final report

Traffic Management Plan

EFFECTIVENESS STUDY

Prepared for

California Department of Transportation
TRAFFIC OPERATIONS DIVISION

Prepared by

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in association with

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May 28.1993

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June 1, 1993

Mr. David Saia, Project Manager
Division of Traffic Operations
California Department of Transportation
1120 N Street, P.O. Box 94873
Sacramento, CA 94273-0001

Subject: **Contract No. 51S049**
Traffic Management Plan Effectiveness Study

Dear Mr. Saia:

Enclosed are five bound copies and one reproducible copy of the Final Report.

The Final Report reflects the comments received by the TMP Task Force at our April 28th meeting at District 4 Headquarters as well as our own review of the Draft Final Report. Major changes from the Draft Report are:

1. An Executive Summary has been added.

2. Chapters 2 and 3 are reversed.

3. Chapter 4 has eliminated the charts relating emphasis on various TMP strategies to project characteristics. Instead, we have emphasized an approach that provides qualitative guidelines to use in selecting individual TMP elements at the PSR project stage. Overall strategy emphasis and cost estimates are then derived.

Throughout the study we found that accurate and consistent cost and benefit information were difficult to obtain. To aid future analyses, we strongly recommend that a uniform system of categorizing and costing TMP strategies and elements (as proposed in this study) be adopted by Caltrans.

The WSA team has enjoyed working with you and others at Caltrans on what has been a very interesting project.

Very truly yours,

Richard D. Tilles, P.E.
Principal Transportation Planner

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279490
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EXECUTIVE SUMMARY

Introduction

Multi-dimensional Traffic Management Plans (TMPs) have become increasingly accepted by transportation professionals, state and local governments and the public as a viable means of maintaning acceptable levels of traffic flow during periods of traffic disruption. These comprehensive TMPs differ from traditional work zone traffic controls in that they are typically:

- **Multi-jurisdictional in scope, encompassing** city, county and regional governments, State DOTs, employers, merchants, developers, transit operators, ridesharing agencies, neighborhood and special interest groups, and Transportation Management Associations (TMAs);

- **Multi-faceted,** comprised of an innovative mix of traffic operations, facility enhancement, demand-management and public relations strategies, as well as more traditional work zone actions, construction methods and contract incentives, customized to meet the unique needs of the impacted corridor. and

- **In place over a longer period of time,** sometimes implemented up to a year prior to the start of actual construction, with specific elements often implemented incrementally to coincide with construction phasing.

The purpose of the Caltrans Traffic Management Plan Effectiveness Study is to develop a set of guidelines that will help Caltrans, as well as other public agencies and project sponsors, to select, implement, monitor, and evaluate the various TMP strategies available in order to develop a comprehensive TMP that meets specific project objectives. Although TMPs have been developed to mitigate traffic disruptions due to special events, and man-made or natural disasters, the focus of this study is on highway reconstruction mitigation.

The project is a two-pronged effort undertaken jointly by Caltrans staff and a consultant team led by Wilbur Smith Associates (WSA). Caltrans is developing procedural guidelines far determining whether or not a TMP is required, timing and scheduling of activities, and responsibilities among various Caltrans divisions or departments. The WSA has developed technical guidelines to help Caltrans select, implement, monitor and evaluate the various elements which comprise a TMP.

TMP Planning in the Overall Project Development Process

A major consideration in developing and implementing a TMP is its interaction with the planning, design, **construction** and funding phases of the highway project. The earlier in the process that TMP components can be specified and costed, the better, for two reasons:

1. Some TMP elements require extended lead times (in some cases, even longer than the actual project) and should be identified early; and

2 Having TMP elements identified as an integral component of the total project is very helpful in the overall budgeting and approval processes.

The process developed by Caltrans staff ties the TMP development and implementation process to Caltrans three-stage project development process. Initial identification of TMP strategies should occur during the PSR stage. The Traffic Management Plans Data Sheet shown in Chapter 2 should be completed at this time. Information collected during this initial stage can provide guidance on the applicability of TMP strategies and approximations of costs that allow for budgeting and an assessment **of** benefits **of** the TMP.

At the PSR stage, it is important to identify the need for a TMP, the strategies expected to be employed and the cost of the TMP for budgeting purposes. It is also advisable to evaluate probable cost effectiveness of candidate strategies and elements before deciding which to include and at what level of funding. Any long lead items, such as traffic signals, alternate route construction, etc. should be identified at this time.

The next step in the TMP development process occurs during the Plans, Specifications and Estimates (PS&E) stage. It is at this stage that strategies and elements identified during the PSR stage are refined so that a fully-operable TMP program is in place prior to the construction phase.

Most TMPs have organized Task Forces with representatives of various public agencies and private sector organizations to provide input on the development implementation of selected strategies. The Task Force should provide guidance and oversight during the three stages of TMP development. During the first stage **of** TMP strategy selection, the Task Force should be assembled to review the TMP strategies recommended by planning staff and discuss the levels of emphasis assigned to each (using the conclusions derived from these guidance procedures as a resource). At this stage, the Task Force should include representatives from the following groups:

- Caitrans TMP Coordinator;
- Caltrans Resident Engineer (or other representative from Construction);
- Project Manager;
- State Highway Patrol:
- Regional or Metropolitan Planning Organizations:
- Regional Rideshare Organizations:
- Transportation Management Associations;
- City/County Public Works/Traffic Engineering Departments: and
- Citizens' Interest Groups (Sierra Club, neighborhood organizations).

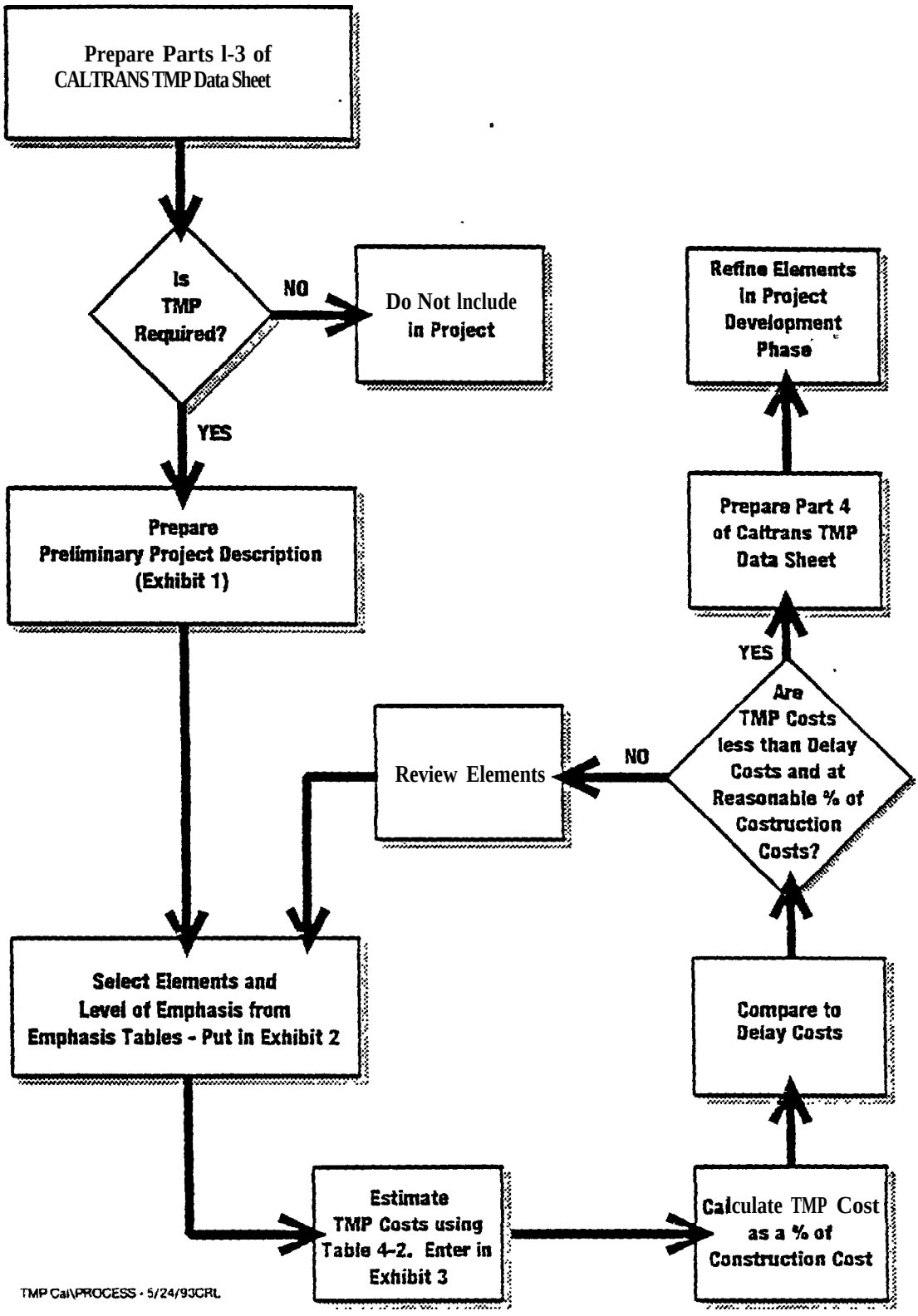


Figure A

PROCESS FOR TMP SELECTION AT PSR STAGE

Figure A indicates the process that is recommended for selection of TMP strategies at the PSR stage. Step 1 is to fill out Sections 1, 2 and 3 of Caltrans' TMP Data Sheet. Completion of this step will lead to a decision on whether or not to recommend a TMP for a given project **If a** TMP is warranted, preliminary strategies and costs need to be specified to complete the remainder of the Data Sheet. A series of exhibits and tables have been set up as part of this study to facilitate this process.

Exhibit 1 - Preliminary Project Description Table: A tabulation **of** project data from the PSR that have relevance in selecting levels of emphasis for TMP strategies and elements.

Emphasls Tables: A series of tables describing high and low emphasis actions for each element of the TMP strategies.

Exhibit 2 - Summary of Emphasis on TMP elements and strategies.

Exhibit 3 - TMP Cost Worksheet: A summary of costs based on the emphasis levels selected for each strategy, and ratios of the costs to total construction and delay costs.

Exhibit 1 provides a worksheet to tabulate data that may be relevant in determining the level of emphasis for each TMP strategy. Exhibit 1 lists 15 factors that should be considered: most can be derived from data available at the PSR stage.

Duration – The duration of highway reconstruction projects influences the kinds of strategies considered and their emphasis. High capital investment elements need to be considered carefully for short duration projects. Large scale public information centers, costly alternative route modifications and new transit routes are generally not appropriate for ***short*** duration projects, unless they can be used later as permanent improvements.

Length – Projects that involve reconstruction at a single point along a corridor lend themselves to emphasis on public information, motorist information and construction strategies. Because of the short impacted travel segment, such a project may lend itself far better to investment in these strategies than alternate routes, for example.

Phasing – A multiple-phased project can create a long-term change in the availability of and accessibility to freeway facilities. Motorists may become confused regarding the location of ramp closures during a multi-phased project. This necessitates a greater emphasis on public information elements to ensure that adequate notification is supplied on project scheduling and locations for closures and detours. investment in motorist information (such as CMS), construction strategres, alternate routes and demand management are important to consider for a multi-phase project.

Urbanization – The degree of urbanization in a project area will affect the availability and use of certain TMP strategies. For example, an urban setting provides a more cost-effective area for public information since there tends to be more local traffic and travelers can be reached relatively easily. In a ***rural*** environment, more traffic comes from outside the area and motorist information is a strategy deserving more attention.

Average Daily Traffic – High Average Daily Traffic (ADT) suggests strong consideration of incident management, demand management and alternate route strategies. In general, the higher the ADT through the corridor, the more persons affected, the greater the total costs of delay and the greater the justification for investment in the TMP.

Reduction in Vehicle Capacity – Lane closures can increase delay and accidents significantly during highway construction. The extent of the disruption to travel is a function of how many lanes remain open during construction activities, and how many lanes can remain open during peak periods. The greater the reduction in capacity, the more emphasis on all aspects **of** the NP. Top candidates for attention are use of alternate routes, incident management and motorist information.

Viable Alternate Routes – Frontage roads and secondary streets that parallel the construction corridor are necessary if a large number of automobiles are to be diverted from the construction zone. The presence of viable aitemative routes brings TMP emphasis to public and motorist information and, obviously, alternate route strategies. Lack of alternatives routes leads to emphasis on construction strategies, incident management and demand management.

Delay - Delay considerations are important in two ways. First, greater expected delay warrants more investment in the TMP strategies. Second, an estimate of total cost for expected delay, as called for in the Traffic Management Plan Data Sheet, provides an upper limit on the worthwhile TMP expenditure. Total TMP costs should not exceed the savings in reduced delay. Experience suggests some of the least costly TMP elements for reducing (total) delay over the project period include incident management and contractor incentive/disincentive provisions. These might be examined first by the TMP planner for delay reduction.

Piblic/Media Exposure – Some projects may attract considerable public and media attention, depending on the project location, duration and expected delay. Where attention is expected to be keen, strategies deserving emphasis include: public information, motorist information and incident management. In short, information channels to the public, motorists and the media will be key considerations, as well as the responsiveness of project managers to highly visible accidents drawing attention to the reconstruction' facility. A successful TMP can create a very positive image of Caltrans, particularly important in a high visibility project.

Political Sensitivity – Projects with high political sensitivity include those where lawsuits are underway or threatened, or where political leaders and interest groups are taking highly visible positions pro **or** con on the project. Such projects require attention to public and motorist information, as well as other strategies subject to political attention such as alternate routes or lane/ramp closures under construction strategies.

Affected Activity Centers/Employers – Generally, the more centers and employers affected, the more TMP planning should pay attention to public information, construction strategies, alternate routes and demand management. Rideshare incentives, transit improvements and HOV facilities should receive more emphasis when they can be targeted toward major activity centers, thereby making the strategies more viable.

Proportion of Trucks – Significant truck volumes can increase delay, especially due to accidents. Where high truck volumes occur, attention should focus on construction and alternate route strategies, especially truck traffic restrictions (where feasible) and lane/ramp closures affecting goods movement and delivery. In particular, incident management and the capacity for tow services to handle large trucks and load spills is a primary consideration.

Business Impacts – Some reconstruction projects will have a direct impact on businesses in the area. It is critical that their ability to function be maintained as much as possible. A number of strategies are possible for this. Public Information can be used to promote these businesses and, along with motorist information, explain how they can be accessed. Alternate route strategies need to be considered in light of their impact on these businesses and those on the alternate routes. Construction strategies need to be particularly well thought out when businesses are affected; contractor incentives/disincentives may be appropriate when business impacts are **great.**

Potential Increase In Accidents – Reconstruction projects normally increase accident potential through narrowed lanes, sight blockage, and new merging and weaving movements caused by reconfigured lanes or shoulders where these are a particular problem, strategies deserving attention include Motorist Information, Incident Management, and Construction Strategies. Motorist Information can alert motorists to reduce speed, merge with caution or use alternative routes. incident Management can ensure quick removal of accidents, and reduced potential for secondary accidents as motorists try to view an accident.

Special Factors-- Some projects may contain other factors that influence strategy emphasis as in the examples below:

Steep Inclines – Steep Inclines can pose additional dangers during construction. In a situation where there is a steep grade, motorist safety could be compromised by closing all lanes in one direction and allowing two-way traffic on the remaining lanes.Emphasis should be given to alternate routes, motorist information and, particularly, incident management.

Raised Median – A raised median will make it difficult to re-route traffic from closed lanes onto open lanes. Again, alternate routes, motorist information and incident management should be emphasized.

Monitoring and Evaluation Guidelines

Once a TMP is under way, monitoring serves both an oversight and evaluation purpose. Monitoring for oversight includes:

- **Determining how strategies are being Implemented.** The first job of monitoring is to determine if specified TMP elements are happening on schedule and in the manner planned.

- **Tracking costs and comparing** these to budget. It is vital to know how costs compare to budget at least on a quarterly basis. With this information, the budget can be adjusted accordingly.

Monitoring for **evaluation** is important for TMP managers to:

- Assess and fine-tune performance of all TMP strategies and overall performance of the project corridor and alternative routes;

- Track public acceptance and ensure continuation of the project;

- Determine cost effectiveness of individual TMP strategies and shift resources from the least to most cost effective strategies: and

- Determine if additional TMP elements are needed or if particular elements need refinement.

TMP evaluation should focus on the performance of both individual TMP strategies and overall performance of the reconstruction corridor or facilities. Various measures of effectiveness and measuring techniques are appropriate to corridor and strategy evaluation. This section suggests key measures of effectiveness and associated measuring methods. Table EX-2 summarizes the monitoring and evaluation measures.

Effectiveness of Public Information as a TMP Strategy

A public information campaign implemented as part of a TMP usually consists of at least one or more of the following elements, each of which has been described in more detail elsewhere in this report.

- Speakers' Bureau and/or Public Meetings:
- Brochures (disseminated by targeted direct mail, by hand, through employers or businesses);
- Public Information Centers (equipped with scale model displays, maps, videos);
- Telephone Hotline:
- Press Releases and Paid Advertising in Mass Media (radio, TV, newspapers); and
- Visual Information (including slogans, displays, logos, letterheads).

Despite significant costs and consensus as to the overall importance of public information, there are little quantitative data available to help planners determine which of these elements is most effective under various circumstances. Although measures have been used to gauge the level of activity generated by the various public information elements, these data provide little insight as to how effective each may be in actually influencing travel behavior.

To help assess the effectiveness of various elements, the public information campaigns for four of the case study highway reconstruction projects identified and discussed in Phase Iwere analyzed in more detail:

1. Philadelphia-Schuylkill Expressway (I-76) Reconstruction - Philadelphia, Pennsylvania:
2. I-680/SR-24 Interchange Widening and Reconstruction Project - Walnut Creek, California;
3. I-5 American River Crossing - Sacramento, California; and
4. Lodge Freeway Reconstruction Project - Detroit, Michigan.

These were projects where actual follow-up evaluation of the various public information elements was undertaken.

Key findings and recommendations on the effectiveness of TMP public information elements are summarized below:

Table EX-2

TRAFFIC MANAGEMENT PLAN EVALUATION CONSIDERATIONS
Caltrans Traffic Management Plan Effectiveness Study

TMP strategy	*Measures of* Effectiveness	Evaluation Methods	Cautions
Overall Comdor	· Traffic Volumes - Delay · Vehicle Occupancy · Accident Rates • Seventy · Peak/Off-Peak	· Machine Counts · Video Surveillance - o/o Surveys · Transit Ridenhip · Accident Reports · Floating/Test Car * Transit Ridership	· Sample should represent total traffic volume · Control/comparison data needed · Entire corridor must be surveyed
Public Information	· Awareness of TMP Strategies · Self Report Travel Behavior Change	· Survey of Travelers Mail/Phone · Focus Groups	· Surveys should not prompt respondents
Motorist Information	· Awareness of Motorist Information · Reactions to Messages	· Survey of Travelers Mail/Phone · Traffic Observation	0 Surveys should not prompt respondents
Incident Management	· Response and Removal Time · Delay Reduction	· Video Surveillance · Dispatcher • Police • Service Patrol Logs	· Secondary accident benefit difficult to measure · Control/comparison data needed
Construction Strategies	· Delay · Vehicle Operating Cost - Vehicle Occupancy · VMT · Emissions · Accident Rates • Seventy 0 Peak/Off-Peak	· Machine Counts · Video Surveillance - O/D Surveys · Accident Reports · Floating/Test Car	· Carefully define contractor strategies baseline · Control/companson data nwded · Sample should represent total traffic volume
Demand Management	· Vehide Trip Reduction · Vehicle Occupancy · VMT	· Survey of Rideshare • Transit • Park-and-Ride Users • Mail/Phone · Employer Surveys of Employees	· Surveys should not prompt respondents · Assess prior mode. route
Alternate Router	· Traffic Volumes · Delay · Vehicle Occupancy · VMT - Emissions · Accident Rates • Seventy · Peak/Off-Peak	· Machine Counts · Postcard Survey · Video - O/D Survey · Locality Traffic Counts · Ftoating/Test Car	· Assess formal and informal alternate routes · Sample size should represent total traffic volumes · Control/comparison data needed · Assess prior route, mode · Assess delay for both reglonal and local trips.

Wilbur Smirth Associates: June 1993

- Use of the mass media (newspapers, radio and television) and highway advisory signs are the two most cost-effective public information resources. For high profile projects, the media may seek out stories on the TMP, resulting in a relatively low cost. Low profile projects may require occasional paid advertising in the media in order to get the message out In either case, dissemination by the mass media insures the broadest possible audience.

- A single point of contact for the TMP is imperative to assure consistency of information. This can either be a Caltrans staff person or a special public relations consultant. Clear, concise graphics and a 'catchy' slogan help to make sure the message gets picked up by the mass media.

- **Caltrans** should utilize Task Force member cooperation and input to minimize the cost of the TMP public information campaign and avoid duplication by piggy-baoking **onto** existing mass media, transit or ridesharing publicity campaigns.

- A public information/visitors center, speakers' bureau, and employer information packets are useful as secondary resources. To the extent they can be implemented at minimum cost to the TMP by utilizing existing facilities or staff, they can be useful in broadening the scope of information coverage. For complex, multi-phased projects, they can also provide added depth to the TMP. They are useful for improving community relations and in answering in-depth questions, but are relatively ineffective in reaching large numbers of individuals.

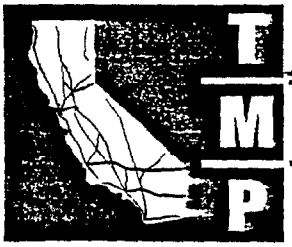
- A telephone hotline is essential for every project but does not have to be project-specific if other resources are available and the project is not too complex. The hotline should be monitored during the TMP to ensure that resources are adequate and that questions are answered satisfactorily.

- Brochures appear to be the least cost-effective public information resource. Because of their relatively long lead time and cost to produce, brochures and most practical for long-term, complex, multi-phased projects. If brochures are used at all, their distribution should be followed by some sort of monitoring effort to determine who saw them, what they learned from them, and if or how the brochures changed their travel behavior.

- Between 10 and 20 percent of the TMP budget is a good rule of thumb for the public information budget if the project is of relatively short duration (say 1 -1/2 years or less). For longer, more complex projects, the public information element may reach 25% of the total TMP budget.

- In order to build up meaningful quantitative cost-effectiveness data on each of the public information elements, Caltrans should require that costs be tabulated fully and consistently for each public information element.

