Providers (Police, Fire, Medical)

SD 7. Private Highway Investors

8. State Department of Transportation

SD 9. Environmental Protection Agency

10. Environmental Protection Advocate Groups
11. Commuters
12. Local Residents

SD 13. Real Estate Developers

14. General Public
15. Legislature

SD 16. Taxpayer Groups

17. Media
18. Automobile Insurance Companies
19. State Legislature
20. Highway Construction Firms
21. Mass Transit Proponents
22. CHP Road Patrol Personnel

## APPENDIX J

### Table 5 - Responsibility Chart

### Strategy #1 - Develop a A Public Education Program

| Tasks | CHP Executive Management | CHP Office Of Public Affairs | CHP Office Of Special Projects |
|---|---|---|---|
| Develop/present proposal to CHP Management | A | I | R |
| Select public awareness advisory committee | A | R | - |
| Develop final plan | A | I | R |
| Coordinate statewide program | I | R | - |
| Conduct training | - | R | - |
| Evaluate program | - | I | R |

R = Responsibility (not necessarily authority)
A = Approval (right to veto)
S = Support (put resources toward)
I = Inform (to be consulted)
- = Irrelevant to this item

## APPENDIX K

### Table 6 - Responsibility Chart

### Strategy #2 - Develop an Integrated Traffic Management System

| Tasks | CHP Exec Mgt | Caltrans Exec Mgt | CHP Public Affiars | CHP Traffic Plan Unit | State Leg | Governor & Staff |
|---|---|---|---|---|---|---|
| Develop proposal | A | - | I | R | - | - |
| Present Proposal to CHP/Caltrans | A | - | S | R | - | - |
| Select joining CHP/ Caltrans planning group | A | A | S | R | - | - |
| Present final proposal to legislature and Governor | R | A | S | S | A | A |
| Select joint CHP/ Caltrans oversight committee | A | A | - | R | - | - |
| Select/train personnel | A | - | - | R | - | - |
| Procure equipment | A | R | - | S | A | A |
| Conduct public and officer awareness program | A | A | R | S | I | A |
| Evaluate program | A | A | S | R | A | A |

R = Responsibility (not necessarily authority)
A = Approval (right to veto)
S = Support (put resources toward)
I = Inform (to be consulted)
- = Irrelevant to this item

## APPENDIX L

### Table 7 – Responsibility Chart

### Strategy #3 – Assure Future Freeway Refuge Areas

| Tasks | CHP Exec Mgt | Caltrans Exec Mgt | CHP Traffic Plan Unit | Governor & Staff | Legislature | City Officials | Caltrans Engineers |
|---|---|---|---|---|---|---|---|
| Develop/present proposal to CHP Management | A | – | R | – | – | – | – |
| Develop joint CHP/ Caltrans policy position | A | A | R | – | – | I | S |
| Present final plan to approval authorities | A | A | R | A | A | A | S |
| Develop new freeway design specifications | A | A | S | – | – | I | R |
| Evaluate program | A | A | R | I | I | I | S |

R = Responsibility (not necessarily authority)
A = Approval (right to veto)
S = Support (put resources toward)
I = Inform (to be consulted)
– = Irrelevant to this item

## APPENDIX M

### Table 8 - Responsibility Chart

### Strategy #4 - Create Specialized Emergency Response Units

| Tasks | CHP Executive Management | CHP Office Of Special Projects | CHP Road Patrol Officers | CHP Area Commander |
|---|---|---|---|---|
| Develop/present proposal to CHP Management | A | R | - | I |
| Select project development committee | A | R | S | S |
| Develop final program plan | A | R | I | S |
| Acquire equipment and facility | A | R | I | S |
| Select test area | A | R | I | S |
| Conduct training | A | R | S | S |
| Coordinate field test of program | A | R | S | S |
| Evaluate program | A | R | I | S |

R = Responsibility (not necessarily authority)
A = Approval (right to veto)
S = Support (put resources toward)
I = Inform (to be consulted)
- = Irrelevant to this item

## APPENDIX N

### Table 9 - Responsibility Chart

### Strategy #5 - Increased Utilization of Motorcycles

| Tasks | CHP Executive Management | CHP Area Commander | CHP Office Of Special Projects |
|---|---|---|---|
| Develop/present proposal to CHP Management | A | - | R |
| Select test area | A | I | R |
| Increase motorcycle deployment | A | R | S |
| Evaluate program | A | S | R |

R = Responsibility (not necessarily authority)
A = Approval (right to veto)
S = Support (put resources toward)
I = Inform (to be consulted)
- = Irrelevant to this item

## ENDNOTES


1. California Department of Motor Vehicles, September 1990. Vehicle Registration Data Base Report; Sacramento, California. p. 6.

2. California Department of Transportation, March 1990. Assembly Of Statistical Reports - 1988; Sacramento, California. Section 2-1.

3. California Department of Transportation, 1990. California's Transportation Future; Sacramento, California. p. 38.

4. California Department of Transportation, March 1990. Assembly Of Statistical Reports - 1988; Sacramento, California. Section 1-1.

5. United States General Accounting Office, November 1989. Traffic Congestion, Report to The Chairman, Subcommittee On Transportation and Related Agencies, Committee on Appropriations, U.S. Senate. p. 10.

6. Department of California Highway Patrol, 1989. California Statewide Integrated Traffic Records System Report For The California Highway Patrol; Sacramento, California. Report #2.

7. United States General Accounting Office, November 1989. Traffic Congestion, Report to The Chairman, Subcommittee On Transportation and Related Agencies, Committee on Appropriations, U.S. Senate. p. 9.

8. Institute of Transportation Engineers, 1986. Urban Traffic Congestion: What Does the Future Hold?; Washington, D.C. p. 36.

9. Assembly Office of Research, March 1988. California 2000: Gridlock In The Making; Sacramento, California. p. 2.

10. IBID. p. 5.

11. California Department of Transportation, June 1989. Trends Affecting Caltrans; Sacramento, California. pp. 1-2.

12. U.S. Department of Transportation, February 1990. Moving America - New Directions, New Opportunities; Washington, D. C. p. 21.

13. Garver, Michael S., January 1989. What Role Can The California Highway Patrol Play In Providing Police Traffic Services to Cities In The Future?; California Command College Paper, p. 55.

## Selected Bibliography


Advisory Committee on Highway Policy, 2020 Transportation Program, Beyond Gridlock - The Future Of Mobility As The Public Sees It. Sacramento 1988.

California Assembly Office of Research, California 2000: Gridlock In The Making. Sacramento, 1988.

California Department of Transportation, Proceedings of The California Transportation 2020 Forum. Sacramento, 1988.

California Department of Transportation, Trends Affecting Caltrans. Sacramento, 1989.

California Transportation Commission, California's Transportation Future. Sacramento, 1990.

Institute of Transportation Engineers, Urban Traffic Congestion: What Does The Future Hold. Washington, D. C., 1986.

Joint Center For Urban Mobility Research, Private Sector Involvement In Urban Transportation. Rice Center: Houston, Texas, 1986.

Transportation Research Board, Traffic Management For Freeway Emergencies and Special Events. Washington, D. C., 1989.

U. S. Department of Transportation, Moving America - New Directions, New Opportunities. Washington, D. C., 1990.

U. S. General Accounting Office, Traffic Congestion - Trends measures, and Effects. Washington, D. C., 1989.