- Caltrans should set aside a percentage of the public information budget for monitoring its effectiveness through surveys similar to those discussed in this appendix. These surveys should quantify how respondents get information on the project and how they are using this information. These surveys should be standardized as much as possible to facilitate comparisons.



1. INTRODUCTION

Multidimensional Traffic Management Plans (TMPs) have become increasingly accepted by transportation professionals, state and local governments and the public as a viable means of maintaining acceptable levels of traffic flow during periods of traffic disruption. These comprehensrve TMPs differ from traditional work zone traffic controls in that they are typically:

- Multi-jurisdictional in scope, encompassing city, county and regional governments, State DOTs, employers, merchants, developers, transit operators, ridesharing **agencies,** neighborhood and special interest groups, and Transportation Management Associations (TMAS);

- Multi-faceted, comprised of an innovative mix of traffic operations, facility enhancement, demand-management and public relations strategies, as well as more traditional work zone actions, construction methods and contract incentives, customized to meet the unique needs of the impacted corridor; and

- In place over a longer period of time, sometimes implemented up to a year pnor to the start of actual construction, with specific elements often Implemented incrementally to coincide with construction phasing.

The emphasis of these comprehensive TMPs is on the more efficient movement of people through demand management and a variety of other techniques, not just simply moving vehicles. In addition, TMPs evolve over time due to strategy refinements dictated by changed conditions and ongoing monitoring programs.

The purpose of the Caltrans Traffic Management Plan Effectiveness Study is to develop a set of guidelines that will help Caltrans, as well as other public agencies and project sponsors, to select, implement, monitor, and evaluate the various TMP strategies available in order to develop a comprehensive TMP that meets specific project objectives. Although TMPs have been developed to mitigate traffic disruptions due to special events, and man-made or natural disasters, the focus of this study is on highway reconstruction mitigation.

The project is a two-pronged effort undertaken jointly by Caitrans staff 'and a consultant team led by Wilbur Smith Associates (WSA). Caltrans is developing procedural guidelines for determining whether or not a TMP is required, timing and scheduling of activities, and responsibilities among various Caltrans divisions or departments. The WSA team has developed technical guidelines to help Caltrans select. implement, monitor and evaluate the various elements which comprise a TMP.

The first product of this study was Working Paper #1 , which provided an overview of TMP experience in the U.S., based on a review of relevant resource material and interviews with selected TMP coordinators. That research provided input on the most cost-effective TMP elements, order-of-magnitude cost of TMPs compared with overall construction costs, ongoing monitoring programs and organizational and public relations strategies. Appendix B describes and summarizes data obtained from the case studies.

Drawing upon this background, this report outlines a procedure for selecting, implementing, monitoring and evaluating TMP strategies. This procedure and associated guidelines are closely tied to the various phases of the Caltrans project development process, from Project Study Report (PSR), to Plans, Specifications and Estimates (PS&E) through to Construction. Each stage of the project development process is discussed more fully in Chapter 2.

The goal of this study is to provide guidance to traffic planners and TMP Coordinators particularly in the Caltrans District Offices, in preparing a comprehensive TMP program for all stages of the project development process.

- **Chapter 2** summarizes how TMPs fit into Caltrans' project development process.

- **Chapter** 3 of this report provides an overview of the range of TMP strategies and elements available to planners, including summary descriptions, costs and effectiveness. ,

- **Chapter 4** presents guidelines and criteria for selecting TMP strategies.

- **Chapter** 5 presents guidelines for monitoring and evaluatrng the TMP's overall performance as well as specific elements.

- **Appendix A contains an** in-depth review of the relative effectiveness of vanous public information strategies, which are critical to TMP success.

  Since data are relatively limited on the effectiveness of individual public information strategies, Appendix A also contains recommendations for expanding the data base through more focused surveys and monitoring techniques.

- **Appendix** B describes and summanzes data obtained from the case studies.

- **Appendix** C provides sample forms for use in selecting TMP strategies.

INTRODUCTION

A major consideration in developing and implementing a TMP is its interaction with the planning, design, construction and funding phases of the highway project. The earlier in the process that TMP components can be specified and costed, the better, for two reasons:

1. Some TMP elements require extended lead times (in some cases, even longer than the actual project) and should be identified eariy; and

2. Having TMP elements identified as an integral component of the total project is very helpful in the overall budgeting and approval processes.

A detailed analysis of how developing and implementing a TMP fits into Caltrans' Standard Policies and Procedures is concurrently being performed by Caltrans Staff. This brief discussion is included in the report to provide a context for timing considerations included in the guidelines.

A copy of Caltrans' Person Year and Project Scheduling and Cost Analysis (PYPSCAN) Flow Chart is shown in Figure 1. The PYPSCAN Flow Chart illustrates the three-phased project development procedure:

Phase I: Preliminary Project Development including the Project Study Report (PSR), environmental studies and Project Report (PR);

Phase II: Design Project Development which includes the design of structures, design of roadway/facilities and the acquisition and certification of right-of-way: and

Phase III: Construction, during which the project is constructed, right-of-way is completed and the facility is opened to traffic.

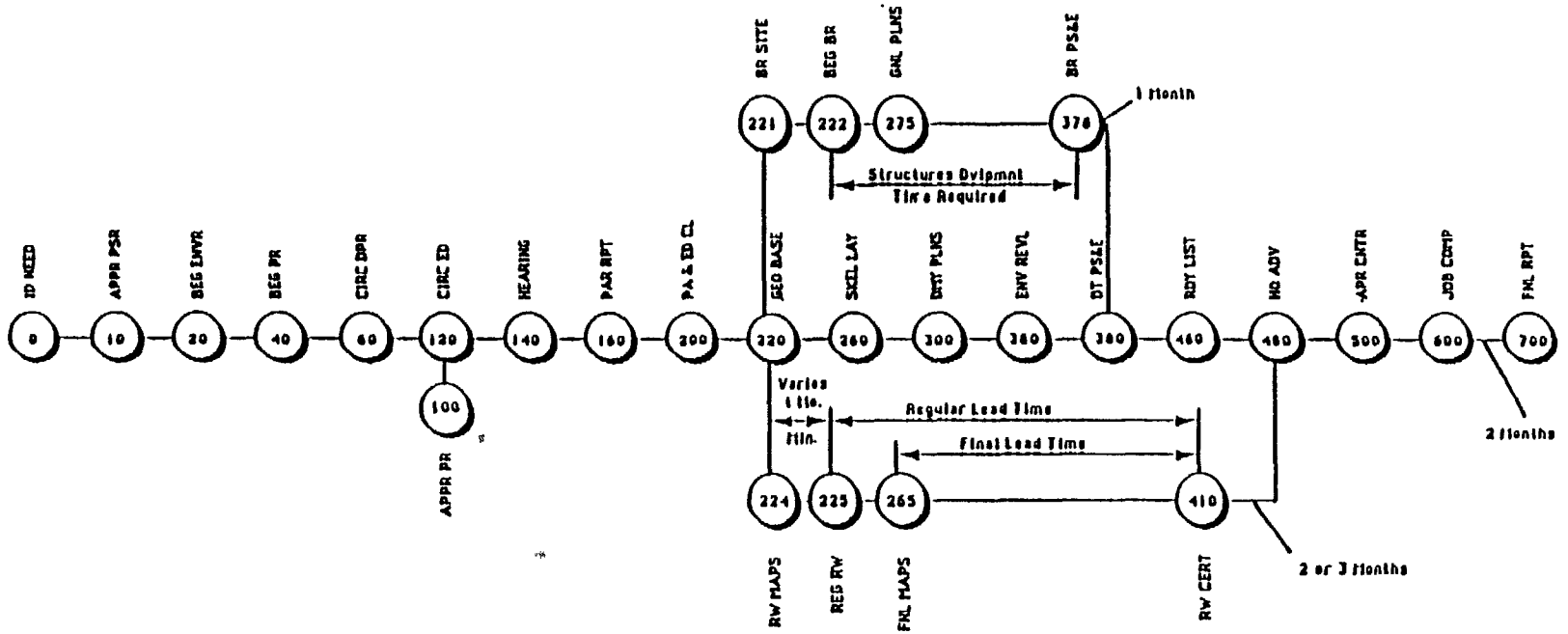
PROJECT STUDY REPORT (PSR)

The purpose of the PSR is to obtain:

- Management approval for major projects prior to their inclusion in the State Transpottation Improvement Program (STIP);

- Conceptual approval of non-State funded projects and authorization to initiate project: and

- Authorization to initiate project development.



PHASE 1 - PRELIMINARY PROJECT DEVELOPMENT

- PROJECT STUDY REPORT
- ENVIRONMENTAL STUDIES
- PROJECT REPORT

PHASE 2 - DESIGN PROJECT DEVELOPMENT

- DESIGN STRUCTURES
- DESIGN ROADWAY/FACILITIES
- ACQUIRE & CERTIFY RIGHT OF WAY

PHASE 3 CONSTRUCTION

- CONSTRUCT PROJECT
- COMPLETE RIGHT OF WAY
- OPEN FACILITY TO TRAFFIC

Figure 1

SOURCE. Caltrans, *Project Development Procedure s Manual of Instructions.*

CALTRANS PYPSCAN FLOW CHART

It is unlikely that minor projects not requiring a PSR would have a formal TMP component.

The PSR defines the problem to be solved and looks at alternative solutions and their associated traffic impacts. If significant traffic delays or other impacts are projected, then, according to Caltrans policy, a TMP must be included as a separate section of the PSR, complete with conceptual strategies and order-of-magnitude costs.

The specific guidelines contained in Caltrans Procedures Manual are to:

> *'**Determine** the need for **a** TMP....Is 'significant delay' due to construction anticipated? Analyze the factors associated with the traffic impacts during construction. If a TMP is required, identify the TMP elements that would mrtigate these traffic impacts and their associated costs. TMP costs must be separated into capital outlay and capital outlay support...."*

Thus, the PSR phase of the project is a critical time in the TMP process. The decision to include or not to include a TMP is typically made at the PSR stage. The range of potential TMP strategies available to mitigate project impacts and their associated costs should be estimated at this stage. In this way, the TMP costs can be incorporated as part of the overall project costs presented to the California Transportation Commission (CTC) staff. Time and budget to perform these preliminary analyses is typically limited at this stage: the project is usually not defined in great detail. Therefore, this is a particularly appropriate time for a TMP planner to use formalized guidelines.

PROJECT DEVELOPMENT

The next phases after approval of the PSR concern preparation of the project development report and environmental documents for the project. During this stage, three important factors affect the TMP:

- The project is getting better defined:
- Environmental mitigation elements (which usually include traffic) are being explored: and
- There is increased interaction with the local jurisdictions and communities as part of the environmental process.

This then becomes an ideal time to refine the TMP elements that were initially identified during the PSR stage. This is particularly important for elements requiring long lead times that need to be established prior to the start of construction, such as consultant contracts for public information coordination, alternate route and other improvements requiring completion prior to construction.

I *Project Development Procedures Manual, ' Gold Book'. Figure 2-1 .3A. Section 7. July, 1990.*

FUNDING

TMP elements can be funded as part of the total construction package approved by the CTC or in separate agreements. A recent Caltrans memorandum addressed this question:2

> *'TMP activities which need to be in place before the start of main construction activities will continue to be identified and funded as stage construction or as the first order of work under one total package presented to the CTC . . . All TMP activities* may *not necessarily be included under the main contract .. For most projects there is a four to six month window to get those TMP eiements not scheduled in the main contract in place before construction begins...'*

> *'In certain situations the [California Transportation] Commission can be requested to fund a portion of the TMP as an initial phase of the main project. . . . This will require a fund request submittal from the district requesting funds on the TMP portion and explaining why it is necessary for a portion of the project to proceed before funding for the main project is allocated. These early funds will reduce the amount of programmed funds avaliable for the main project.'*

From this, one can conclude that it is very helpful to have a good idea of the total TMP funding required at the **PSR** stage, prior to the main construction allocation by the CTC, since it can be difficult to obtain additional funding. The precise details of how those funds should be allocated can be worked out later, but if insufficient money is allocated initially, additional appropriations will be required which could delay the project.

DEVELOPMENT AND IMPLEMENTATION PROCESS

The process developed by Caltrans staff, and illustrated In Figure 2, ties the TMP development and implementation process to the three-stage project development process. Initial identification of TMP strategies should occur during the PSR stage. The Traffic Management Plans Data Sheet shown In the following Exhibit should be completed at this time. Information collected during this initial stage can provide guidance on the applicability of TMP strategies and approximations of costs that allow for budgeting and an assessment of benefits of the TMP. At the PSR stage, it is important to identify the need for a TMP, the strategies expected to be employed and the cost of the TMP for budgeting purposes. It is also advisable to evaluate probable cost effectiveness of candidate strategres and elements before deciding which to include and at what level of funding. Any long lead items, such as traffic signals, alternate route construction, etc. should be identified at this time. The next step in the TMP development process occurs during the Plans, Specifications and Estimates (PS&E) stage. It is at this stage that strategies and elements identified during the PSR stage are refined so that a fully-operable TMP program is in place prior to the construction phase.

Most TMPs have organized Task Forces with representatives of vanous public agencies and private sector organizations to provide input on the development implementation of selected strategies. The Task Force should provide guidance and oversight during the three stages of TMP development. During the first stage of TMP strategy selection, the Task Force should be assembled to review the TMP strategies

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2 **Memorandum from the Department of Transportation Director to all District Director entitled 'The** *Funding of Traffic Management Plans'.* **September 28. 1992.**

Phase 1

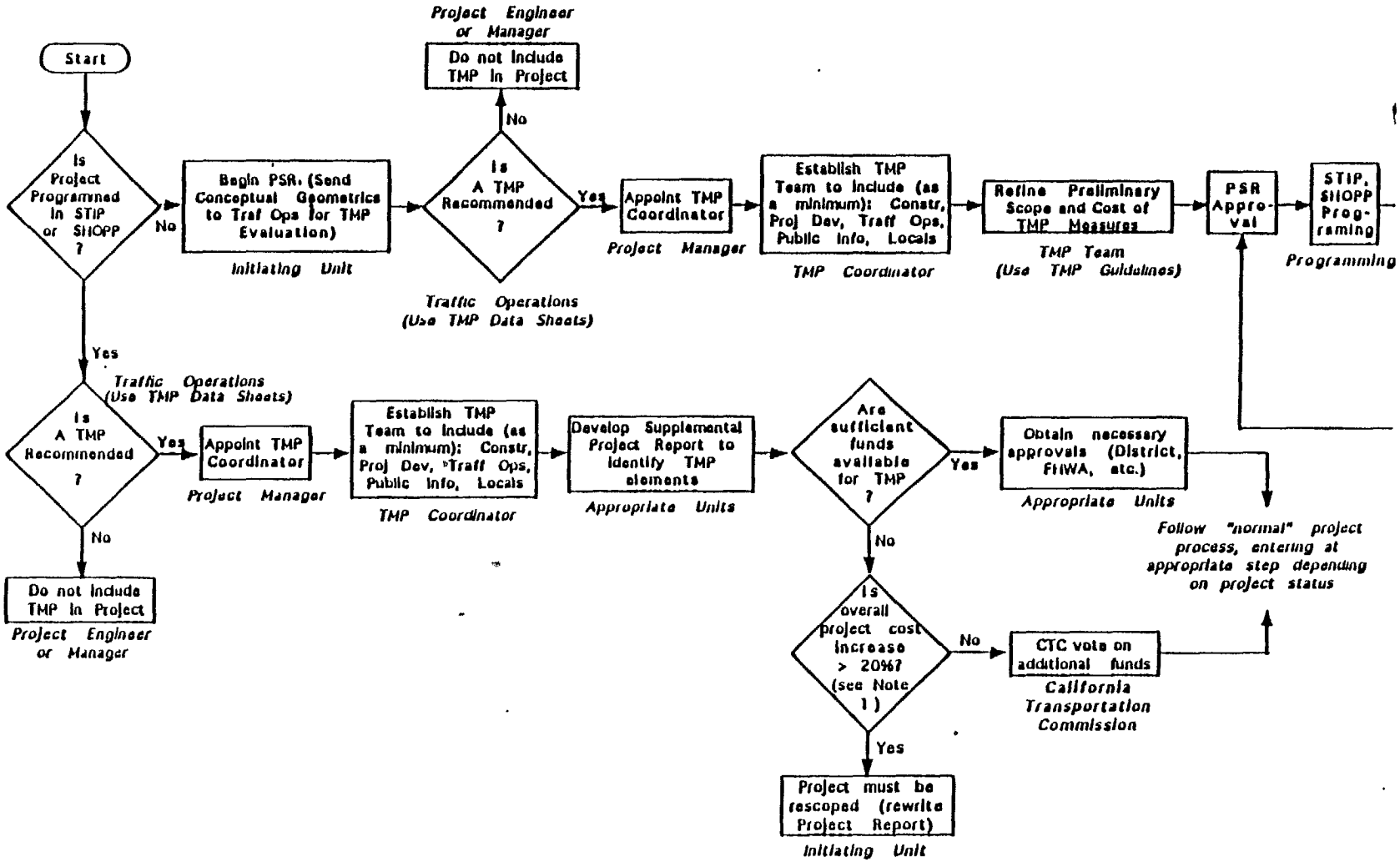
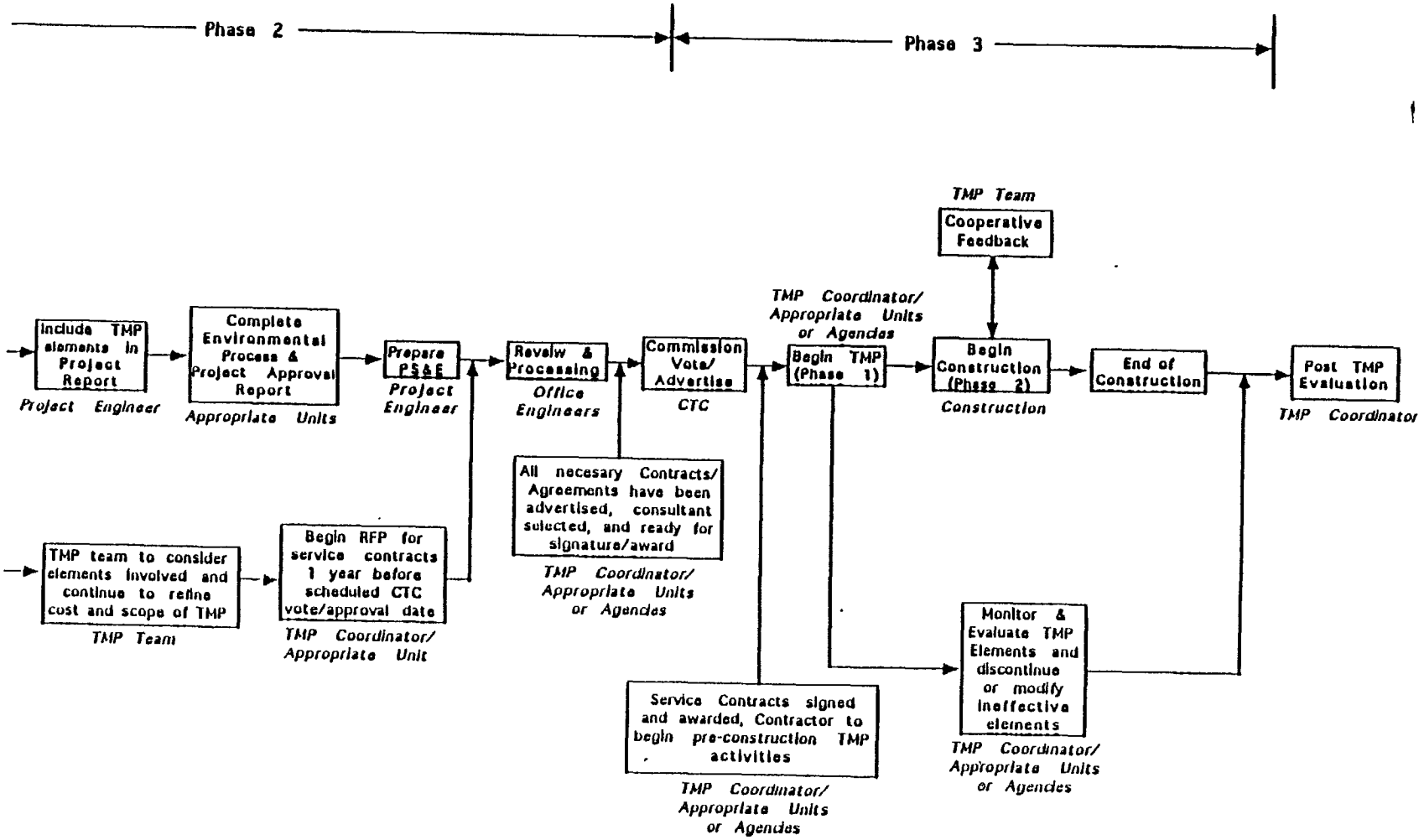


Figure 2

SOURCE: Caltrans, Division of Traffic Operations

TMP DEVELOPMENT AND IMPLEMENTATION PROCESS FLOW CHART



SOURCE. Caltrans, Division of Traffic Operations

Figure 2

TMP DEVELOPMENT AND IMPLEMENTATION PROCESS FLOW CHART

TRAFFIC MANAGEMENT PLANS DATA SHEET

To:

Attn:

Date___/___/___
Dist___Co___Rte___P/M___
EA_____
Project Description:_____
_____

Subject: TMP Data - Alternate No._____

1. Alternate Construction Strategies

Have alternate construction or staging strategies been considered which might reduce or eliminate construction related delays?

❑YES ❑ NO

If NO, discuss:

_____
_____
_____
_____

2. Delay

A.	Projected daily vehicle delay due to Project (w/o TMP)	=	_____	veh-hr/day
*B.	Amount of delay acceptable to the District	=	_____	veh-hr/day
**C.	Daily vehicle delay requiring mitigation (A-B)	=	_____	veh-hr/day
D.	Estimated Duration of Project	=	_____	days
E.	Total vehicle delay requiring mitigation	=	_____	veh-hr
F.	Cast of Delay = (E)_____ X $8.40/veh-hr	=	$____	

*Branch Chief to use best judgement of acceptable delay by considering project type , location, commuter sensitivity, political sensitivity, safety, etc.

**If (A-B) is zero or negative, no Traffic Management Plan is required unless factors other than delay dictate otherwise.

3. Recommendation

A. Is a Traffic Management Plan recommended for this project?

❑YES ❑ NO

B. If YES, proceed to Step 4. If NO, proceed to Step 5.

C. Reason for recommendation:

_____
_____
_____
_____

4. Preliminary Traffic Management Plan

Recommended Strategies	Estimated Cost
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
25% Contingencies	$_____

Total estimated cost of TMP Strategies to reduce delay to existing condition or acceptable level = $_____

Project Cost (w/o TMP) = $_____ TMP = _____% of Project Cost

5. Approval

___ No Traffic Management Plan is recommended at this lime.
___ Traffic Management Plan recommended at this time.

Signed by: _____
(Branch Chief)

Approved by: _____ Date: _____
(Office Chief)

recommended by planning staff and discuss the levels of emphasis assigned to each (using the conclusions derived from these guidance procedures as a resource)). At this stage, the Task *Force* should include representatives from the following groups:

- Caltrans TMP Coordinator:
- Caltrans Resident Engineer (or other representative from Construction);
- Project Manager;
- State Highway Patrol:
- Regional or Metropolitan Planning Organizations;
- Regional Rideshare Organizations:
- Transportation Management Associations:
- City/County Public Works/Traffic Engineennng Departments; and
- Citizens' Interest Groups (Sierra Club, neighborhood organizations).

Once the TMP has been finalized and specific contracts awarded to transit and rideshare agencies, public relations firms, contractors, etc., the Task Force should focus on implementation of the TMP and development of a work plan to ensure adequate integration with plans for construction. This will involve allocating sufficient lead time for public information elements before construction, finalizing personnel responsibilities and working closely with the Resident Engineer for the project.

Once construction has begun, most Task Forces have selected smaller subcommittees to handle day-to-day issues, while keeping the Task Force membership adequately apprised of project and TMP progress. In these later stages, after more definite TMP development, the Task Force should include representatives from:

- Federal Highway Administration:
- City Police Departments:
- Chambers of Commerce:
- Transit Operators:
- Media/Traffic Reporters;
- State Truckers' Associations:
- S&ate Automobile Associations (AAA);
- City/County Parks and Recreation Departments;
- Traffic Management Coordinator:
- Construction Contractor;
- Public Relations Consultant; and
- Emergency Traffic Patrol.

Table 3-2

COST OF TRAFFIC MANAGEMENT PLAN STRATEGIES
Caltrans Traffic Management Plan Effectiveness Study

Direct/Project Conrtruction Costs	<– Traffic Management Plan Strategies (Cost In Thousands of Dollars and Percentage of Total) —>												Total TMP Cost ($000)	Percentage of Construction Cost
	Public Information		Motorist Information		Incident Management		Construction Strategies		Demand Management		Alt. Route Strategies			
	Cost	% of TMP	Cost	% of TMP	Cost	% of TMP	Cost	% of TMP	Cost	% of TMP	Cost	% of TMP		
District **#3/I-5 American River Crossing $3 5 million**	$125	11%	$840	8%	$30*	3%	$632	58%	$204	19%	$10	1%	$ 1,085	31%
District #4/I-680 . $270 million	$6,200	45%	$1,020	8%	$2,760	20%			$2,500	19%	$1,020	8%	$13,500	5%
District #4/I-80- $230 **million**	$1,900	13%			$3,600	24%	–		$7,100	48%	$2,300	15%	$1 4,900	6%
Distrlct #5/Cuesta Grade _ $3 **million**	**$50**	**20%**	**$50**	**20%**	**$50**	20%	<-- Other costs not specified —>						$250	**ax**
District #7/Ventura Freeway _ $20 million	$590	13%	$695	15%	$1,186	25%	$961	20%	$50	1%	$1,218	26% *	$4,700	23%
District # 1 1/Coronado Bridge **$3 5 million**	**In-house**		·		·				$357	99%	$3	1%	$360	10%
District # 12 -I 5/I 405 - I-5/SA-55 $73 **million**	**$600**	**15%**			$1,690	42%			$800	20%	$910	23%	$ 4,000	5%
Philadelphia/Schuylkill $223 million	$1 200	10%									$10,800	90%	$12,000	5%
Minneapolis/I-394 $420 **million**	$1,011	6%							$2,271	13%	$14,539	81%	$17,820	4%
Miami/I 95 . $400 million	$12,900*	–	$1,832	7%	$6,712	25%	$4,910	18%	$2,238	8%	$11,080	42%	$26,760	7%
Chicago Kennedy Expressway $640 **million**	$1,600	5x	$972*	3%							$27,765	94%	$29,365	4%

• **= Partially funded from other sources**

Wilbur Smith Associates, March 1993

Brochures and Mailers – Brochures can be prepared to explain the project in detail. Notices can be sent to residents, planners of special events, and community groups to address their special circumstances, and to present alternative route maps, construction status, and information about the available TMP program.

Unit Cost: Variable depending on the text, graphics and presentation quality of the materials produced, numbers printed and distribution methods. Cost could range between $0.40 to $0.50/brochure for a large quantity.

Media Releases – Similar to brochures and mailers, the media can be contacted to inform the public about the project prior to construction, and project construction status and TMP program elements dunng the construction. This can be done through radio and TV news broadcasts or newspaper columns. If the corridor is heavily congested and the project impacts large numbers of people, the project and its associated TMP will often be treated as a ' hard' news item.

Unit Cost: Labor cost associated with TMP personnel interacting with media, as well as time developing press releases. Cost vanes with labor up to a few hours of labor/month.

Public Information Center – A public information center can be established near the Resident Engineer's Office, or near the project site. If additional space is used as the center office, the anticipated cost would be the rent and operating expenses such as utilities and overhead costs. The unit cost varies depending on the location. There should be adequate space to display mock-ups that can be used to describe the project as well as to store hand-outs describing transportation alternatives.

Unit Cost: Basic cost would range from zero to $1.50 per square foot per month depending on the location. Additional costs could include staffing, equipment, furnishings and operating costs.

Paid Advertising – Paid advertising can be placed in the local newspapers to inform the public about the project status and TMP program.

Unit Cost: The cost depends on newspaper rates in the 'area, but can range between $100 to $600 for 3 column inches, one time only.

Visual Information – This includes videos, posters, and slide shows used to supplement Speakers' Bureau presentations, information center displays or media releases.

Unit Cost: Variable

Telephone Hotline -- A 24-hour, seven days/week toll free hotline can be established to inform the public about the construction schedule and locations, lane or street closures, and available TMP program options. The toll free hotline can be answered by recordings with optional combination of actual voice answers. Tape-recorded messages, provided they are frequently updated, are probably the most *cost-effective* method of handling hotline calls. However, personal operator assistance with potential for direct one-on-one interaction can be justified for large controversial projects.

Traffic Management Plans (TMPs) present a cohesive program of operational and demand management strategies designed to maintain acceptable levels of traffic flow during periods of construction activities. Each strategy contains a subset of elements, as shown in Table 3-l which are used throughout this report. Depending on the location, type and duration of the disruption, TMPs can be either simple or complex. As shown in Table 3-2, a TMP can account for five (5) to 30 percent of the total construction costs, although it is typically less than 10 percent. Descriptions, associated cost estimates, and effectiveness of each of these strategies and elements are summarized below.

PUBUC INFORMATION

Public information is an essential and vital component of all TMPs. The goals **of** the public Information element are to:

1. Improve public awareness/understanding of the project;
2. Modify travel habits to reduce traffic congestion during the project: and
3. Promote project support

The public information campaign should start about six months prior to the project construction. The mission of this strategy is to make the public aware of the project and potential impacts prior to construction, and to inform the public about the construction status and the available TMP program elements such as alternative travel routes, additional shuttle service, park-and-ride lots, or improved transit services. The focal point of the public information campaign often is a public information center which is managed and operated by designated public staff or private consultants. On average, among the case studies reviewed, three (3) percent of construction costs were allocated for pubiic information for all types of construction projects.

Public information strategies were usually comprised of some or all of the following elements:

Speaker's Bureau (Public Meetings) – This element utilizes the public information or relations staff already formed for the project to serve as the speakers to business groups, public officials, and the public. No additional labor costs are incurred besides the costs associated with other elements of this strategy.

Table 3-1

CATEGORIZATION OF TMP STRATEGIES AND ELEMENTS
Caltrans Traffic Management Plan Effectiveness Study

A. Public Information

- Speaker's Bureau
- Brochures and Mailers
- Media Releases
- Public information Center
- Paid Advertising
- Visual Information (videos, slide shows, etc.)
- Telephone Hotline

B. **Motorist Information**

- Changeable Message Signs
- Signing and Striping
- Highway Advisory Radio

C. Incident Management

- Traffic Monitoring Stations (including loop detectors and CCTV)
- Tow Service
- Aerial Surveillance
- Call Boxes
- Construction Zone Enhanced Enforcement Program
- Traffic Operations Centers

D. Construction Strategies

- Variable Lanes
- Project Phasing
- Incentive/Disincentive Clauses
- Lane/Ramp Closures
- Glare/Gawk Screens
- Truck Traffic Restrictions .
- Total Facility Closure
- Lane-by-Lane Rental

E. Demand Management Strategies

- Rideshare Incentives
- Rideshare Marketing
- Park-and-Ride Lots
- Transit Service Improvements
- Transit Incentives
- HOV Lanes
- Parking Management/Pricing
- Variable Work Hours

F. Alternate Route Strategies

- Ramp Metering
- Street Improvements (additional lanes, parking removal, etc.)
- Traffic Control Improvements (signals, police, etc.)
- Ramp Closures (for diversion to other routes)

Unit Cost: Installation: . . . . . In the range of $100-$110 for one line (local access only). (This does not include having the actual lines installed into the location.)

Additional tines: . . Approximately $75.00 each.

Monthly Fee: . . . . $20.00 plus usage (rates are discounted if over 100 hours are used during a **billing** period). Voice mail is not included in this quote.

Plus Personnel Cost: Variable depending **on** number of hours hotline is in service.

Because of the importance and large investment in the public information component of the TMP, the consultant team devoted particular attention to analyzing the cost-effectiveness of various elements of this strategy, The findings **of** this analysis are contained in Appendix A.

MOTORIST INFORMATION

The goal of motorist information strategies is to provide information to drivers on the road during the construction of the project. Signing and Changeable Message Signs (CMS) were considered very effective by most TMP planners. These elements are obviously Important components of any project where alternate routing is a practical alternative. Caltrans already requires signing and CMS as part of the traffic control or staged construction traffic handling in the Plans, Specifications and Estimates (PS&E) package.

Changeable Message Signs – Real-time motorist information displays provided on variable message signs can play an important role in improving highway safety, operations, and use of existing facilities. These traffic control devices can be used for traffic warnings, routing, and management, and can be invaluable in improving traffic flow in construction zones by providing motorists with real-time highway-related information. CMSs can be either permanently mounted at fixed locations (longer lead time unless already place, generally larger to accommodate longer messages) or portable (less expensive and more flexible placement).

Unit Cost: $35,000 to $50,000 to purchase depending upon whether installation is permanent or portable; $1,900 to $2,400/month to lease in 1993 dollars.' Annual operating costs can range from $13,000 to $22,000 (1989 dollars) per unit.2

Signing and Striping – Construction operations which occupy part of the roadway present the motorist with a change in normal operating conditions. To avoid confusion and the resultant speed reduction and/or increased accidents, clear, positive guidance must be provided. As part of standard traffic control procedures, advance warning and channelizing devices are typically installed and maintained, designed to be effective under varying light and weather conditions which clearly convey what to expect and the proper path to follow. On occasion, higher level devices than those normally used (e.g., raised pavement markers versus plain pavement markings) may improve motorist response. Any conflicting signs and markings must be covered

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I **CMS costs should be included in construction cost estimate rather than TMP since they are typically purchased by the contractor.**

2 *Guidelines* **on the Use of Chargeable Message Signs. Office of Technology Applications. July 1991**

or removed. Guidance must also be dynamic, adjusting to changes in operations when necessary.

Unit Cost: Variable

Highway Advisory Radio – Using low frequency broadcast channels, highway advisory radio provides up-to-date information on traffic and road conditions, traffic hazard and travel advisories, directions, etc. 24 hours per day. Although reception and usage can be problems, such a *system* can result in increased diversion of traffic to alternate routes, faster resumption to normal traffic patterns after incidents are cleared, and improved communications. Siting of antennas to ensure good signal reception and timing to obtain necessary licenses are critical implementation issues. Signing is also needed to support HARs. Fixed signs at various points along the project area denoting the HAR frequency and, if deemed necessary, extinguishable message signs, used when there is real-time information being broadcast.

Unit Cost: $30,000 to $35,000/spot; $53,000 for portable unit

INCIDENT MANAGEMENT

On highways already constricted by construction, further reduction in capacity caused by accidents or vehicular breakdowns can compound adverse impacts to motorists.. Provisions can be made to have standby tow trucks or vehicles equipped with push bumpers on site or close at hand to minimize response time and reduce the effect on traffic flow. Use of incident management elements as well as motorist information elements is usually coordinated through a traffic monitoring station or a traffic operations center (TOC).

Traffic Monitoring Station – The most complex element of incident management is the traffic monitoring station system which includes Closed Circuit Television (CCTV) and counter loops along the freeway corridor connecting to a nearby traffic monitoring station by telephone lines or communication cables. When an incident is detected, personnel at the traffic monitoring station will dispatch tow trucks to remove the subject vehicles. The traffic monitoring station will also collect real-time data useful in evaluating the effectiveness of the TMP. The chief drawback relating to roadway detectors is that they may be difficult to maintain dunng construction, particularly if lane shifting is expected.

Unit Cost: $30,000 per mile[3]

Tow Service – Tow service or dedicated freeway service patrols which are stationed along heavriy congested corridors can be a cost-effective incident management technique under normal operating conditions as well as during periods of highway reconstruction. Expenence reviewed in the Phase I case studies was mixed. However, if structured properly (with an adequate vehicle fleet, stationed appropriately, with convenient pull-off points), tow services can reduce response time to clear minor Incidents as well as detection time. At its most effective, tow services can reduce delays caused by minor incidents by eight minutes (MNDOT). A benefit/cost ratio of $17 worth of public benefit for every $1 spent was estimated for the Chicago Minuteman program.

[3] **Installation of detectors and CCTVs should be included as part of construction estimate, not TMP**

Unit Cost: Cost/truck hour of service ranges from $50.00 to $60.00.[4] Annualized cost of $85,000/vehicle, or about $250/day.[5]

Aerial Surveillance – Not many TMPs used aerial surveillance on a frequent basis. If a helicopter could be made available at little or no cost (such as a radio station traffic reporter), then it was used; otherwise it was not a major part of the TMP.

Unit Cost: Ranges from $5,000 to 6,000 per month (based on District 12 project) to $12,000/ month (I-95 project in Florida).

Call Boxes – Call boxes were not used in the TMPs of any of the case studies. However, it is Caltrans policy to place call boxes along all major state facilities, regardless of whether or not construction is taking place. Therefore, temporary call boxes may be installed during the project construction if feasible. Through proper design and planning, call boxes may be left in place after the completion of the project.

Unit Cost: $5,000 to $6,500 for field units (part of construction cost, not TMP cost): $25,000 to $32,000 dispatching unit: $500 to $600 annual operating cost/unit. Cost could also include telephone message charges and dispatching.

Construction Zone Enhanced Enforcement Program – Police assistance has always been a key element of reconstruction projects, and so it is an important part of every TMP. Some TMPs, such as District 5's Cuesta Grade project, used a Construction Zone Enhanced Enforcement Program (COZEEP) contract with the California Highway Patrol (CHP) to ensure adequate police assistance. The presence of law enforcement officers can have a positive effect by slowing traffic down in the work zone and can help implementation of the traffic control plan by providing enforcement, guidance and emergency response support. Participation in the COZEEP program is a precondition for any project for which a speed zone is proposed. Reduced speeds can be imposed only when a CHP officer is present.

Caltrans has prioritized a number of other conditions where COZEEP activity is warranted: (1 = highest priority, 12 = lowest priority)

Prioritized COZEEP Actions	**Degree of** Worker Exposure
1. Workers exposed to traffic and escape route blocked	Very High
2 Night construction Activity that is not obvious when inactive	
3. Activities with a large number of truck movements in the work area	
4. Enforcement for reduced speed zones through construction zone	

[4] **District 4 experience per April 21, 1993 memo from Albert Yee.**

[5] *Syntbesis of Traffic Management Strategies for* **Urban** *Freeway Reconstruction Projects,* **Raymond Krammer. Gerald Ullman, paper before the 68th Annual Meeting of TRB, 1969.**

Prioritized COZEEP Actions	Degree of Worker Exposure
5. Night work in an identified work zone that requires a lane closure	High
6. Work on freeways with six or more lanes	
7. Facility closures at night	
8. Daytime construction activity that is irregular	Low
9. Work zones protected by flaggers with or without pilot cars	
10. End **of** queue management	Variable
11. Poor highway alignment approaching the work zone, high truck counts. or other unique conditions	

In addition to these situations, alternate route strategies, discussed elsewhere in this report, can also benefit from added police presence during peak hours, especially at the intersections operating near *or* at capacity.

Unit Cost: $50 to $60/hour[6]

CONSTRUCTION STRATEGIES

Construction strategies are those strategies which can be implemented throughout the contract documents (plans, specifications and cost estimates) with the contractor dunng the construction. The objectives of construction strategies are to reduce construction time, to minimize traffic disruptions and to avoid potential safety problems during construction.

Variable Lanes – When a portion of a multi-lane highway is occupied for construction, an existing lane or lanes can be assigned a reversible role to accommodate the predominant flow of traffic. Another option is an interim High Occupancy Vehicle (HOV) lane, as in Minnesota's I-394 project, to encourage ridesharing. With the advent of the movable concrete barrier system or traffic cones and traffic channelizers, which enable quick shifts of the entire system by machine to provide positive separation of traffic, this method has become much more viable.

Unit Cost: Temporary concrete barriers: . . . $15 per linear foot
Traffic cones: . . . . . $10 each
Channelizers: , ... $35 each

[6] **Caltrans District 5. Cost estimates are generally obtained from the District Construction Safety Officer and are Included in the construction estimate.**

Project Phasing – Project phasing to schedule lane closures can be critical where a number of projects are occurring simultaneously. If a permanent lane closure is necessary to move construction forward, a lane closure report prepared to evaluate impacts and to determine phasing. This information provides input to the phasing of construction and traffic handling design. In most of the case studies evaluated in Phase I, the existing number of traffic lanes was to be maintained during the peak hour and therefore only off-peak restrictions were implemented. Project phasing can entail the use of shoulders as travel lanes, narrower lanes, or temporary widening, construction of temporary or permanent parallel facilities as detour roadways and/or ramps to maintain existing capacity.

Unit Cost: Variable depending on the duration of construction, materials used for the staged construction, and additional design fees for preparation of PS&E.

Incentive/Disincentive Provisions – This element is designed to motivate the contractor to complete work faster than normal, which can be beneficial for projects which would severely disrupt highway traffic operations. One method is to offer contractors a financial incentive through the use of Incentive/Disincentive (I/D) clauses which reward the contractor for completing the work ahead of schedule and assess penalties on the contractor for not meeting the completion date. They were used for the I-5 American River Crossing near Sacramento and the Ventura Freeway project in Los Angeles. They were not used **for** the I-680/Route 24 project in District 4 because of legal concerns and difficulties in implementation.

The I/D amount should be determined based on established construction engineering costs, state-related traffic control and maintenance costs, detour costs, and motorist delay costs. The daily cost should be compared with the user benefit, which can be computed using A Manual *on User Benefit Analysis of Highway and Bus Transit Improvements.7*

Unit Cost: $6,000 per day with maximum 5 percent of construction cost for incentive
$12.000 per day for disincentive (based on the I-45 project in Houston, Texas).

In addition to the I/D clauses, other mechanisms which can motivate contractors to shorten construction duration are listed below.

- **Cost-Plus-Time** Bidding: This procedure allows award of a project to the low bidder based on a combination of the aggregate bid of individual contract Items and a bid for the total time the contractor will spend on the project. North Carolina DOT is currently putting monetary value on time of contract performance on some contracts so that contractors can be selected on the basis of time in addition to cost. .

- **Owner-Imposed Physical Restrictions:** This approach allows the owner of the project to specify use of fast placement materials such as precast rather than cast-in-place materials for structures and asphalt or fast-curing concrete at critical locations to reduce public inconvenience. This approach is, however, likely to increase the project cost.

[7] American Association of State Highway and Transportation Officials (AASHTO. 1977).

- **Use of Owner-Supplied or Stockpiled Materials:** Owner-supplied (or State-furnished) materials should be encouraged for projects which will require materials which are normally hard to get or involve unpredictable delivery schedules. This approach can avoid prolonged occupation of the work site.

- **Value Engineering Incentive:** A value engineering incentive clause which shares any cost savings resulting from accepted changes with the contractor can be included in contracts to encourage contractors to develop and propose better ways to build the project. This method takes advantage of the contractor's construction knowledge and special capabilities and can often result in shortened contract time.

- **Surveillance:** This will require the contractor to drive through the construction zone and alternate routes on a routine (monthly, etc.) basis to detect possible problems. This approach was used for the Kennedy Expressway Reconstruction Project in Chicago.

Unit Cost: Not available

Lane/Ramp Closures – A Lane Closure Chart is a standard requirement in the Caltrans Standard Special Provision (SSP). This chart should be enforced with the contractors to reduce traffic Impacts. The chart is to be used to restrict work to off-peak hours for short-tgrm construction activities or to restrict work to nights or weekends if more time is required for construction. To prepare such lane/ramp closure charts, seven-day 24-hour counts are required. (Counts may also be required for routes used for detours.)

Unit Cost: $2,800 per direction per count location, if counts not already available in District' s inventory section

Glare/Gawk Screens – Use of traffic screens is often effective when construction areas are immediately adjacent to the travel lanes. They can prevent slow downs resulting from the distraction caused by adjacent construction activities. Traffic screens are mounted on the top of K-rails. Glare/gawk screens were used for the I-95 reconstruction project in Florida and are typically used on California projects. Caltrans SSP has specific requirements about the materrals and installation of traffic screens.

Unit Cost: $10 per linear foot to lease
$15 per linear foot to purchases

Truck Traffic Restrictions – Restricting truck traffic during a certain time window or **a** particular construction phase can facilitate other vehicular traffic flow. The restrictions can be incorporated into the staged construction and traffic handling design and/or project SSP. However. such restrictions may be difficult to enforce and could present potential legal problems. Districts should coordinate closely with Headquarters for direction on implementing this element.

Unit Cost: None

8 **ibid.**

Total Facility Closure – Construction time is shortened if all or a major part of the facility can be completely closed for all or parts of the day or week. For example, I-84 in Hartford was closed in one direction late at night and at certain times on weekends. Obviously, this element must be accompanied by COZEEP and alternative route strategies.

Unit Cost: Cost for COZEEP depends on extent of closure.

Lane-b-Lane Rental – This is a relatively new concept aimed at providing an incentive to contractors to minimize usage of road space, particularly during peak periods. Colorado and Oklahoma are presently experimenting with this element. Rental charges, based on number/configuration of lanes, are assessed when the contractor has a portion of the roadway impacted. This concept is similar to a bonus/rental charge method which has been applied in 11 states.

Cost: Varies, depending on construction engineering costs, traffic control costs and road user costs. This element would typically be funded as part of the construction contract, rather than the TMP.

DEMAND MANAGEMENT STRATEGIES

The objective of demand management strategies is to increase the normal person movement capacity of a freeway corridor.

Rideshare Incentives – To be effective, rideshare incentives (such as carpool matching and preferential parking) have to be implemented in conjunction with other elements of demand management such as park-and-ride lots, HOV lanes on freeway, entrance ramp meter bypass lanes, preferential carpool or vanpool parking, and/or flexible working hours.

Unit Cost: Vanpooling incentives range from $0.19[9] to $0.62[10] per vehicle using the corridor (based on ADT).

Rideshare Marketing – This element includes the formation of rideshare matching programs and promotion of existing rideshare programs through the use of flyers, brochures and events. The purpose **of** this element is to publicize commuting alternatives and to achieve a significant shift to Carpool and Vanpool to lower the drive-alone traffic volumes through the project site. Promotion of existing rideshare programs can be implemented as part of the Public Information Strategy which would involve minimum additional cost.

Unit Cost: Unknown. (TMP costs do not differentiate between overall marketing costs and rideshare marketing costs.)

9 **Caltrans District 7. Ventura Freeway TMP**

10 **Caitrans Oistrrct 12. I-5/I-405 · I-5/SR-55 TMP**

Park-and-Ride Lots – The provision of temporary or permanent park-and-ride lots adjacent to the project corridor can utilize available state owned right-of-way, other public agency properties, existing park-and-ride lots, or leased space from existing shopping centers.

Unit Cost: Variable, depending whether new lots must be acquired or built. Temporary at-grade parking would cost $1,000 per space with $50/space for annual maintenance cost.

Transit Service Improvements -This element includes an increase in existing transit service frequencies, provision of shuttle buses, and additions of expressway bus service along the project corridor.

Unit Cost: $500/vehicle mile.

Transit Incentives – Transit pass subsidies through employers, adjustment of transit schedules during the commute hours, and guaranteed ride home for rideshare users can all be effective in encouraging transit use, provided routes, service hours and frequencies serve major origins and . destinations in the corridor. Use of Commuter Check programs has resulted in increases in transit ridership of up to 50 percent.

Unit Cost: Depends on level of incentive, up to $60/month is now tax-free.

High Occupancy Vehicle Lanes – HOV lanes can be provided as the first phase of construction for the HOV lane construction project, by utilizing existing shoulders or median, or by designating one of the existing lanes for HOV use. If the HOV lanes are to remain permanently, no additional cost be incurred. Temporary HOV lanes require temporary signing and striping. The designation of an existing lane for HOV use is likely to be controversial. This element was used successfully in Minnesota and unsuccessfully in Sacramento.

Unit Cost: $6,000 per mile for temporary HOV lane.

Parking Management/Pricing – None of the case studies contained provisions for encouraging/marketing parking management as a method to reduce traffic demand. Overall, parking management strategies tend to have smaller impacts on employee mode choice at firms with an abundant parking supply and where options for controlling spill-over (i.e., employee parking on the streets or in other off-site lots) are limited.

Unit Cost: Minimal.

ALTERNATE ROUTE STRATEGIES

The goal of alternate route strategies is to reduce traffic through the construction zone by diverting traffic to feasible alternative routes. Volumes of diverted traffic should be estimated to determine if mitigation measures are required on the alternative routes to accommodate Increased traffic. However, the estimation of traffic volumes is complicated by the fact that the number of vehicles diverted will depend on type of improvements made to the alternate route to encourage diversion. There are two types of alternate routes: the 'official' routes which are well publicized and marked by signs to divert trucks, discretionary travelers, and/or commute traffic: and the 'unofficial' routes which are not publicized, that are used by travelers with local knowledge. In some cases, such as District 5 Cuesta Grade project, capital improvements to the alternate route were not required. In other cases, such as I-5 Santa Ana

Freeway and I-80, local street improvements were combined with law enforcement to make this an acceptable strategy.

Ramp Closure and Ramp Metering – Traffic flow disruptions can occur at entrance and exit ramps. When construction activity occurs in areas where entry/exit maneuvers are compromised, selected ramp closures are appropriate. Ramp metering is another alternative which can be implemented to relieve traffic flow disruption problems. However, both ramp closure and ramp metering could cause vehicles to divert to alternate routes. Furthermore, site-specific environmental/air quality studies will likely be required to assess 'hot spot' idling impacts.

Unit Cost: $80,000 to $100,000 per ramp for ramp metering.

Street Improvements – This element can include measures such as the temporary removal of a median island or on-street parking in order to provide additional turning lanes at critical intersections. Additionally, improved signing, striping, and lighting are often included. Most street improvements are implemented within the existing right-of-way and/or existing street curb-to-curb width to minimize the disruption to adjacent establishments or existing utilities.

Unit Cost: Variable depending on the magnitude of geometric changes, approximately $10,000 per intersection.

Traffic Control Improvements – Diverted traffic results in increased traffic on the adjacent streets and intersections. Modifications to the existing signal system or installation of temporary signals can be implemented on the alternate routes to accommodate this diverted traffic. Signal timing strategies are most effective if the unit cost per intersection can be kept in a reasonable range. For the I-80 TMP, Caltrans estimated delay savings resulting from signal coordination and other alternate route Improvements (costing $2.3 million to implement) amounted to about $10,000/day.

Unit Cost: $10,000 to 25,000 per temporary signal or signal modification.

4. GUIDELINES FOR SELECTING TMP STRATEGIES AND ELEMENTS

This chapter outlines methods and guidelines for determining the applicability of TMP strategies to a proposed project. The guidelines and methodology are based on an assessment of TMP data collected from the 14 case studies, a review of TMP literature and discussions with TMP Coordinators.

OVERVIEW OF THE PROCESS

This section provides guidance on how to identify appropriate TMP strategies and elements and develop preliminary budgets as called for in a PSR. Most information on which to make these judgements is available during the PSR stage.' Project planners should keep in mind that additional data collection and analysis will be required to develop individual TMP elements in the Project Development Phase.

The first step in developing a TMP for a project is to identify appropriate TMP strategies during the PSR stage. The TMP case studies showed that most TMPs utilize elements from each of the six broad strategies, although the emphasis varies according to particular circumstances. During the PSR stage, careful attention should be paid to'relevant site and facility characteristics, which in turn will influence the selection of specific TMP strategies and elements. The next step is to develop approximate costs required for each strategy. The final step is to compare costs to expected delay costs requiring mitigation and average cost of TMPs to check for reasonableness and adjust accordingly.

Figure 3 indicates the process that is recommended for selection of TMP strategies at the PSR stage. Step 1 is to fill out Sections 1, 2 and 3 of Caltrans' TMP Data Sheet (see copy of Data Sheet following Page 2-3). Completion of this step will lead to a decision on whether or not to recommend a TMP for a given project. If a TMP is warranted, preliminary strategies and costs need to be specified to complete the remainder of the Data Sheet. A series of exhibits and tables have been set up as part of this study to facilitate this process.

Exhibit 1 - Preliminary Project Description Table: A tabulation of project data from the PSR that have relevance in selecting levels of emphasis for TMP strategies and elements.

Emphasis Tables: A series of tables describing high and low emphasis actions for each element of the TMP strategies.

Exhibit 2 - Summary of Emphasis on TMP elements and strategies.

Exhibit 3 - TMP Cost Worksheet: A summary of costs based on the emphasis levels selected for each strategy, and ratios of the costs to total construction and delay costs.

I **See TMP data sheet in Chapter 2.**

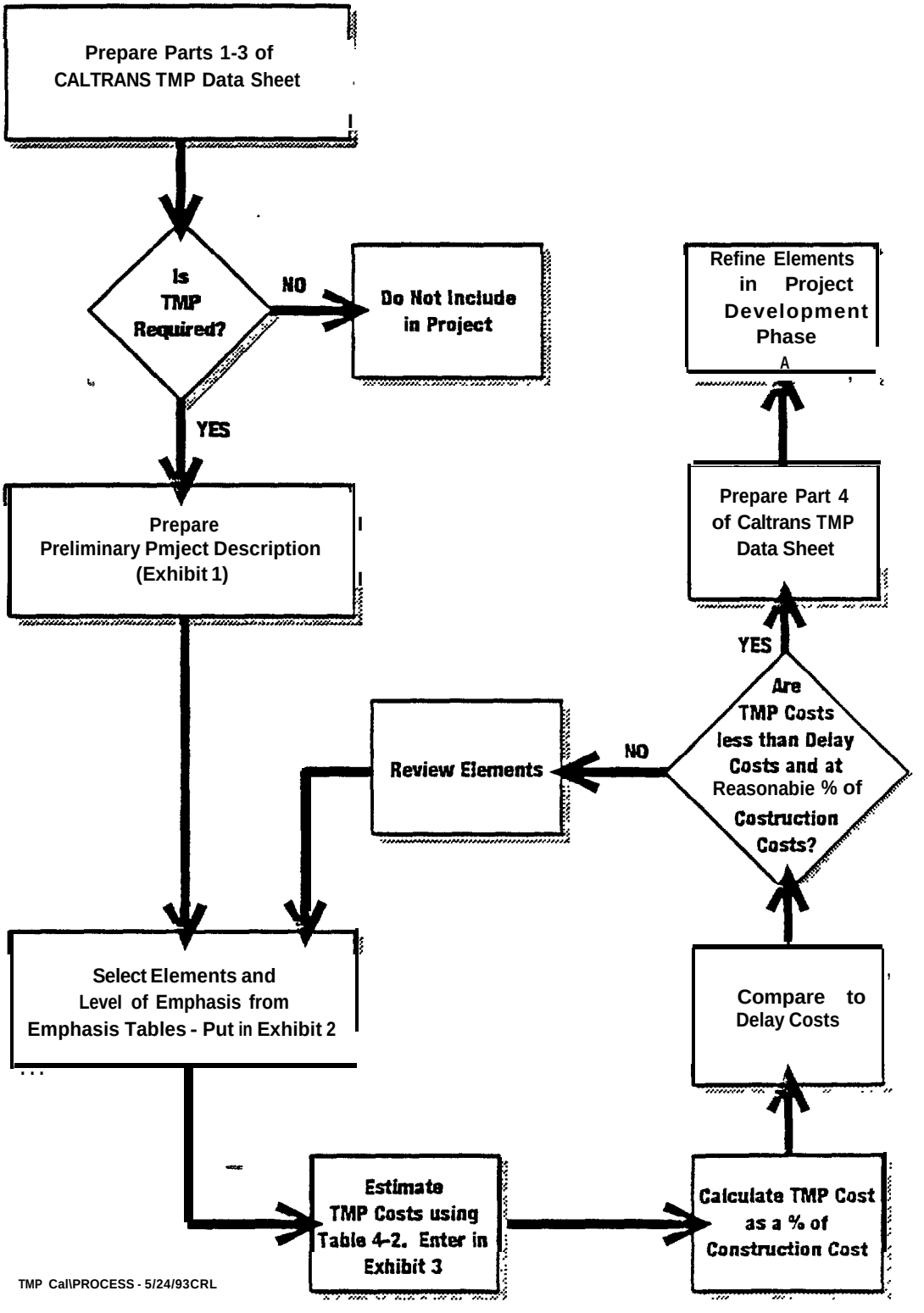

Figure 3

PROCESS FOR TMP SELECTION AT PSR STAGE

The overall process and use of each exhibit is explained in the following sections.

PROJECT CHARACTERISTICS AND THEIR RELATIONSHIP TO TMP STRATEGIES

Exhibit 1 provides a worksheet to tabulate data that may be relevant in determining the level of emphasis for each TMP strategy. Exhibit 1 lists 15 factors that should be considered; most can be derived from data available at the PSR stage.

1. Duration of Construction (months);
2. Length of Project (miles);
3. Number of construction phases (major phases only);
4. Level of urbanization (urban, suburban or rural);
5. Average Daiiy Traffic (2-way ADT through corridor;)
6. Percent reduction in vehicle capacity (w/o TMP);
7. Presence of viable alternative routes;
8. Expected delay w/o TMP (vehicle hours per day):
9. Public/Media exposure:
10. Political sensitivity;
11. Extent of affected major activity centers or employers;
12. Proportion of trucks;
13. Extent of impacts to businesses:
14. Potential increase in accidents:
15. Any other special factors.

Certain project characteristics relate to the level of emphasis that may be given to various TMP strategies. These project characteristics are discussed in the following paragraphs.

Duration – The duration of highway reconstruction projects influences the kinds of strategies considered and their emphasis. High capital investment elements need to be considered carefully for short duration projects. Large scale public information centers, costly alternative route modifications and new transit routes are generally not appropriate for short duration projects, unless they can be used later as permanent improvements.

Length Projects that involve reconstruction at a single point along a corridor lend themselves to emphasis on public information, motorist information and construction strategies. Because of the short impacted travel segment, such a project may lend itself far better to investment in these strategies than alternate routes, for example.

Phasing – A multiple-phased project can create a long-term change in the availability of and accessibility to freeway facilities. Motorists may become confused regarding the location of ramp closures during a multi-phased project. This necessitates a greater emphasis on public information elements to ensure that adequate notification is supplied on project scheduling and locatrons for closures and detours. Investment in motorist information (such as CMS), construction strategies, alternate routes and demand management are important to consider for a multi-phase protect.

Exhibit 1

PRELIMINARY PROJECT DESCRIPTION

PROJECT CHARACTERISTICS	DATA	COMMENTS
Project Name:		
Duration of Construction (months)		
Length of Project (miles)		
Number of Major Construction Phases		
Urbanization (urban, suburban or rural)		
Trips (two-way ADT)		
Reduction in Vehicle Capacity (%)		
Viable Alternative Routes (poor or good)		
Expected Delay (vehicle-hour/day from TMP data sheet)		
Public/Media Exposure (low/medium/high)		
Political Sensitivity (low/medium/high)		
Affected Activity Centers/Employers (none/few/many}		
Proportion Trucks (percentage of traffic)		
Business Impacts (low/medium/high)		
Potential Increase in Accidents (low/medium/high)		
Special Factors (if any)		

Urbanization – one degree of urbanization in a project area will affect the availability and use of certain TMP strategies. For example, an urban setting provides a more cost-effective area for public information since there tends to be more local traffic and travelers can be reached relatively easily. In a rural environment, more traffic comes from outside the area and motorist information is a strategy deserving more attention.

Average Daily Traffic – High Average Daily Traffic (ADT) suggests strong consideration of incident management, demand management and alternate route strategies. In general, the higher the ADT through the corridor, the more persons affected, the greater the total costs of delay and the greater the justification for investment in the TMP.

Reduction in Vehicle Capacity – Lane closures can increase delay and accidents significantly during highway construction. The extent of the disruption to travel is a function of how many lanes remain open during construction activities, and how many lanes can remain open during peak periods. The greater the reduction in capacity, the more emphasis on all aspects of the TMP. Top candidates for attention are use of alternate routes, incident management and motorist information.

Viable Alternate Routes – Frontage roads and secondary streets that parallel the construction corridor are necessary if a large number of automobiles are to be diverted from the construction zone. The presence of viable alternative routes brings TMP emphasis to public and motorist information and, obviously, alternate route strategies. Lack of alternatives routes leads to emphasis on construction strategies, incident management and demand management.

Delay - Delay considerations are important in two ways. First, greater expected delay warrants more investment in the TMP strategies. Second, an estimate of total cost for expected delay, as called for in the Traffic Management Plan Data Sheet, provides an upper limit on the worthwhile TMP expenditure. Total TMP costs should not exceed the savings in reduced delay. Experience suggests some of the least costly TMP elements for reducing (total) delay over the project period include incident management and contractor incentive/disincentive provisions. These might be examined first by the TMP planner for delay reduction.

Public/Media Exposure -Some projects may attract considerable public and media attention. depending on the project location, duration and expected delay. Where attention is expected to be keen. strategies deserving emphasis include: public information, motorist information and incident management. In short, information channels to the public, motorists and the media will be key considerations, as well as the responsiveness of project managers to highly visible accidents drawing attention to the reconstruction facility. A successful TMP can create a very positive image of Caltrans, particularly important in a high visibility project.

Political Sensitivity – Projects with high political sensitivity include those where lawsuits are underway or threatened, or where political leaders and interest groups are taking highly visible positions pro or con on the project. Such projects require attention to public and motorist information, as well as other strategres subject to political attention such as alternate routes or lane/ramp closures under construction strategies.

Affected Activity Centers/Employers – Generally, the more centers and employers affected, the more TMP planning should pay attention to public information, construction strategies, alternate routes and demand management. Rideshare incentives, transit improvements and HOV facilities should receive more emphasis when they can be targeted toward major activity centers, thereby making the strategies more viable.

Proportion of Trucks – Significant truck volumes can increase delay, especially due to accidents. Where high truck volumes occur, attention should focus on construction and alternate route strategies, especially truck traffic restrictions (where feasible) and lane/ramp closures affecting goods movement and delivery. In particular, incident management and the capacity for tow services to handle large trucks and load spills is a primary consideration.

Business Impacts – Some reconstruction projects will have a direct impact on businesses in the area It is critical that their ability to function be maintained as much as possible. A number of strategies are possible for this. Public Information can be used to promote these businesses and, along with motorist information, explain how they can be accessed. Alternate route strategies need to be considered in light of their impact on these businesses and those on the alternate routes. Construction strategies need to be particularly well thought out when businesses are affected: contractor incentives/disincentives may be appropriate when business impacts are great.

Potential Increase in Accidents – Reconstruction projects normally increase accident potential through narrowed lanes, sight blockage, and new merging and weaving movements caused by reconfigured lanes or shoulders where these are a particular problem, strategres deserving attention include Motorist Information, Incident Management, and Construction Strategies. Motorist Information can alert motorists to reduce speed, merge with caution or use alternative routes. Incident Management can ensure quick removal of accidents, and reduced potential for secondary accidents as motorists try to view an accident.

Special Factors – Some projects may contain other factors that influence strategy emphasis as in the examples below:

Steep Inclines – Steep Inclines can pose additional dangers during construction. In a situation where there is a steep grade, motorist safety could be compromised by closing all lanes in one direction and allowing two-way traffic on the remaining lanes. Emphasis should be given to alternate routes, motorist information and, particularly, incident management.

Raised Median – A raised median will make it difficult to re-route traffic from closed lanes onto open lanes. Again, alternate routes, motorist information and incident management should be emphasized.

Table 4-1 indicates graphically how project characteristics influence TMP strategies. These relationships are intended to guide the TMP planner toward appropriate strategies. They are not to be considered as absolutes. It's important to recognize that each project has unique characteristics that must be considered in formulating the TMP.

Table 4-1

INFLUENCE OF PROJECT CHARACTERISTICS ON TMP STRATEGIES

CHARACTERISTIC	Public information	Motorist information	Incldent Management	Construction Strategleo	Demand Management	Alternate Route Strategies
Long Construction Duration						
Long Project Length						
Multiple Construction Phases						
High Urbanization						
High Traffic Volumes						
Significant Reduction in Vehicle Capacity						
Viable Alternative Routes						
High Expected Delay						
High Public/Media Exposure						
High Political Sensitivity						
Many Affected Activity Centers/Employers						
High Proportion Trucks						
High Business Impacts						
High Potentlal Increase in Accidents						

Likely influence on use of strategy

SELECTING TMP ELEMENTS AND LEVEL OF EMPHASIS

Having identified the various strategies of the TMP, it is necessary to develop each strategy further by choosing the elements and their level of emphasis. There are a number of considerations in the selection process including all those enumerated under project characteristics (Exhibit 1) and others specific to each element.Based on the case studies evaluated, a list of selection considerations is provided for each element. The elements are grouped by the various strategies: Public Information, *Motorist Information, Incident Management, Construction Strategies, Demand Management Strategies and Alternate Route* Strategies. A series of Emphasis Tables describes high and low emphasis actions for each element.

Public Information[2]

The elements noted below are part of a comprehensive public information program designed to inform the comniunity about the construction project, traffic conditions and alternatives for commuting during the project.

1. Speaker's Bureau (implemented by 29% of case studies). Most useful if:

- Long construction period expected:
- High public/media exposure:
- High political sensitivity:
- Major business/activity centers/employers are affected:
- Business impacts are high:
- TMP encompasses many different elements.

Benefits:	Provides direct information to the community and direct, immediate feedback to the oroiect team.
Low Emphasis:	One-time presentation to all interested parties.
High Emphasis:	Target various activity centers, interest group and community forums along the construction corridor.

2. Brochures & Mailers (implemented by 93% of case studies).[3] Most useful if:

- Long construction period expected:
- High public/media exposure;
- High political sensitivity:
- Major business/activity centers employers are affected;
- Intent is to target specific audience(s) and encourage transit, ridesharing and alternate route use:
- TMP encompasses many different elements.

[2] **See Appendix A for more detailed information.**

[3] **Findings of the study Indicate that brochures are not generally cost-effectrve (see Appendix A).**

Benefits:	Provides detailed information to affected parties for reference at any time.
Low Emphasis:	Lower cost flyer distributed to chambers of commerce or major employers in the construction zone. Minimal mailing.
High Emphasis:	Color brochures developed by a graphics/marketing firm and mailed to large segment of area commuters, employers and businesses..

3. Media Releases (implemented by 71% of case studies). Most useful if:

- Construction project is complex and phased over time and location:
- High public/media exposure;
- High political sensitivity:
- Major business/activity centers/employers affected;
- TMP encompasses many different elements.

Benefits:	Potentially cost effective if utilizes free publicity to inform the community.
Low Emphasis:	Periodic press releases generated in-house to trigger public service announcements alerting commuters to the project,
High Emphasis:	Public relations firm and/or project staff provide on-going project information to local media, schedules press conferences and Informs media of major project changes.

4. Public Information Center (implemented by 36% of case studies). Most useful if:

- Project has long duration:
- Project is localized:
- Project has number of major construction phases:
- Project located in urban area:
- High public media exposure:
- High political sensitivity;
- Construction zone is near major activity centers:
- TMP staff is available to staff office:
- Information hotline is planned:
- Center located near project construction and traffic operations staff.

Benefits:	Provides employers and community with a single, centralized access point to information about project.
Low Emphasis:	Specified location in-house where information can be disseminated to the general public, with regular staff equipped to answer questions.
High Emphasis:	A central office is leased, staffed, equipped with toll-free phone lines and answering machines, and supplied with brochures and other information for distnbution.

5. Paid Advertising (implemented by 21% of case studies). Most useful if:

- High political sensitivii;
- Business impacts are high:
- Free media coverage is not sufficient for project;
- Demand management is significant:
- Use of alternative routes is significant.

Benefits:	Covers a large or multi-jurisdictional area, reinforces public awareness of the oroiect.
Low Emphasis:	One-time, detailed newspaper advertisement.
High Emphasis:	On-going television/radio commercials, newspaper advertisements, bulletin boards, and/or transit ad space.

6. Visuals: videos, slides, etc. (implemented by 28% of case studies). Most useful If:

- Project has many phases;
- In support of Speaker's Bureau and Public Information Center;
- Project lends itself to visual presentation;
- Needed to encourage alternate route, transit, park-and-ride use.

Benefits:	Increases community understanding of the project.
Low Emphasis:	Utilize in-house resources.
High Emphasis:	Contract with public relations/graphics firm to develop products, using consistent logo, slogan, etc.

7. Telephone Hotline (implemented by 50% of case studies). Most useful if:

- Project is of medium or long duration (for exclusive number);
- Construction phasing is complicated:
- Project is located in dense urban area;
- Alternate route, ramp closure is significant and variable;
- Part **of** Incident Management system:
- Information on rideshare, transit and Demand Management services is needed.

Benefits:	Provides commuters with up-to-date traffic/construction alternative and demand management information.
Low Emphasis:	**One** line with a recorded message updated continuously or standard Caltrans information number.
High Emphasis:	Full-time staff to answer phones. line dedicated to project.

Motorist Information

Motorist information elements are designed to assist motorists in structuring their travel plans by providing information on the latest traffic and road conditions in the vicinity of construction.

1. Changeable Message Signs (implemented by 64% of case studies). Most useful if:

- Complex construction phasing;
- Alternate routing is viable:
- Traffic Operations Center (TOC) existing or planned;
- Truck regulation in effect:
- There are frequent and varying lane/ramp closures;
- Incident management is in use.

Benefits:	Gives commuters opportunity to adjust travel plans according to information provided.
Low **Emphasis:**	Use portable CMSs
High Emphasis:	Purchase for permanent installation along corridor.

2. Highway Advisory Radio (implemented by 43% of case studies). Most useful if:

- Construction of significant duration;
- Complicated phasing:
- Alternate routing is practical:
- There are few obstacles to broadcast reception;
- There are frequent and varying lane/ramp closures:

Regular radio or TV commuter reports are not available, are infrequent or will not accept project status reports.

Benefits:	**Allows** commuters to adjust travel plans according to information provided.
Low Emphasis:	Utilize recorded traffic reports.
High Emphasis:	Install broadcast equipment necessary and staff accordingly.

Incident Management

The purpose of incident management is to reduce delays and provide safety measures for both workers and travelers in the construction zone.

1. Construction Zone Enhanced Enforcement Programs (COZEEP) (implemented by 14% of case studies). **Most useful** if:

- Potential for worker and motorist accidents is high;
- Truck movement in construction zone is heavy:
- There is no median divider or it has been removed as a result of construction: and
- Complete closure of freeways or ramps is required.

(See Chapter 3 for complete list of warrants)

Benefits:	Increases safety of workers and travelers in the construction zone.
Low Emphasis:	Work with local law enforcement agencies and highway patrol throughout the project, keeping them updated on conditions and safety concerns in the construction zone.
High Emphasis:	Contract with highway patrol to monitor the zone.

2. **Tow Service** (implemented by 64% of case studies). Most useful if:

- Alternate routes not viable:
- High public/media exposure:
- Proportion of truck traffic is high: and
- Frequency and severity of accidents/stalls is above average rate or anticipated to increase during the project:
- Shoulders have been removed as a result of construction;
- Lane blockages are expected to be frequent (i.e. 10 minutes of lane blockage results in one hour of congestion).4

4 **See Chapter 2 for further warrants.**

Benefits:	Estimated to reduce 8 minutes off average removal time for shoulder stalls, cost/benefit ratio of 17 to 1 in delay savings, and a reduction in secondary accidents.
Low Emphasis:	Coordinate with local enforcement agencies and tow services to enhance inter-communications, thereby reducing response times.
High Emphasis:	Fund the operation of a service patrol through the construction zone. to remove disabled vehicles due to stalls or collisions, thereby reducing response times and associated delays.

3. Aerial Surveillance (implemented by 29% of case studies). Most useful if:

- Project extends over a significant area:
- Available for little or no cost:
- Weather is conducive to regular flights, particularly during peak periods;
- Supports Incident Management system.

Benefits:	Provides up-to-the-minute traffic conditions and alternate routing information.
Low Emphasis:	Coordinate efforts wdh local traffic reporters.
High Emphasis:	Contract the services of an aerial surveillance provider.

4. **Closed-Circuit TV** (implemented by 50% of case studies). Most useful if:

- Construction of significant duration:
- Construction in limited area;
- Traffic levels and incident management are critical concerns at specific points; and
- Follow-up monitoring is anticipated for which video-taped license numbers would be useful, (requires high-resolution equipment):
- Incident Management in place:
- Traffic Operations Center (TOC) existing or planned.

Benefits:	Provides continuous monitoring of traffic conditions.
Low Emphasis:	Utilize existing equipment.
High Emphasis:	Lease or purchase CCTV and communications equipment, lease space for a monitoring station, and staff appropnately.

5. **Call-boxes** (no indication of usage: may already be in place as in Southern California). Most useful if:

- Call boxes currently exist in the corridor;
- Corridor is rural or sparsely developed;
- TOC exists or planned:
- Incident Management in place.

Benefits:	Increases safety of travelers along freeways: solar powered boxes are portable and can be placed anywhere.
Low Emphasis:	Boxes placed only in the construction zone.
Hlgh Emphasis:	Boxes placed throughout the corridor.

6. **Loop Detectors** (implemented by 29% of case studies; others may have been in place). Most useful if:

- Long-term construction is anticipated;
- Construction is localized;
- Loop detectors currently exist in the corridor;
- TOC existing or planned.

Benefits:	Provides continuous monitoring of traffic conditions.
Low Emphasis:	Very limited installation.
High Emphasis:	Permanent installation: regularly maintain.

Construction Stratecaies

Construction strategies are procedures that are used to mitigate impacts on motorrsts and others that fall outside those that might be used in normal construction practice. In many cases the distinction is not clear and is important only in allocating costs to the TMP or to the construction project.

1. Reversible and/or HOV Lanes (usually included as part of normal construction practice). Most useful if:

- Extended periods of lane closures are expected:
- Coordinated with Demand Management strategies, especially HOV.

Benefits:	Allows construction work to proceed without losing any lanes.
Low Emphasis:	Few and/or short segments
High Emphasis:	many and/or long segments

2. Project Phasing (usually included as part of normal construction practice). Most useful if:

- Extended periods of lane/ramp closures are expected;
- Coordination with other reconstruction projects is possible;
- Minimum number of lanes are required to remain open during course of project;
- Off-peak traffic allows lane restrictions.

Benefits:	Reduces impacts of lane closures to motorists.
Low Emphasis:	Lane width reductions, use of shoulders.
High Emphasis:	Construction of detours or temporary roadway facilities.

3. Incentive/DisincentiveClauses (implemented by 36% of case studies). Most useful if:

- High reduction in vehicle capacity:
- Alternate routes limited or not available;
- Anticipate high delay cost to motorists:
- High political sensitivity:
- High potential impact on business:
- Multi-phased or adjacent projects require strict adherence to schedule and coordination.

Benefits:	Reduction of construction time; potentially cost-eff ective. for large, long-term projects. May increase project cost by 10-20%; however, savings in reduced delay, vehicle operation **costs,** accidents and pollution may justify additional costs.
Low **Emphasis:**	Regular work schedule,
High Emphasis:	Utilize two or three work shifts/day, 7 days/week, also special equipment or materials.

4. Ramp Closures (usually included as part of normal construction practice). Most useful if:

- Viable alternate routes are available;
- The intent is to discourage local traffic from using freeway while allowing long-distance traveiiers to stay on the route:
- Goal is to maximize capacity of corridor during construction;
- Low impact on activity centers, environment and businesses;
- Alternative ramps available.

Benefits:	May reduce construction time, accidents.
Low Emphasis:	Close as necessary for construction onlv.
High Emphasis:	Close strategic ramps to restrict local traffic from using the freeway through the construction zone.

5. Glare/Gawk Screens (implemented by 21% **of** case studies). Most useful if:

- Construction duration is prolonged:
- Localized project:
- Traffic volumes high:
- Accident potential is high:
- Construction activity is immediately adjacent to traffic lanes;
- Motorist sight distance is not restricted by screen.

Benefits:	Prevents slowing due to distraction, increases worker safety, reduces accident potential.
Low Emphasis:	Only at major construction points.
High Emphasis:	At most/all construction points.

6. Truck Traffic Restrictions (implemented by one of the fourteen case studies). Most useful if:

- Alternate routes available with minimal noise and adverse business impacts;
- Trucks are involved in a high proportion of the accidents in the corridor:
- High truck volumes exist;
- Geometrics (grades, widths) are difficult for trucks:
- Legal problems can be addressed satisfactorily.

Benefits:	Prevents delay and injury due to truck accidents and maneuvering.
Low Emphasis:	Peak hour restrictions, short segments, few points.
High Emphasis:	All day restrictions.

Demand Management Strategies

The specific elements for demand management that follow are designed to increase the use of HOVs or non-motorized vehicles as alternate modes of travel, reducing the number of commute vehicles during peak congestion periods.

1. **Rideshare Incentives** (implemented by 64% of case studies). Most useful if:

- Project has significant duration:
- Commuter traffic is significant:
- There are few or no alternate routes:
- Significant delays are expected:
- Major activity centers and employers can be targeted for rideshare service;
- Regional ridematching is available for commuters.

Benefits:	Reduces vehicle trips and traffic.
Low Emphasis:	Capitalize on rideshare matching and promotional programs in existence.
High Emphasis:	Subsidies for HOVs, coupons/discounts from local merchants, promotional items, direct mailers to motorists.

2. Rideshare Marketing (implemented by one of the fourteen case studies). Most useful if:

- Project has significant duration:
- Commuter traffic is significant:
- There are few or no alternate routes:
- Significant delays are expected:
- Major activity centers and employers can be targeted for rideshare service;
- Regional ridematching is available for commuters.

Benefits:	Reduces vehicle trips and traffic.
Low Emphasis:	Capitalize on programs in existence.
High Emphasis:	Design as part of comprehensive/marketing campaign with staged promotional events, focused promotional items, regular media contacts and consistent press releases.

3. Park and Ride Lots (implemented by 36% of case studies). Most useful if:

- Long duration construction:
- Construction corridor accesses major employment center or other centralized destinations:
- Environmental impacts are minimal;
- Access to HOV lanes and transit through construction zone is available;
- Good sites are available;
- Employer-based programs planned and promoted:
- Shopping centers, churches, and other similar sites will lease space.

Benefits:	Can be very cost-effective to implementing agency and commuters, provides easy access to rideshare arrangements, transit, and possibly HOV lanes.
Low Emphasis:	Improve/expand existing lots (park-and-ride, transit centers, rail stations, etc.).
High Emphasis:	Lease or build new lots:

4. Transit Service Improvements (implemented by 57% of case studies). Most useful if:

- Major activity centers and employers can be targeted for service;
- Transit already in corridor:
- There is high transit capacity and accessibility;
- Shuttles operate from park-and-ride lots, rail stations, and transit centers to CBD;
- Implemented with other transit incentives such as fare discounts, employer promotions:
- Express service possible.

Benefits:	Reduce vehicle trips and traffic.
Low Emphasis:	Work with transit agencies for additional service at peak penods.
High Emphasis:	Contract with transit operator to provide special express buses, shuttles, etc.

5. Transit Incentives (implemented by one of the fourteen case studies). Most useful if:

- Major activity centers and employers can be targeted for service;
- Transit already in corridor;
- There is high transit capacity and accessibility;
- Shuttles operate from park-and-ride lots, rail stations, and transit centers to CBD;
- Implemented with other transit incentives such as fare discounts, employer promotions;
- Express service possible.

Benefits:	Reduce vehicle trips and traffic.
Low Emphasis:	Sell transit passes through- transit district.
High Emphasis:	Transit district and employers provide cash incentives, discount passes/tickets, subsidies, two-for-one monthly pass sales.

6. HOV Lanes (implemented by 14% of case studies). Most useful if:

- There is sufficient median and/or shoulder width to accommodate HOV lane;
- Time savings provided are significant:
- Supported by preferential ramp metering, park-and-ride;
- HOV to be implemented as part of project.

Benefits:	Increases HOV use, offers commute time savings, reduces congestion.
Low Emphasis:	Designate median or shoulder with striping or signing
High Emphasis:	Construct separate lanes for HOVs.

7. Parking Management/Pricing (no indication of usage). Most useful if:

- Long duration:
- Urban area:
- Many activity centers:
- There is limited alternative parking available on streets or off-site lots;
- There is limited supply of on-site parking:
- There are sufficient alternative modes (i.e., transit, vanpools, etc.);
- Employer-based rideshare and transit programs exist or planned at major activity centers in corridor;
- Air quality, trip reduction regulatrons require parking management/pricing.

Benefits:	Cost-effective, decreases SOV use when used with other elements and incentives.
Low Emphasis:	Free or preferential parking for HOVs at some employers.
High Emphasis:	Implement an area-wide parking pricing program that sets a market rate on parking: installs access equipment: provides free, discounted, and/or preferential parking for HOVs.

8. Variable Work Hours (implemented by 14% of case studies). Most useful if:

- Project of long duration:
- There are employers and/or activity centers along corridor and alternate routes:
- There are heavy existing peak period direction traffic volumes:
- Supported by key interest groups, political leaders, media

Benefits:	Distributes peak hour commuting over greater time period, decreasing congestion, accident potential.
Low Emphasis:	Encourage implementation by local employers by promotion
High Emphasis:	Incorporate into trip reduction/air quality ordinances and rules: mount demonstration programs; aggressively promote.

Alternate Route Strategies

These elements utilize investments in Capital or operating improvements to Improve the efficiency of viable alternates to the route being constructed. Though not stated, each of these elements assumes that viable alternate routes exist.

1. Traffic Police (implemented by 50% of case studies). Most useful ii:

- Short duration project:
- Surface streets are used as alternate routes:
- A large displacement of commute vehicles onto surface streets is expected during peak hours:
- Flexibility of traffic control at various intersections is required depending on time of day, day of week, etc.
- Permanent improvements to alternate routes are not made:
- Business, neighborhood organizations support.

Benefits:	Reduces congestion at Intersections during peak periods.
Low Emphasis:	Periodic use at major intersections during peak periods or specific construction phases.
High Emphasis:	Consistent use at major intersections along alternate route.

2. Ramp Metering. Most useful if:

- Project of long duration;
- Enforcement resources available:
- Minimal backup onto local streets/intersections:
- No/minimal political opposition on issue for possible backup;
- Ramps are near major work centers in the construction zone:
- Supports temporary/permanent HOV lanes:
- Can be made permanent.

Benefits:	Keeps merging traffic moving more efficiently, opportunity for HOV bypasses: decrease of short distance travel from freeway; decrease accident potential on facility.
Low Emphasis:	Meters on ramps near construction zone only.
High Emphasis:	Comprehensive network of meters along corridor.

3. Traffic Control Improvements (signals, etc.). **Most useful if:**

- Project of long duration:
- Business, local jurisdictions support:
- Possible to coordinate signal timing across jurisdictions:
- Large volumes of traffic are expect to be diverted from construction zone;
- Permanent improvements desirable.

Benefits:	Keeps traffic moving more efficiently along the corridor, reduces accident potential.
Low Emphasis:	Retime existing signal trming for alternate route at peak periods or key segments only.
High Emphasis:	New coordinated signal system, interactive network of loop detectors, possible CCTV and control center.

4. Street Improvements (additional lanes, parking removal, etc.). Most useful if:

- Long construction period:
- Existing alternate route capacity is insufficient for diverted traffic:
- Large volumes will be diverted from construction zones:
- Schedule can be tied to project construction schedule:
- Low cost improvements opportunities available:
- Business, local jurisdictions support;
- **Impact** on alternate street capacity during construction is acceptable.

Benefits:	Accommodates higher displacement of vehicles to alternate routes.
Low **Emphasis:**	Restrict on-street parking during peak periods.
High Emphasis:	Extensive widening, lane additions, parking restrictions, restriping along route.

5. Ramp Closures (for diversion to other streets). Most useful if:

- Alternate routes are available:
- Intent is to eliminate short freeway trips;
- Temporary closure during peak period is beneficial, with alternate routes;
- Environmental consequences minimal;
- Little political opposition.

Benefits:	Allows through traffic to remain on the freeway and improves traffic flow and reduces accident potential.
Low Emphasis:	Temporary closures at off-peak periods while work is conducted, opened at peak periods.
High Emphasis:	Systematic closures to restrict access for the duration of the project.

TABULATING EMPHASIS LEVELS AND ESTIMATING TMP COSTS

Based on the prior tables, **Exhibit** 2 should be completed, specifying appropriate TMP elements and their potential emphasis. The cumulative impact of the individual elements can then suggest an overall emphasis level for each strategy.

The levels of emphasis for each strategy then help to estimate TMP costs. High-low cost ranges for the strategies are provided in Table 4-2 along with Cost/ADT and Cost/ADT/Year. The ranges are based on case studies summarized in Working Paper #1 of this study. Appendix B provides a synthesis of findings from this working paper.

The level of emphasis and capital vs. operational nature of elements determine the estimated *cost* for each strategy. Strategies requiring primarily capital investment such as motorist information and possibly construction and alternative routes should use cost/ADT in developing ranges. Strategies requiring primarily operating costs should use cost/ADT/year. Strategies with high emphasis elements should be assigned costs toward the upper end of the range in Table 4-2, and visa versa for strategies with low emphasis elements. me cost information is then entered into Exhibit 3 to develop total costs for each strategy and a grand total for the TMP.

Total TMP cost should then be compared to both construction and delay costs. The case studies show TMP costs ranging from 4 to 31 percent of construction costs (see Table 3-2), with most at 5-10 percent. There should be a reasonable match between the ratio of TMP to construction costs and the project characteristics. Specifically, total TMP costs above the median should be justifiable in terms of such characteristics as high ADT, anticipated reduction in vehicle capacity, expected delay, and possibly high political sensdivity, public exposure, number of affected activity centers and/or other project characteristics listed in Exhibit 1. Projects with lower intensities on these characteristics should result in TMP costs closer to or below the median.

EXHIBIT 2

LEVEL OF EMPHASIS FOR TMP ELEMENTS AND STRATEGIES

Strategy	Element	Level of Emphasis			Overall Emphasis for Strategy
		None	Low	High	
1. Public Information	Speakers Bureau				
	Brochures & Mailers				
	Media Releases				
	Public Information Center				
	Paid Advertising				
	Visuals				
	Telephone Hotline				
2. Motorist Information	Changeable Message Signs				
	Highway Advisory Radio				
3. Incident Management	Construction Zone Enhanced Enforcement Programs (COZEEP)				
	Tow Service				
	Aerial Surveillance				
	Closed-Circuit TV				
	Call-boxes				
	Loop Detectors				
4. Construction Strategies	Reversible and/or HOV Lanes				
	Project Phasing				
	Incentive/Disincentive Clauses				
	Ramp Closures				
	Glare/Gawk Screens				
	Truck Traffic Restrictions				

EXHIBIT 2

LEVEL OF EMPHASIS FOR TMP ELEMENTS AND STRATEGIES

Strategy	Element	Level of Emphasis			Overall Emphasis for Strategy
		None	Low	High	
5. Demand Management	Rideshare Incentives				
	Rideshare Marketing				
	Park and Ride Lots				
	Transit Service Improvements				
	Transit Incentives				
	HOV Lanes				
	Parking Management/Pricing				
	Variable Work Hours				
6. Alternate Route Strategies	Traffic Police				
	Ramp Metering				
	Traffic Control				
	Street Improvements				
	Ramp Closures				

Table 4-2

TRAFFIC MANAGEMENT PLAN COST GUIDELINES
Caltrans Traffic Management Plan Effectiveness Study

Strategy	Cost	Years	ADT	Cost/ADT(1)	Cost/Yr/ADT(1)
Public Information					
High (Miami I-95)	$12,900,000	2.00	200,000	$ 64.50	$32.50
Low (District 5/Cuesta Grade)	50,000	0.33	68,000	1.00	3.00
Motorist Information					
High (Miami I-95)	$ 1,800,000	2.00	200,000	$ 9.00	$ 4.50
Low (District 5/Cuesta Grade)	50,000	0.33	50,000	1.00	3.00
Incident Management					
High (Miami I-95)	$ 6,700,000	2.00	200,000	$ 35.50	$17.00
Low (District 5/Cuesta Grade)*	50,000	0.33	50,000	1.00	3.00
Construction Strategies					
High (Miami I-95)	$ 4,900,000	2.00	200,000	$ 24.50	$12.50
Low (District 7/Ventura)	960,000	1.50	265,000	4.00	2.50
Demand Management					
High (District 4/I-80)	$ 7,100,000	7.00	260,000	$ 27.50	$ 4.00
Low (District 7/Ventura)	50,000	1.50	265,000	0.50	0.50
Alternate Route Strategies					
High (Minneapolis I-394)	$14,500,000	7 00	99,000	$146.50	$21.00
Low (District 3/I-5)	10,000	0.33	68,000	0.50	1.50

Note: Data from Case Studies (see Appendix B); some data very limited

(1) Costs rounded up to nearest $0.50.
* Sacramento I-5 Incident Management Strategy partially funded from other sources.

Wilbur Smith Associates; March 1993

Exhibit 3

CALCULATION OF TMP COST
Caltrans Traffic Management Plan Effectiveness Study

Stralegy	Emphasis (L/M/H)	Estlmated Unit Cost	ADT	ADTxYear	cost/ Strategy	Adjusted Cost/Strategy
Public Informalion						
Motorist Information						
Incident Management						
Construction Strategies						
Demand Management						
Alternate Route Strategy						
				Total		
Construction Cost						
Percent of Construction Cost						
Delay Cost Expected to be Mitigated by TMP (from TMP Data Sheet 2F)						

Remarks:

L/M/H = Low, medium, high.

Cost of delay expected without a TMP serves as another check on the reasonableness of total TMP costs.. The Caltrans Traffic Management Plan Data Sheet requires an estimate of the total vehicle delay cost expected without the TMP, and the proportion of this cost which requires reduction to existing or acceptable levels (see Chapter 2). The cost of the TMP should be less than the cost of delay to be reduced. Only in this way does a favorable cost/benefit ratio result.

If the first version of the TMP's strategies and element emphasis results in higher than median costs without justifiable project characteristics, or if costs exceed delay costs to be reduced, then the TMP should be revised. Specifically, each strategy and mix of elements should be evaluated and scaled back to reduce costs while maintaining as much effectiveness as possible. Again, total costs should be calculated and checked against percent of construction costs and delay costs. The entire process should be repeated until a favorable mix of strategies and costs results.

EXAMPLE

The following example illustrates how the TMP calculation might proceed. Exhibit 1 lists the characteristics of XYZ Highway Reconstruction, a $50 million, 14-month project. The project corridor runs through a largely residential area of medium density with one major office/shopping center adjoining the reconstruction facility. No alternate routes are viable. No interest group opposition has emerged and no political leaders have taken strong positions pro or con. No lawsuits are pending.

Exhibit 2 was completed using the project characteristics in Exhibit 1 as a guide. The emphasis and use of individual elements helped to determine the overall emphasis in each strategy. The cost of each strategy was estimated from Table 4-2 and tabulated in Exhibit 3.

The first round of strategies and elements resulted in a higher than median percent of construction costs (9.5 percent) and was reconsidered (see Exhibit 3). For example, motorist information was scaled back by reducing the number of fixed signs and CMS. Construction strategies were scaled back from the first estimate by making better use of shoulders instead of construction detours.

Public information was reoriented to target employers in the activity center, emphasizing ridesharing and variable work hours, promotions through the regional rideshare agency instead of mass mailings to motorists, and extensive speaker bureaus. Incident management costs were reduced by curtailing aerial surveillance but maintaining contract tow service.

The adjusted TMP cost is more acceptable for two reasons. One, the cost amounted to 7.4 percent of construction costs, closer to the median for the cases reviewed. Two, TMP cost is less than the delay cost targeted for reduction. Specifically, without the TMP, delay is estimated to be 2,000 vehicle-hours/day. In this example, following the Caltrans Data Sheet procedure and consultations with the Branch Chief, it was estimated that 75 percent of this delay or 1,500 vehicle-hours/day could be mitigated through the TMP. This delay translates into 630,000 vehicles hours of total delay over the project period (assuming 30/days/month), or $5.3 million in delay at $8.40/vehicle-hour (Data Sheet, item 2F). Therefore, the TMP cost is less than the delay cost.

The costs and selected TMP strategies and elements are then entered into Section 4 of Caltrans' TMP Data Sheet.

Exhibit 1

PRELIMINARY PROJECT DESCRIPTION

PROJECT CHARACTERISTICS	DATA	COMMENTS
Project Name: XYZ Highway Reconstruction		$50.0 million construction cost
Duration of Construction (months)	14	
Length of Project (miles)	3	
Number of Major Construction Phases	3	
Urbanization (urban, suburban or rural)	Urban	Medium density residential
Trips (two-way ADT)	100,000	
Reduction in Vehicle Capacity (%)	15%	
Viable Alternative Routes (poor or good)	Poor	Little alternate route capacity avail.
Expected Delay (vehicle-hour/day from TMP data sheet)	2,000	average 10 minutes
Public/Media Exposure (low/medium/high)	Medium	Some TV, newspaper news anticipated
Political Sensitivity (low/medium/high)	Low	No suits pending
Affected Activity Centers/Employers (none/few/many)	Few	One office/shopping center in corridor
Proportion Trucks (percentage of traffic)	5%	Peak percentage; off-peak higher
Business Impacts (low/medium/high)	Low	
Potential Increase in Accidents (low/medium/high)	Medium	During lane restriction phase only
Special Factors (if any)	None	

EXHIBIT 2

LEVEL OF EMPHASIS FOR TMP ELEMENTS AND STRATEGIES

Strategy	Element	Level of Emphasis			Overall Emphasis for Strategy
		None	Low	High	
1. Public Information	Speakers Bureau	X			Medium
	Brochures & Mailers	X			
	Media Releases			X	
	Public Information Center		X		
	Paid Advertising		X		
	Visuals		X		
	Telephone Hotline			X	
2. Motorist Information	Changeable Message Signs		X		Low/Medium
	Highway Advisory Radio		X		
3. Incident Management	Construction Zone Enhanced Enforcement Programs (COZEEP)			X	Medium/High
	Tow Service			X	
	Aerial Surveillance	X			
	Closed-Circuit TV		X		
	Call-boxes	X			
	Loop Detectors			X	
4. Construction Strategies	Reversible and/or HOV Lanes	X			Medium/High
	Project Phasing			X	
	Incentive/Disincentive Clauses	X			
	Ramp Closures			X	
	Glare/Gawk Screens			X	
	Truck Traffic Restrictions	X			

EXHIBIT 2

LEVEL OF EMPHASIS FOR TMP ELEMENTS AND STRATEGIES

Strategy	Element	Level of Emphasis			Overall Emphasis for Strategy
		None	Low	High	
5. Demand Management	Rideshare Incentives		X		
	Rideshare Marketing		X		
	Park and Ride Lots		X		
	Transit Service Improvements			X	
	Transit Incentives		X		
	HOV Lanes		X		
	Parking Management/Pricing	X			Medium
	Variable Work Hours		X		
6. Alternate Route Strategies	Traffic Police		X		
	Ramp Metering		X		
	Traffic Control	X			
	Street Improvements	X			Low
	Ramp Closures	X			

Exhibit 3

CALCULATION OF TMP COST
Caltrans Traffic Management Plan Effectiveness Study

Strategy	Emphasis (L/M/H)	Estimated Unit Cost	ADT	ADTxYear (100,000 x 14/12)	Cost/ Strategy	Adjusted Cost/Strategy
Public Information	M	$15/yr/ADT	100,000	117,000	$1,755,000	$1,500,000
Motorist Information	L/M	$3/ADT			300,000	200,000
Incident Management	M/H	$12/yr/ADT			1,404,000	1,200,000
Construction Strategies	M/H	$10/ADT			1,000,000	500,000
Demand Management	M	$2/yr/ADT			234,000	200,000
Alternate Route Strategy	L	$1/ADT			100,000	100,000
				Total	$4,793,000	$3,700,000
Construction Cost					$50,000,000	$50,000,000
Percent of Construction Cost					9.5%	7.4%
Delay Cost Expected to be Mitigated by TMP (from TMP Data Sheet 2F)					$5,300,000	$5,300,000

Remarks:

L/M/H = Low, medium, high.

PROJECT DEVELOPMENT PHASE

The mix of TMP elements should be refined and further developed in the project development phase. In this phase, elements and costs are defined more exactly, implementation steps are set out in detail and the organizationalas well as financing components of TMP are set in place. Some elements still may be added, expanded or dropped as changing circumstances, new information, political and financing variables dictate. However, with good planning at the PSR stage, the TMP planner will be better able to adjust elements as necessary during project development and eventual implementation.

ROLE OF MONITORING

Once a TMP is under way, monitoring serves both an oversight and evaluation purpose. Monitoring for oversight includes:

- **Determining how strategies are being implemented. The first** job of monitoring is to determine if specified TMP elements (e.g. extra bus service, changeable message signs, tow services) are happening on schedule and in the manner planned.

- **Tracking costs and comparing these to budget.** It is vital to know how costs compare to budget at least on a quarterly basis. With this information, the budget can be adjusted accordingly.

Monitoring for evaluation is important for TMP managers to:

- Assess and fine-tune performance of all TMP strategies and overall performance of the project corridor and alternative routes:

- Track public acceptance and ensure Continuation of the project;

- Determine cost effectiveness of individual TMP strategies and shift resources from the least to most cost effective strategies; and

- Determine if additional TMP elements are needed or if particular elements need refinement.

Evaluation focusing on both impacts and costs can help tune performance of TMP strategies and allow TMP managers to shift resources among project Strategies as the project proceeds. For example, periodically evaluating prior mode and route of new transit, rideshare and ferry service patronswill help determine whether the services are competing with one another. Explicit evaluation of delay and TMP Strategy effectiveness on alternative routes may suggest that revised signal timing or even selective police control are worth the cost in reduced delay. Periodically evaluating costs associated with project management, vehicle delay and accidents may Suggest that incentives for faster contract performance and/or speedier construction techniques are worthwhile. Tow services may be highly cost effective and worthy of expansion, depending on the extent the services reduce delay and how delay time is valued.

Of course, additional resources for any TMP strategy eventually will reach diminishing returns. Response time to an incident can be reduced by committing more vehicles and personnel to a tow service, but *soon* each added increment of resource brings less and less reduction in response time. Likewise, *one* intensive rideshare campaign may bring an initial burst of rideshare applications, but each added campaign can be expected to bring fewer or less productive returns, such as more applications from current carpoolers or transit users. To shift resources among TMP strategies, **TMP** managers need frequent monitoring of key performance indicators and flexibility in the allocation of TMP staffing and contract terms with tow service, transit and rideshare providers

MEASURES OF EFFECTIVENESS AND MEASURING METHODS

TMP evaluation should focus on the performance of both individual TMP strategies and overall performance of the reconstruction corridor or facilities. Various measures of effectiveness and measuring techniques are appropriate to corridor and strategy evaluation. This section suggests key measures of effectiveness and associated measuring methods. Table 5-1 summarizes the monitoring and evaluation measures.

Overall Corridor Performance

Measures of Effectiveness

An important task in evaluating TMP effectiveness is tracking and analyzing several measures of corridor performance. Overall corridor performance is the 'bottom line' of evaluation. Key performance indicators for both the reconstruction facility and alternative routes include:

- Traffic volumes:
- Delay;
- Vehicle occupancies: and
- Accident rates and severity.

These performance measures should be measured very regularly within budget constraints (at least quarterly during construction, if not monthly) and include peak and off-peak periods. Measurement should take place before, during and after reconstruction. A good model for data collection is the surveys done by Caltrans District 4 for the I-680/SR-24 project.

For major and long lasting TMPs, evaluation should also track at least some of the same key variables in a non-TMP corridor for control purposes. For example, some changes in vehicle occupancies and transit utilization in the TMP corridor may be attributable to the rise or fall in gasoline prices or unemployment in the region. Only a comparison with fluctuations in other corridors will pick up the influence of these 'outside' variables and give a better picture of how TMP strategies are doing.

Data Collection Methodology

Various methods can be used to evaluate corridor performance. Standard machine counting or video procedures can be used to make traffic counts. Several methods can be used to estimate vehicle occupancies. Direct observation is the most direct and accurate method to evaluate slow moving streams of traffic. Another method is to incorporate passenger questions into standard origin and destinatron surveys mailed to users of the reconstruction facility identified through license plate monitoring. However,

Table 5-1

TRAFFIC MANAGEMENT PLAN EVALUATION CONSIDERATIONS
Caltrans Traffic Management Plan Effectiveness Study

TMP Strategy	Measures of Effectiveness	Evaluation Methods	Cautions
Overall Corridor	• Traffic Volumes • Delay • Vehicle Occupancy • Accident Rates • Severity • Peak/Off-Peak	• Machine Counts • Video Surveillance • O/D Surveys • Transit Ridership 0 Accident Reports • Floating/Test Car • Transit Aidenhip	• Sample should represent total traffic volume • Control/comparison data needed • Entire corridor must be surveyed
Public Information	• Awareness of TMP Strategies • Self Report Travel Behavior Change	• Survey of Travelers Mail/Phone • Focus Groups	• Surveys should not prompt respondents
Motorist Information	0 Awareness of Motorist Information • Reactions to Messages	• Survey of Travelers Mail/Phone • Traffic Observation	0 Surveys should not prompt respondents
Incident Management	. Response and Removal Time . Delay Reduction	. Video Surveillance I . Dispatcher • Police • Service Patrol Logs	Secondary accident benefit difficult to measure • Control/companson data needed
Construction Strategies	. Delay . Vehicle Operating Cost . Vehicle Occupancy . VMT . Emissions . Accident Rates . Severity . Peak/Off-Peak	. Machine Counts . Video Surveillance . O/D Surveys . Accident Reports . Floating/rest Car	. Carefully define contractor strategies baseline . Control/comparison data needed . Sample should represent total traffic volume
Demand Management	. Vehicle Trip Reduction . Vehicle Occupancy . VMT	. Survey of Rideshare • Transit • Park-and-Ride Users • Mail/Phone . Employer Surveys of Employees	. Surveys should not prompt respondents . Assess pnor mode, route
Alternate Routes	. Traffic Volumes . Delay . Vehicle Occupancy . VMT . Emissions . Accident Rates • Seventy . Peak/Off-Peak	. Machine Counts . Postcard Survey . Video . O/D Survey . Locality Traffic Counts . Floating/Test Car	. Assess formal and informal alternate routes . Sample size should represent total traffic volumes . Control/comparison data needed . Assess pnor route. mode . Assess delay for both regional and local trips.

Wilbur Smith Associates: March 1993

care **must** be taken to obtain a sample size representing total traffic volume, which may be difficult to do. Past experience with response rates and the desired confidence level (e.g. confidence of 95 percent sample mean will differs by no more than 5 or 10 percent from the population mean) will determine appropriate sample size.

Transit occupancies on relevant routes should be available through transit agencies. Transit specifically funded through TMP should require agencies to report on detailed occupancy date.Major accidents can be tracked through police and Highway Patrol reports. Evaluating delay and speeds is more difficult but important as the public and media are sensitive to these measures. 'floating or test car' procedures are common methods used by Caltrans for measuring travel time, delay and speeds.

It is critical that all major corridor streets be included in the surveys. A TMP is not successful if it maintains or improves traffic flow on the reconstructed route while dumping problems on alternative routes. It is also useful to survey local and state enforcement and maintenance personnel to gain insight on how well the TMP is working and to identify any problem areas.

Public Information

Public information campaigns serve two main purposes in TMP projects. They inform the public about the overall purposes of the project to generate and maintain public support: and they encourage changes in travel behavior during the project to minimize congestion and accidents. It is important that elements of the public information campaign be monitored frequently so that resources can be allocated most effectively (see Appendix A).

Measures of Effectiveness

The principal objectives of a public information monitoring program should be to determine the following:

1. Is the public getting correct information? and
2 Is this information changing their travel behavior'?

Determining how TMP information is disseminated and how well it is understood can best be established through questionnaire surveys and/or focus groups. These are discussed in detail in Appendix A.

In general, there are two ways to measure whether information is changing travel behavior. One way is to categorize travelers responding to awareness surveys **on** an awareness scale, then determine if there is any correlation between awareness and self reported change in travel mode, time or route as suggested in the public relations campaign. A successful information program should result in the most change in travel behavior among the most aware, and the least change in the least aware.

Another way to evaluate the relationship between awareness and change in travel behavior is to ask those making travel changes *why* they have done so. For example, periodic on-board surveys could be conducted to uncover new riders switching from auto to transit use in the reconstruction corridor. These surveys could ask such switchers about their awareness of billboards, TV spots and other public information campaign actions, as well as their reasons for changing to transit. If public relations is effective, the switchers should be aware of information coming from at least some campaign elements, and name such information as instrumental in their mode change.

Data Collection Methodology

Surveys are the usual method of measuring how well information is reaching the public and the position of the public on the TMP. Surveys can be targeted to travelers using the reconstruction corridor or zone. Telephone or maii surveys can be directed toward travelers based on video or photographic records of traveler license plates. Another means of surveying travelers is the panel-back method which was used for the I-5 American River Crossing project in Sacramento.' Under thii method, a group of travelers is surveyed periodically on awareness measures throughout the project. Using one or more of these methods, TMP managers in Boston found 95 percent of Southeast Expressway users knew about a planned reconstruction before it started. In Detroit, 40 percent of Lodge Freeway users recognized ' Lodge-ability' as the slogan of the mitigation project there."

Questions about awareness and reaction to the TMP must be structured carefully. For example, questions should start by tapping unprompted recollection of messages and information about the reconstruction project Where there is recollection, then questions might probe more specifically about what information was recalled, the exact media channels (e.g. TV, radio, newspaper, etc.) through which the information was picked up and reactions about the clarity or helpfulness of the information. Only if there is little or no recall should prompting questions then be posed about whether or not respondents remember a particular billboard, a particular radio spot, or a certain newspaper notice. As for public reaction to the TMP, questions can be directed to those who are aware of TMP elements. Respondents can be asked to rank the overall quality of the TMP, and name best and worst elements of the TMP, if any.

Motorist Information

Measures of Effectiveness

Motorist information strategies, including signing and highway advisory radio, can be evaluated on the same basis as public information strategies. The first evaluation issue is whether or not motorists are aware of the information transmitted and whetherthe information is useful in the decision-making process.

Data Collection Methodology

Two appropriate evaluation methods include a survey of motorists in the reconstruction corridor or zone, as well as direct observation *of* motorist behavior.

As with evaluation of public information strategies, mail or telephone surveys can be targeted to travelers using the reconstruction corridor or zone. Questions can be asked about whether or not motorists tuned in to highway advisory radio or if they noticed changeable message signs and if so where. Questions also can be directed toward how travelers responded to the information received.

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1 **Discussed more fully in Appendix A.**

3 ***Freeway Reconstruction*** **Mitigation:** ***Recent Experience in the United States.*** **Susan Sanderson, Metropolitan Transportation Commission, Oakland. California April. 1969.**

A good evaluation should give clues as to why motorist information may not be working. For example, for those indicating they did not hear an advisory radio message, follow up questions should be asked about whether they saw signs telling about where to dial for the message, or if they saw the notice, why they did not dial. Did they presume the message was not important? If so, why? Likewise, for those who dialed in and heard the message but did not heed it, follow up should probe about why. Was the message too long or *not* clear? Was reception pool? Saying something already known? Does the message seem to contradict existing conditions? Does the message seem to suggest a change in route or travel behavior which will bring only small savings in time or gains in safety?

For changeable message signs, evaluation might focus on the pattern of sign recognition to get clues about what does and does not work. Perhaps signs highlighted with arrowboards get higher recognition than those without. Perhaps travelers in middle and fast lanes are the least aware of signs in an area, suggesting truck traffic in the right lane may be blocking the signs.

Another way to evaluate the effect of motorist information is through observation. Presuming the requested behavior change is relatively soon after the message, observers can determine the degree to which travel change is occurring. Again, video recording may be useful for this purpose. -Video may be able to determine to what degree traffic is slowing or diverting as requested, or whether there is no change in speed and little diversion. Observation Over a sufficiently long period also can be useful for revealing patterns of change. Perhaps daytime traffic is more likely to respond to signs than night traffic, suggesting visibility of signs may be suffering at night. Perhaps traffic changes the least when right lane truck traffic is the heaviest, suggesting trucks are blocking the message.

Incident Management

Comprehensive evaluation should go beyond simple indicators of overall response and removal time and focus on all the components of the system intended to reduce traffic delay. Key parts include:

- Detection of incidents:
- Response by police or service vehicles;
- Screening of the incident to reduce traffic delay due to gawking; and
- Removal of vehicles involved in the incident.

The components of incident management requiring evaluation also need to be Clarified. Service patrols are one incident management strategy, but emergency Call boxes, police and radio station helicopters, COZEEP contracts with the CHP, service contracts with local law enforcement agencies, freeway telephone trouble numbers and even transit vehicles with emergency communications equipment all may be part of the incident management system deserving evaluation.

Measures Of Effectiveness

Incident management should be evaluated on the basis of how well it reduces time to respond to and remove accidents and shoulder stops compared to two baselines. One baseline is response and removal time for comparable incidents before the Incident management system was put into place, and another baseline is response and removal time on comparable facilities where there is no similar incident management system. At the simplest level, an effective incident management system reduces detection and response time compared to both these baselines. Even a few minutes of reduced response and

removal time can bring major savings in reduced traffic delay. An evaluation of the Chicago Minuteman program estimated a cost benefit ratio of 17 to 1 in delay savings alone.3

Data Collection Methodology

Each part and component of the incident management system will entail some common and some unique measures of effectiveness and associated evaluation methods. For example:

- Incident detection might be measured where video surveillance records an accident or shoulder stop. By providing a 'real time' basis for the incident, evaluators can determine how long after the actual incident detection Occurred, presuming a!! incident response parties agree to maintain logs of when they notice or receive notice of incidents. Such time logs are routinely kept by the Highway Patrol, 911 operators, transit emergency service operators and operators responding to call boxes. However, radio station helicopters and radio station telephone operators receiving cellular calls may or may not keep such logs.

- Response and removal time are somewhat easier to evaluate, since start of response is logged by a dispatcher, arrival on the scene is (or certainly should be) recorded by the police or responding service patrol, and the time When the incident is cteared also should be logged.

- Visual screening of incidents is perhaps the most difficult component to evaluate because the intended effect is on the highly variable stream of traffic over a relatively short period of time. For incidents detected by video surveillance, it may be possible to detect differences in the flow of traffic before and after the screen is put up. However, it probably is not possible to compare Incidents with and without screens since traffic volumes rarely will be comparable from one case to another, and for many TMPs the number of screened incidents may be small.

There is another possible benefit of incident management worthy of evaluation. However, given the current state of knowledge, it is one best left to a full blown research project rather than TMP monitoring and evaluation. Caltrans estimates 30 percent of freeway accidents occur as after effects of other accidents, meaning incident management services which quickly remove stranded or damaged vehicles may reduce the odds of secondary accidents and associated traffic delays. Because secondary accidents are not a frequent phenomenon, a large data collection effort over considerable time may be required to establish the necessary baseline for evaluating the effects Of incident management. The effort is probably beyond the resources of TMP managers. However, Caltrans is addressing the issue of secondary accident benefits from incident management under a consultant contract. Information may be forthcoming within the next year or two.4

3 ***Estimating Service Patrol Assists.*** **Stephen Finnegan, Caltrans, June, 1992**

4 **Finnegan. Op. Cit.**

Construction Strategies

Measures, of Effectiveness

Some construction strategies can be evaluated by comparison with conditions prior to implementing the strategy and with conditions on similar facilities without the strategies in place. For example, reversible lanes, lane and ramp closures and truck traffic restrictions all can be evaluated based on traffic, delay and accident conditions prior to and after implementation, again taking care to compare any before/after changes with control conditions on another similar corridor not involved in reconstruction. Controls are important as traffic volume and accident rates may be changing on all facilities comparable to the reconstruction facility, especially for TMPs lasting over several years.

Examples of construction strategy evaluations show the kinds of conclusions which are possible with good evaluation, For example, Pittsburgh found auto occupancy increased from 1.4 to 1.6 persons per auto at ramps before and after HQV lanes were implemented as part of reconstruction strategies.[5] Evaluators of the I-395 reconstruction in Minnesota found auto occupancy for the corridor climbed from 1.17 to 1.28, largely due to implementation of a reversible HOV lane.[6] Evaluators compared the result to auto occupancy trends on 'similar highways in the Twin Cities metropolitan region' and found these had been declining during the same period. Such a comparison suggests the change in occupancy is not simply due to changes in the economy or gasoline prices, but is due to the TMP strategies aimed at increasing auto occupancy, including the HOV lane. The I-395 evaluation also measured travel times in mixed flow and HOV lanes and concluded the HOV lane saved eight minutes in travel time. This information is valuable in assessing the cost benefit of the lane, presuming a monetary value for time saved is estimated.

Contract management strategies such as incentives/disincentives can be evaluated by comparing project completion relative to schedule vs. other contracts not having such clauses. Using the latter yardstick to evaluate incentive and disincentive provisions in Houston, TMP managers concluded the effect was to reduce project time by as much as 50 percent, often saving a year or more.'

When evaluating incentive/disincentive options, it is important to structure the evaluation to estimate all the possible benefits. For example, the potential of finishing the project early must be tempered by other factors, such as delay, vehicle operating costs and accidents. If large additional motorist delays result from a 'fast track' approach, then these effects must be weighed in assessing pros and cons of the approach. Air pollution benefits also may be important to assess depending on the demands of local air quality districts and can be calculated from estimates in VMT reductions. Local air quality districts can provide standard factors used to estimate emissions from VMT reductions at varying average speeds. On the cost side, providing and managing incentives and disincentives will cost the agency more than a regular contract, possibly as much as 20 percent more, so these costs should be tracked carefully.

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5 **Sanderson, Op.Cit.**

6 ***I-394 Interim HOV lane Case Study, Phase*** **II, for MN DOT. SRF Consulting Engineers. July. 1990.**

7 ***An Analysis of the Use of Incentive/Disincentive Contracting Provisions for Early Project Completion,*** **Dennis Christiansen, in Transportation Management for Major Highway Reconstruction. Transportation Researcn Board Special Report 212, 1987.**

8 **Christiansen, Op. Cit.**

However, even a few months of reductions in delay, vehicle operating costs, accidents and **pollution** associated with reconstruction may well justify the added contract cost.

Data Collection Methodology

The mechanisms for evaluating travel impacts of reversible lanes, lane and ramp closures and truck traffic restrictions are all similar to those for tracking general corridor performance, as given above. Standard machine counting or video procedures can be used to make traffic counts. Vehicle occupancies can be measured by direct observation or video, and by questions about passengers incorporated into standard origin and destination surveys. VMT can be assessed through questions getting at trip length. The same cautions about sample size apply. Major accidents can be tracked through police and Highway Patrol reports Evaluating delay and speeds can be done with floating or test car procedures.

Demand Management Strategies

There are a host of possible demand management strategies calling for evaluation during a TMP. They include rideshare incentives and marketing, park-and-ride lots, transit service improvements and incentives, HOV lanes and employer demand management programs. Often, **TMP** managers will contract with a rideshare and transit agency for implementation and monitoring of these strategies. For rideshare campaigns, incentives and marketing, the rideshare agency often will track the number of rideshare applications submitted subsequent to campaigns. Transit agencies will report ridership on new lines **established as** part **of** the **TMP. Employers** may monitor employer demand management programs, Additionally, TMP managers may evaluate other strategies under their direct control, such as park-and-nde lots and HOV lanes. Monitoring of these strategies may include counting cars in park-and-ride lots, and measuring utilization of HOV lanes.

Measures of Effectiveness

All these means of evaluation can be improved to get at impacts of the strategies on corridor traffic. Ridesharing campaigns and promotions, new transit or ferry services, park-and-ride lots and employer based programs should be evaluated on the basis of vehicles removed from the reconstruction comdor and associated reductions in delays. To determine vehicles removed, TMP managers must assess prior mode for new rideshare, transit or ferry patrons. Rideshare, transit and ferry strategies do not reduce vehicles in direct proportion to new patrons. For instance, in the MNDOT I-394 case where a new HOV lane and promotions formed the rideshare strategy, HOV lane use was substantial, but only 28 percent of HOV lane users were previous solo drivers from the reconstruction route. The balance were previous carpoolers both on and off the reconstruction route, as well as drive alone and transit users from other routes. [9]

Evaluation of demand management services should pay close attention to effectiveness compared to contract costs. Once rideshare, transit and ferry services are evaluatted on the basis of vehicles removed, some services may cost considerably more than others for the Same effect. Using the measure of vehicles removed from the reconstructed facility, planners for the Caltrans District 4 I-80 TMP estimated costs (actual costs not available as service has not begun) of up to $7 per peak auto removed for ferry service. For comparison, park-and-ride is estimated at up to $2 per trip removed, bus service up to $4.00 and ridesharing up to about $1. Another issue for transit, feny and rideshare services is that the cost-

[9] **SRF Consulting Engineers. I-394 *Interim* HOV Lane Case Study, Phase II, July 1990.**

effectiveness of one service may be reduced by the other, Auto occupancy on the Southeast Expressway in Syracuse declined during reconstruction in spite of personalized ndeshare promotions with 41 percent of downtown workers. It Seems expanded transit opportunities lured Some carpoolers onto transit. In short, the low success rate for carpool promotion and high cost campaign (about $15 per placement) resulted in part from expanded transit service.10

Data Collection Methodology

Various methods can be used to get at the effect of demand management strategies on corridor performance. Rideshare agencies should be encouraged to go beyond simple counts of rideshare applications after particular promotions. One way to measure campaign effectiveness is to sample the applicant data base subsequent to promotions then carry out telephone interviews to ask open ended questions about reasons for the application, or what factors were important from a list of possible influences. Questions should not prompt the respondent to determine if a particular promotion was instrumental. Prompts can bias respondents. For those responding that a TMP promotion, marketing or incentive was instrumental, questions should follow about prior mode and route, time of travel, and trip length. In case of an HOV lane and park-and-ride lots, mail surveys can be used to serve the same function as telephone surveys to rideshare data base applicants. For transit, ridership levels on new service in the reconstruction corridor is of interest, but again on-board surveys are needed to get at prior mode, route, time of travel and trip length. At the same time, transit users should be asked some brief questions about perceived quality and reliability of service.

Employer-based demand management programs may be monitored under requirements of local regulations. TMP managers might be able to piggyback on this monitoring as a means for evaluating demand management effectiveness. The usual instrument used to evaluate employer based programs is the annual employee survey. Such surveys increasingly are required under focal trip reduction ordinances, whether promulgated by cities and counties *or* local air quality districts. TMP managers should check on the availability of evaluation summaries from these annual surveys, and focus attention on a sample of employers likely to generate commuter traffic on the reconstruction corridor. In cooperation with localities or the local air quality district, questions might be added to the annual surveys about travel on the reconstruction facility, time of travel, trip length, recent mode change, prior mode and route and reason for changes.

Alternative Route Strategies

Evaluation of alternative route strategies should focus on the reconstruction corridor, as well as formal and informal alternative routes. Alternative route strategies include ramp metering and closures, temporary and long-term detours, traffic control improvements including police and signalization and street improvements such as added lanes or parking removal. All these strategies potentially affect traffic flows on both the reconstruction and alternate routes. However, because the strategies divert rather than reduce auto use, they can relocate traffic congestion,

10 **Sanderson, Op.Cit.**

Measures of Effectiveness

A good baseline prior to the reconstruction will be needed to properly evaluate alternate route strategies. As with other strategies affecting traffic flows, it is important to assess traffic volumes, delay and accident rates on not only improved and formally designated alternate routes but unimproved routes not designated as alternates but possible diversion routes. In the case of city arterials paralleling a freeway facility where diversion is encouraged or likely to occur, the local city or county may have traffic volume information at a couple of time periods prior to reconstruction, and may keep track of accidents rates. As with all TMP strategies, it is important to establish a control baseline by tracking these same variables on a couple of arterials not likely to be affected by the reconstruction. Information from controls will help TMP managers sort out the extent to which increased traffic volumes on diversion routes is due to diversion versus normal traffic growth.

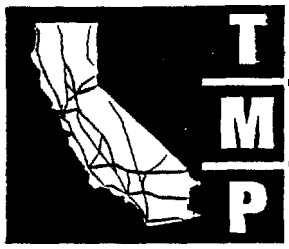
Where major alternative route strategies are implemented, such as extensive signal improvements and/or added lanes and restriping, it is advisable to do detailed evaluations of prior mode and route for a sample of alternative route users. The key issue for evaluation purposes is whether the alternative route improvements primarily are sewing travelers who previously used the reconstructed facility, or are they serving other travelers previously using entirely different routes or modes who are attracted to the improved facility. This is an important issue for localities concerned about the extent to which traffic on diversion facilities is due to reconstruction versus facility improvements. It is also an important issue for air quality planners, since route diversion may increase VMT and reduce speeds, depending on how diversion affects trip length and the degree of stop and go driving.

Data Collection Methodology

The method for evaluating prior mode, route and VMT is through postcard surveys of drivers where traffic volumes allow or through video sampling of license plates and follow-up mail surveys. These methods are similar to those discussed under general corridor monitoring, above. Traffic volumes can be measured through standard machine counting or video procedures. As with monitoring of traffic volumes on the reconstruction corridor itself, sample size is important to accurately represent traffic volumes, prior mode, prior route and VMT for the alternative route. Delay studies focusing on two kinds of trips also are important.

Delay studies should focus on trips originating throughout the region typical of users of the reconstruction facilities. But they should also examine delays to users of diversion facilities who are restdents of jurisdictions through which diversion routes pass. Delays to both kinds of travelers are important to the acceptance and political feasibility of a TMP, especially over the long haul.

APPENDICES



EFFECTIVENESS OF PUBLIC INFORMATION AS A TMP STRATEGY

INTRODUCTION

Traffic Management Plan(TMP) coordinators and highway officials generally agree that accurate, on-going communication with the public is an essential part of any major highway construction project. This is particularly true when the highway being re/constructed is located in a dense urban corridor with high traffic volumes and increasing levels of congestion extending beyond the peak periods.

A public information campaign implemented as part of a TMP usually consists of at least one or more of the following elements, each of which has been described in more detail elsewhere in this report:

- Speakers' Bureau and/or Public Meetings:
- Brochures (disseminated by targeted direct mail, by hand, through employers or businesses);
- Public Information Centers (equipped with scale model displays, maps, videos);
- Telephone Hotline:
- Press Releases and Paid Advertising in Mass Media (radio, TV, newspapers); and
- Visual information (including slogans, displays, logos, letterheads).

The TMP Task Force plays an important role in disseminating information to the public, as well as agencies, businesses and institutions in the affected corridor. The TMP Task Force also helps to coordinate the development of marketing and public information materials among various agencies,

Because of the importance of public information not only for the TMP but for the success of the project as a whole, the budget for public information can be substantial. For example, in the ten case studies reviewed during Phase I, public information budgets ranged from 6 percent to 45 percent of the total TMP budgets; The $3.0 million Cuesta Grade project in Caltrans District 5 had the lowest public information budget at $50,000; the highest public information budget reviewed was $129 mlllion for the $400.0 million I-95 project in Miami, which was partially funded from other sources.[1]

[1] **This latter example points to one of the difficulties in comparing public information budgets. In some cases the public information campaign for a particular highway reconstruction project includes elements already in place and funded by other sources (such as a regional rideshare matching agency) or utilizes existing in-house staff resources, the costs for which are difficult to extract and attnbute specifically to the TMP.**

Despite these significant costs and consensus as to the overall importance of public information, there are little quantitative data available to help planners determine which of these elements is most effective. Although some measures, such as those listed below, have been used to gauge the level of activity generated by the various public information elements, these data provide little insight as to how effective each may be in actually influencing travel behavior.

TMP Element	Typical Measures of Activity
Speakers Bureau/ Public Meeting	• Number of meetings held; - Number of public in attendance: • Number of complaints: and • Qualitative assessment of mood.
Brochures/ Mailers	• Number distributed by time released; and • Return of "mail-in" information requests.
Media Releases	• Presence of media representatives at news release; and • Number of mention in media (TV, radio, newspaper).
Public Information Center/Hotline	• Number of "visitors"; • Literature disseminated; • Number of calls; and • Number of complaints.

In order to get the most 'bang' for each 'buck' allocated to public information, TMP planners need to have answers to some very critical questions:

- Where do motorists and the general public get most of their information about the highway project and alternative options available to them?
- To what extent does this information cause them to change their travel behavior?
- What is the most effective way to measure public awareness of a highway construction project?
- What is a 'reasonable' public information budget vis-a-vis the TMP as a whole or the total project?
- How can this cost-effectiveness be best measured? and
- Is there a point of diminishing returns for one or more of the elements beyond which additional resources are not warranted? If so, what is it and which elements are most affected?

To answer these and other questions, the public information campaigns for four of the case study highway reconstruction projects identified and discussed in Phase I were analyzed in more detail:

1. Philadelphia-Schuylkill Expressway (l-76) Reconstruction - Philadelphia, Pennsylvania;
2 l-680/SR-24 Interchange Widening and Reconstruction Project - Walnut Creek, California;
3. l-5 American River Crossing - Sacramento, California: and
4. Lodge Freeway Reconstruction Project - Detroit, Michigan.

These were projects where actual follow-up evaluation of the various public information elements was undertaken. Each of these public information campaigns is summarized below.

REVIEW OF SELECTED PUBLIC INFORMATION TMP ELEMENTS

Philadelphia-Schuylkill Expressway (l-76) Reconstruction

Construction Cost: . . . . . $223.0 million
Project Duration: . . . . . Phased over 4 years, 1985 through 1989
Average Daily Traffic: . . . . . 500,000 through interchange
Public Information Campaign Cost: . $1.2 million

The l-76 Expressway reconstruction project covered about 18 miles of the 21-mile expressway length of the second most densely traveled urban freeway in the U.S. The reconstruction work included: redecking 38 of 50 bridges: construction of 6 new bridges: repaving; widening; interchange upgrades: replacement of barriers, signs and lighting; drainage improvements. The goal of the project management team was to keep at least one traffic lane open and moving at 35 MPH in each direction.

The public relations campaign for this project was based on results of an Origin-Destination (O-O) survey undertaken in 1982* In addition to providing O-O data, the survey identified a proportion of respondents who might change their travel behavior. The goal was to encourage at least one-half of this group to, in fact, do so. The public relations campaign was targeted to specific groups (visitors, tourists, truckers, commuters, occasional drivers).

The public information campaign consisted of brochures (aimed at commuters and visitors), a telephone hotline, news conferences and regular press releases, radio and TV, public service announcements and Interviews and direct mailings. Following the conclusion of the reconstruction project, the public relations campaign was evaluated from three perspectives:

1. Those who were responsible for implementing the program;
2 Media, business, and government agencies: and
3. The public who used the expressway.

The report documenting this post-project evaluation provides one of the most detailed and relevant analyses of the cost and effectiveness of various public information strategies. In general, the evaluation pointed to the importance of encouraging supportive rather than adversarial relations with the media. Two factors played important roles in the overall success of the public information campaign:

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[2] **Several years prior to the beginning of the reconstruction project**

[3] **Delaware Valley Regional Planning Commission and Precise Communication Inc.. *Evaluation of Schuylkill Expressway Marketing Techniques: Schuylkill Expressway Reconstruction Project, 1990.***

First, even before the start of the project, the public' s attention was aroused by intense coverage in the media; and

Second, considerable travel flexibility was evident among travelers in the corridor, complemented by an extensive multi-modal transportation system already in place.

Other important findings resulting from this evaluation are summarized below.

Brochures – Brochures were developed which targeted visitors as well as commuters.Over three million copies were printed over the four years of the project at a cost of $753,000 (design and printing) or about $0.25/copy. me cost of postage was estimated at $38,000.

Hotline – A toll-free hotline was established, staffed by four full-time and three part-time operators at the peak of its operation, handling between 300400 calls per day. The hotline operation eventually stabilized at about 80-100 calls per day. The hotline handled 128.200 calls over the four-year period at a cost of $420,290 or about $3.75/call. A total of 40,300 person-hours were spent handling the phones

Press Conferences - Nineteen press conferences were held during the course of the project. Four press conferences were held in the two years prior to the start of construction.After construction started, formal press conferences were held on average about every three months. Announcements were supplemented by graphics, charts and press kits. Within a very short time (less than one month after the start of construction), there was a marked improvement from the initial pessimistic press reports.

Public Service Announcements – A series of PSAs were produced at a cost of $43,000 funded by the TMP; however, they received little airplay, possibly because hard news coverage was so substantial. Therefore, a second set of PSAs, originally planned and budgeted, was not used.

Direct Mailings – Brochures describing the project were mailed to companies with 100 or more employees, those with traffic managers and those involved with shipping. In all, about 4,000 business and community facilities were targeted: this number was later reduced to 2,700. Dissemination of these brochures was considered to be the most effective method of initially informing commuters about construction, detours and alternative modes. According to staff sources, about one percent of the total project budget was allocated to direct mail.

Task Force – This group consisted of representatives from Municipal Governments, the Legislature, transit operators, the regional planning organization, auto club, trucking association, chambers of commerce, paratransit organization, traffic reporting services, state DOT, and FHWA. The Task force initially provided input on the O-D survey 'undertaken in anticipation of the reconstruction project. After project initiation, the group served in an advocacy role among their constituents.

Outside Contributors – An important element of the Schuylkill Expressway Reconstruction was the degree of outside participation which was contributed in support of the public relations campaign. For example:

SURVEY QUESTIONNAIRE

SCHUYLKILL EXPRESSWAY MOTORIST SURVEY No. _____

1. Where did you begin this trip today?
   ZIP Code: _____ Community Name: _____ Home? 1___ Work? 2___ Other? 3___

2. Where is your destination?
   ZIP Code: _____ Community Name: _____ Home? 1___ Work? 2___ Other? 3___

3. How often do you make this trip? *(check only one)*

   1__ 3 or more days per week
   2__ 1 or 2 days per week
   3__ 1 to 3 days per month
   4__ less than once a month

4. How did you deal with the Schuylkill Expressway reconstruction project? *(check all that apply)*

   1__ Used another highway route
   2__ Continued to use the Schuylkill (I-76)
   3__ Joined a car/vanpool
   4__ Changed my schedule to avoid congestion
   5__ Took bus, trolley or subway
   6__ Took Regional Rail commuter train
   7__ Stopped making this trip as often
   8__ Other: _____

5. Which of the following best describe how you received the information you needed to deal with the reconstruction project: (*check all the apply)*

   1__ Employer gave PennDOT brochures to every employee
   2__ Employer just made PennDOT brochures available
   3__ Employer's newsletter / memos offered guidance
   4__ Received PennDOT brochure from a hospital, hotel, etc.
   5__ Picked up PennDOT brochure at Information Center, etc.
   6__ Received PennDOT brochure through community group
   7__ Called the PennDOT "Schuylkill Expressway HOTLINE"
   8__ Called SEPTA for transit information
   9__ Followed stories in weekly community papers
   10__ Followed stories in daily newspapers
   11__ Listened to radio "Shadow Traffic" reports
   12__ Followed TV news stories
   13__ Followed radio news stories
   14__ Relied on my knowledge of the area
   15__ Relied on advice from friends

6. How useful were the following efforts in advising you of the construction events, ramp and lane closures, and alternate travel routes? *(circle the number of your choice for each)*

		Useful	Not Useful	Used But Cannot Recall Usefulness	Never Knew About This
A.	PennDOT's Commuters' and Visitors' Guides	1	2	3	4
B.	Radion & TV news programs	1	2	3	4
C.	The Schuylkill Expressway (I-76) Telephone HOTLINE	1	2	3	4
D.	PennDOT meetings with community groups	1	2	3	4
E.	Advisory signs along roadways	1	2	3	4
F.	Information about using transit	1	2	3	4
G.	Radio & TV talkshow interviews with PennDOT officials	1	2	3	4
H.	Assistance in forming car/vanpools	1	2	3	4

7. Which two efforts from the list above should PennDOT emphasize in future projects? ___ & ___ *(enter letters)*

8. How many people were in your car today on the Schuylkill? ___ *(including yourself)*

9. How does this number compare to: before the reconstruction project? __same __fewer __more
   after the reconstruction project? __same __fewer __more

10. During which years (construction sections in parentheses) did you use the Schuylkill Expressway (I-76)? *(check all that apply)*

    1__ Before March 1985 (the start of reconstruction)
    2__ 1985 (vine to University and Turnpike to I-476
    3__ 1986 (I-476 to Vine)
    4__ 1987 (no construction activity)
    5__ 1988 (spring Garden to Roosevelt Blvd)
    6__ 1989 (Vine Street Interchange)
    7__ 1990 (project completed)

We are serious about getting your opinion. Please take a moment to give us a suggestion of how we can better inform Motorists about our construction projects. Write your comments as a "P.S." under the letter on the other side of this form.

EXHIB

SURVEY QUESTIONNAIRE

SCHUYLKILL EXPRESSWAY MOTORIST SURVEY

Dear Motorist:

The Pennsylvania Department of Transportation (PennDOT) wants to know how well we served you with information during the reconstruction of the Schuylkill Expressway.

The Schuylkill project was a major engineering task and could have seriously disrupted traffic flow in our region. However, despite the closing of many ramps and the reduced number of lanes during the construction seasons, motorists like you managed to continue with their business activities. For the project to be successful, motorists had to be well informed about the project and the alternatives to using the Schuylkill.

PennDOT will be reconstructing other major highways, such as I-95 and US 202, in the coming years. We need to know how you received information about the Schuylkill project and which of our efforts were most helpful. We are seeking your opinions now so that we can prepare the best possible program to inform the public about these future projects.

Please answer the questions on the other side of this form and drop the completed card in any mailbox. No postage is necessary. *Thank you.*

Howard Yerusalim
Secretary of Transportation

P.S. _____

_____

_____

_____

Fold Here

SCHUYLKILL EXPRESSWAY
SURVEY

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO 29694 PHILADELPHIA, PA

Postage will be paid by addressee

PENNDOT
c/o DELAWARE VALLEY
REGIONAL PLANNING COMMISSION
21 S. FIFTH STREET THE BOURSE BUILDING
PHILADELPHIA PA 19106-9961

- In addition to extensive coverage of the project as a hard news item and airing the project-produced PSAs, a local TV station (WCAU-TV) produced seven PSAs as well as several half-hour programs explaining the project; the station also printed and distributed 20,000 brochures to viewers using graphics provided by the project team.

- **The Chamber of Commerce** produced a 40-50 page guide on staggered work hours which was distributed to 300 member businesses. From the response cards received back, it was estimated that between 15,000 and 18,000 commuters changed work hours.

- The local transit operator (SEPT) produced numerous materials outlining the various transit options available. On the negative side, the transit operator also litigated against vanpooling which, though not the deciding factor on this element's lack of success, was certainly a contributing factor.

- A major employer [4] in the area (with 5,000 plus employees) produced and aired its own in-house video on the project.

- AAA representatives ordered brochures produced as part of the TMP, then spoke to the community about it without cost to the TMP project.

Follow-Up Motorist Survey

One of the most useful elements of the Schuylkill Expressway '(I-76) public information campaign was the survey (see the following exhibit) administered at the conclusion of the project to determine how motorists received information about the project, and which PennDOT strategy was most effective. The mailback survey was handed out at on-ramps during the AM peak and off-peak hours. Ramps were carefully selected in **order** to provide a reasonable cross-section of the entire corridor. In order to get a 5 - 10 percent usable sample, 6,700 surveys were distributed: 2,000 usable surveys were returned or 30 percent.

Table A-l summarizes the information sources cited by the various user categories: there is little variation in response among the various user groups. By far the most prevalent information source was the 'Shadow Traffic' reports (cited by four out of five respondents), produced by existing traffic reporting services called Shadow Traffic and Arco Go-Patrol. These radio traffic report updates and announcements were already being broadcast as a public service well before the highway construction project began. TMP planners took advantage of this existing resource to disseminate information about the project. About 50 percent of survey respondents cited regular daily news reports (TV, radio, newspapers) as their primary source. Fifty percent relied on personal local knowledge and about one-quarter on interpersonal communications. Only ten percent cited the PennDOT brochures as their information source. Even fewer (six percent) cited the hotline: hotlines are not normally the initial information source, but are used to answer 'in-depth' questions.

[4] **Smith Kline Beecham.**

Table A-I

INFORMATION SOURCES ABOUT I-76 EXPRESSWAY RECONSTRUCTION
Caltrans Traffic Management Plan Effectiveness Study

	<— Percentage of Responses —>		
	All	Peak Period	Off-Peak
PennDOT Brochure through Employer	10	11	6
Employer Newsletter/Memos	4	5	2
PennDOT Brochure from Hospital, Hotel	2	2	1
Picked up PennDOT Brochures at Info. Centers	4	4	4
PennDOT Brochures from Community Group	2	2	2
Hotline	6	6	5
Transit Operator	2	2	1
Weekly Community Papers	17	16	20
Daily Newspapers	48	48	48
'Shadow Traffic' Reports	78	78	79
TV	50	49	53
Radio	52	51	53
Personal Knowledge	49	46	57
Advice from Friends	27	28	25
No Response	2	2	2

Wilbur Smith Associates; March 1993

Table A-2 summarizes respondents* knowledge of information sources available to them. When asked to indicate their awareness of various public information sources available to them, approximately 50 to 60 percent of all respondents had no knowledge of the PennDOT brochures, the hotline, or community meetings. Since the brochures and the hotline (funded at about $7.2 million over the course of the project) accounted for virtually the entire public information budget, this lack of awareness by more than half of those surveyed is an especially important finding. About one-third had no knowledge of radio/TV talk show programs about the project or the availability of rideshare matching services or information. About one-fifth, had no knowledge of transit information.

Awareness was highest for radio and TV news coverage, which was relatively inexpensive since the media treated the project as a hard news item, and the highway advisory signs which were treated as part of the alternate route budget. Again, not unexpectedly, the peak-period, home-work trip, frequent users exhibited similar awareness trends: the off-peak, infrequent users were grouped together and exhibited a slightly different trend.

As shown in Table A-3, among all respondents aware of the various information sources, radio and TV news was viewed as the most useful (by 93 percent), followed by advisory signs (70 percent). Rideshare matching/info was considered 'not useful' by almost 90 percent of all respondents. Community meetings, the telephone hotline and transit information were cited as 'not useful' by 73 percent, 60 percent, and 60 percent, respectively, of all respondents aware of these resources.

As shown in Table A-4, about 60 percent of all survey respondents used another route during reconstruction (which was what PennDOT wanted them to do); however, 60 percent also said they continued to use the expressway. Almost one-quarter of the respondents indicated they changed their schedule to avoid disruptions. Fewer than 10 percent used transit. Off-peak travelers were somewhat more likely to use another highway route or to change their schedule to avoid disruptions; those who were in the peak period, were slightly more likely to continue to use I-76 while changing their commuting schedule.

I-680/SR-24 Interchange Widening and Reconstruction Project - Walnut Creek/Pleasant Hill, California

Construction Cost: , ... , . .	$270.0 million.
Project Duration:	Phased over seven years, 1989 through 1996
Average Daily Traffic:	280,000 through interchange
Public Information Campaign Cost:5 .	$6.2 million

The I-680-SR-24 Interchange Widening and Reconstruction Project is a long-term, complex project located along a heavily congested suburban corridor. The public information campaign is being overseen by a public relations contractor. The public information campaign consists of the following elements:

- **Public Information Center,** located in the project engineering office close to project site, is the base of operation for the public info campaign. A public information consultant staffs the centerwith three full-time public information personnel to answer phones, receive visitors and hand out information.

5 **Also included a Highway Advisory Radio element budgeted at $120.000.**

Table A-2
KNOWLEDGE OF INFORMATION SOURCES ABOUT
I-76 EXPRESSWAY RECONSTRUCTION
Caltrans Traffic Management Plan Effectiveness Study

	<— Percentage of Responses* —>		
	All	Peak Period	Off-Peak
PennDOT Commuters/Visitor Guide			
No Knowledge of Source	46	46	48
Aware of Source	37	38	31
Radio/N News			
No Knowledge of Source	2	2	3
Aware of Source	91	92	88
Hotline			
No Knowledge of Source	51	51	52
Aware of Source	28	29	22
Community Meetings			
No Knowledge of Source	57	58	53
Aware of Source	19	20	17
Advisory Signs			
No Knowledge of Source	4	4	5
Aware of Source	84	84	82
TransitInformation			
No Knowledge of Source	21	21	24
Aware of Source	54	55	46
Radio/TV Talk Shows			
No Knowledge of Source	30	30	31
Aware of Source	52	53	48
RideshareMatchingInformation			
No Knowledge of Source	29	29	28
Aware of Source	46	48	42

* Excludes 'No Response.'

Wilbur Smith Associates; March 1993

Table A-3
(Page 1 of 2)

USEFULNESS OF INFORMATION SOURCES ABOUT I-76 EXPRESSWAY RECONSTRUCTION
Caltrans Traffic Management Plan Effectiveness Study

	<-- Percentage of Responses -->		
	All	Pea& Period	Off-Peak
PennDOT Commuters/Visitor Guide			
Useful	**52**	**53**	**49**
Not Useful	24	23	25
Can't Recall Usefulness	24	24	26
Radio/TV News			
Useful	**93**	**93**	**94**
Not Useful	2	2	2
Can't Recall Usefulness	5	5	4
Hotline			
Useful	26	26	26
Not Useful	60	59	61
Can't Recall Usefulness	14	15	13
CommunityMeetIngs			
Useful	15	13	21
Not Useful	73	74	67
Can't Recall Usefulness	**12**	13	12
Advisory Signs			
Useful	70	69	75
Not Useful	15	16	12
Can't Recall Usefulness	15	15	13
TransitInformation			
Useful	24	23	26
Not Useful	60	61	55
Can't Recall Usefulness	16	16	17

Table A-3
(Page 2 of 2)

USEFULNESS OF INFORMATION SOURCES ABOUT I-76 EXPRESSWAY RECONSTRUCTION
Caltrans Traffic Management Plan Effectiveness Study

	<-- Percentage of Responses -->		
	All	Peak Perfod	Off-Peak
Radio/TV Talk Shows			
Useful	46	44	53
Not Useful	37	38	35
Can't Recall Usefulness	17	18	12
Rideshare Matching Information			
Useful	7	7	a
Not Useful	86	86	87
Can't Recall Usefulness	7	7	5

Wilbur Smith Associates: March 1993

Table A-4

STRATEGY USED TO DEAL PHILADELPHIA-SCHUYLKILL EXPRESSWAY (I-76) RECONSTRUCTION
Caltrans Traffic Management Plan Effectiveness Study

	<-- Percentage of Responses -->		
	All	Peak Period	Off-Peak
Used Another Highway Route	58	57	61
Continued to Use I-76	60	61	58
Joined Car/Vanpool	1	2	1
Changed Schedule to Avoid Congestion	24	22	30
Took Bus. Trolley or Subway	2	2	2
Took Regional Rail	4	5	4
Stopped Making Trips	6	4	11
Other	8	10	5
No Response	2	2	2

Wilbur Smith Associates: March 1993

- **Small Business Resource Guide** summarizing alternative transportation benefits for employers and employees as well as some examples of easy-to-implement programs.

- **Emaiover Resource Kit containing** information about the project phasing, a quick reference guide of transportation alternatives, listing of rideshare agency contacts and services, as well as examples of employer transportation programs.

- Project Video consisting of a 5-1/2 minute presentation about the construction program and need for using alternative transportation.

- **Slide Presentation** showing existing and proposed improvements.

- **Sneakers Bureau/Transit Events Presentations offering** knowledgeable individuals to narrate video and/or slides and answer questions.

- **Gateway- Awards Program** encouraging both those who use and promote transportation alternatives by featuring prizes and a Grand Prize drawing for a tnp to Rome.

- **I-680/SR-24 Improvement Project Brochure,** a comprehensive, fourcolor brochure outlining the project, illustrated with maps **of** various segments of the corridor,

- **Corridor Quarterly** newsletter marled to residents and businesses in corridor and available in bulk quantities for distribution by employers or other neighborhood groups.

- **Press Releases/Media Alerts** prepared by public information consultant staff with input from resident project engineering staff.

- **Posters** highlighting project improvements and Getaway Awards Program available on request and included in Employer Resource Kit.

The I-680/SR-24 public information program includes a program to track the effectiveness of the TMP Public Information element. The stated objectives of the tracking study are to:

- Determine/measure awareness and imagery of the Caltrans I-680/SR-24 Interchange Project;

- Determine awareness of the Information Services Center:

- Identify sources of project information, including awareness for Caltrans' project positioning/advertising;

- Identify opportunities and acquire insights for project management: and

- Provide an on-going, periodic means to monitor market activity, measure results and provide data for tactical marketing.

A series of 8 - 10 minute telephone surveys have been conducted on five occasions throughout the planning and construction process The timing of the surveys and number of individuals surveyed are summarized below:

Wave	Date	Number Surveyed
1	October. 1989*	100
2	January, 1990	133
3	May, 1996	119
4	October, 1991	100
5	October, 1992	100

• Benchmark

A copy of the survey form used for the 7992 survey IS presented in the following exhibit. Survey respondents were screened to include licensed drivers who used the interchange at least four times a week; therefore, responses reflect only the perceptions of frequent users. The surveys provide insight as to where motorists got most of their information about the project, how their perceptions about the project changed over time, and how these trends might be most effectively monitored.

The I-680/SR-24 experience so far indicates that the value of free newspaper publicity should not be underestimated as an information resource for motorists. As shown in Table A-5, an average of almost 80 percent of the respondents over all five surveys indicated that their awareness of the project was obtained from one of two sources: newspaper (36 percent) or the simple roadway signs wdh the 680-INFO phone number (42 percent). The importance of the newspaper as an information source is not surprising given the serious traffic congestion problems in the Bay Area as a whole. me I-680/SR-24 interchange reconstruction project has been treated by the media (TV, radio as well as newspapers) as a hard news item from the beginning. There has been a conscious effort by the TMP coordinator and public relations consultant to work closely with the media to use this interest to the project's advantage by providing timely, accurate press releases. The survey indicates that this strategy has paid off. The lesson to be learned for other TMPs is that well-managed media publicity can be a positive influence by disseminating accurate information: it can also save valuable resources for other public information elements.

One drawback of the survey structure and method of administration was that it did not provide an opportunity for follow-up on cause and effect. For example, the fluctuations in the public's awareness of advertising related to the project is striking, as shown in Table A-6. The reasons behind the fluctuations would have been interesting to pursue. Are they somehow tied to a special publicity campaign, for example? And why did the percentage of respondents seeing ads drop from 1991 to 1992? Were there in fact fewer items about the project placed? Or was the public over-saturated with items so that they no longer noticed ads or pieces. about the protect?

EXHIBI

Appendix 2

Thomas Dunker & Associates
10/92 Telephone **Survey**
100 CONTRA COSTA COUNTY INTERVIEWS

Hello, I'm ______________________ from __________________ a local marketing research firm. We are conducting a short survey about county-wide transportation and would like to ask you a few questions. This is not a sales call nor will it lead to a sales call. May I have **a** few minutes of your time? Record sex:

FEMALE -1
MALE 2

---

1. Are you or is anyone in your immediate family employed in Advertising, Public Relations or Marketing Research?

Yes ( )........... THANK AND TERMINATE
No ( )............. CONTINUE

---

2. Do you currently have a valid California driver's license?

Yes () . . ..CONTINUE
No ( )......TERMINATE

---

3. How many times a week, if any, do you use the Interstate 680 and Highway 24 interchange in Walnut Creek?

0.................. ( ) TERMINATE
1-3.. .... ( ) TERMINATE
4-8............... ( ) CONTINUE . 1
8-12.. .... ( ) CONTINUE . 2
OVER 12......... ( ) CONTINUE . 3

---

4. Can you tell me who or what is responsible for the management and maintenance of the interchange of Interstate 680 and Highway 24?

( ) If a "WHO" (write name here: __________________)...... CONTINUE
( ) If "Caltrans" GOT07
( ) If a "WHAT" other than Caltrans
(write name here: ______________________) .... CONTINUE
( ) If "Don't know"... CONTINUE

---

5. Which of the following departments of the State of California is most likely to be responsible for the management and maintenance of the 680/24 interchange? (VARY THE ORDER FROM INTERVIEW TO INTERVIEW)

( ) California Department of Public Works - 1
( ) California Department of Transportation - 2
( ) State Highway Commission - 3

---

6. Which of the following **short** names is the California Department of Transportation also known as: (VARY THE ORDER)

() CD of T - 1
( ) CalComm - 2
( ) Caltrans, or - 3
( ) C-Trans - 4

EXHIBI

7. Have you seen or heard any advertising for Caltrans work on the 680/24 interchange in the past 3 months?

( ) Yes . . . .CONTINUE - 1
( ) No . . . . . GO TO 9 - 2

8. In a few words can you tell me what the main message was and where it was?

MAIN MESSAGE: _____

SEEN OR HEARD: Magazine Roadside -2 -1 Newspaper Radio -5 -4 Mailing -7

Brochure - 3 Newsletter -6 Other: What? _____

9. Now, thinking specifically about the 680/24 renovation project, I'd like to know which of the following PHRASES best describes your feelings for it:

( ) I don't know anything about it - 1
( ) I feel very positive about it - 2
( ) I feel positive about it. - 3
( ) I feel neither positive nor negative about it. - 4
( ) I feel negative about it. - 5
( ) I feel very negative about it. - 6

10. I'd like to read a list of sixteen words or short phrases to you. As I read each, please tell me, with a simple "yes" or a "no", if you think what I read currently describes the 680/24 interchange.

(CIRCLE THE NUMBER BELOW WHICH CORRESPONDS TO THE WORD THAT THE RESPONDENT SAYS "YES" TO. ALSO, PLEASE VARY THE STARTING POINT FOR EACH INTERVIEW.)

fast - 1
out-dated - 2
meeting the challenge - 3
modem - 4
hazardous - 5
safe - 6
controlled - 7
improving - 8
congested - 9
good signage -10
relief is in sight -11
frustrating -12
clear for emergencies -13
confusing -14
slow -15
a headache -16

EXHIE

11. Which of the foltowing phrases best describes your actions OVER THE PAST 12 MONTHS with regard to ALTERNATIVE TRANSPORTATION, which includes, for example, BART, buses, shuttles, and car-pooling?

I have used alternative transportation less 1
I have used about the same amount..... 2
I have used alternative transportation more..... 3

12. (READ SLOWLY) I'd like to know which, if any, of the following factors MIGHT influence you to drive your car less and use alternative transportation more often. As I read each factor, please state with a "yes" or a 'no" if the factor MIGHT influence you:

higher parking fees - 1
higher gas prices - 2
$1 increase in bridge toils - 3
$2 increase in bridge tolls - 4
more frequent buses - 5
improved bus routes - 6
more BART runs - 7
more Park & Ride lots - 8
a van pool system for you - 9
a car pool system for you - 10
telecommuting - 11
other? - 12'

'IF OTHER, ASK: WHAT? _____

13. finally, have you heard of any public information centers regarding the construction on the 680/24 interchange?

() No. . . . . THANK YOU. THAT COMPLETES OUR SURVEY (HANG UP) - 1
( ) Yes. . . . .I.....Where? - 2

Response: _____

THANK YOU. THAT COMPLETES OUR SURVEY. (HANG UP)

Respondent's Tel. No. _____/city: _____

Table A-5

SOURCE OF AWARENESS ABOUT I-680/SR-24
Caltrans Traffic Management Plan Effectiveness Study

Source	<-- Percentage Among Frequent Users* -->				
	Oct. 89 Wave 1	**Jan. 90 Wave 2**	**May 90 Wave 3**	**Oct. 19 Wave 4**	**Oct.** 92 **Wave 5**
Newspaper	50%	45%	30%	23%	**34%**
Roadside Sign	38	**16**	46	60	48
Television	8	-o-	-o-	-0-	4
Radio	4	14	**11**	7	2
Magazines	-o-	-o-	1	-0-	2
Brochures	**-0-**	4	**-0-**	1	4
Newsletter/Mailing	-0-	6	**10**	7	4
Other	-0-	13	-0-	2	2
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: *Awareness and Imagery Tracking Study* - Wave 5, DuDell & Associates; November 1992.

- Respondents who used corridor four times or more per week.

Wilbur Smith Associates; March **1993**

Table A-6

ADVERTISING(1) AWARENESS ABOUT I-680/SR-24 PROJECT
Caltrans Traffic Management Plan Effectlveness Study

	<--- Percentage Among Frequent Users* --->				
	Oct. 89 Wave 1	Jan. 90 Wave 2	May 90 Wave 3	Oct. 19 Wave 4	Oct. 92 Wave 5
Have you seen advertlsing In the past three months?					
Yes	26%	35%	53%	58%	43%
No	73	65	47	42	57
Total	100%	100%	100%	100%	100%

(1) The general public does not necessarily define advertising as strictly as do those in marketing. To the public, advertising often is perceived as communication of information from any source, including newspaper articles and free roadside signs.

Source: Awareness and imagery Tracking Study - Wave 5, DuDell & Associates; November 1992.

* Respondents who used corridor four times or more per week.

Wilbur Smith Associates; March 1993

As shown in Table A-7, the fluctuation in the public's awareness of Caitrans' responsibility for the project is another example of a missed opportunity to measure cause and effect. Although the results show light improvement overall in the unaided awareness of Caitrans' responsibility for the project over time, the fluctuation in awareness, particularly the drop from 66 percent to 57 percent, could be the most important indicator of how the public information campaign influences awareness. In this instance the public information campaign had been in place two years, yet the awareness of Caltrans's responsibility for the project seams to have dropped. Was there an incident that precipitated the drop or, alternatively, the increase in awareness shown in 1991?

Table A-7
PERCEPTIONS OF RESPONSIBILITY FOR THE MANAGEMENT AND MAINTENANCE OF THE I-680/SR-24 INTERCHANGE

Agency Responsible for Interchange	<--- Percentage Among Frequent Users* --->				
	Oct. 89 Wave 1	Jan. 90 Wave 2	May 90 Wave 3	Oct. 91 Wave 4	Oct. 92 Wave 5
Caltrans	61%	66%	57%	72%	70%
Other	11	17	20	14	5
Don't Know	28	17	23	14	25
Total	100%	100%	100%	100%	100%

Source: *Awareness and Imagery Tracking Study* - Wave 5, DuDell & Associates: November 1992.
* Respondents who used corridor four times or more per week.
Wilbur Smith Associates: March 1993.

If properly timed and stated, questions such as this one could be used to estimate the effectiveness of a logo or'a slogan relating to the highway reconstruction project. For example, the survey might be timed to coincide with the phased introduction of a new logo or slogan and followed up by an open-ended question such as: 'Have you seen this slogan before? If so, where?'

Much of this tracking study was aimed at determining the public's perceptions of Caltrans as manager of the project and of the interchange itself. A list of descriptives was used to trigger imagery ratings by survey respondents. By interpreting the results, analysts were able to identify statistically significant changes in the public's perception of the interchange over time. While this seems to be an effective technique to monitor perceptions about the overall project, it does not provide data about where respondents obtained their information.

As shown in Table A-8, about 20 percent of the survey respondents were aware of the Public Information Center, which is an important element of the I-680/SR-24 public information campaign. Since the beginning of the project, the percentage of respondents aware of the Center has doubled, although this percentage still seems relatively low. Three out of four respondents still did not know it existed. Although

Table A-8

AWARENESS OF PUBLIC INFORMATION CENTERS FOR THE I-680/SR-24 PROJECT
Caltrans Traffic Management Plan Effectiveness Study

	<--- Percentage Among Frequent Users* --->				
	Oct. 89 Wave 1	Jan. 90 Wave 2	May 90 Wave 3	Oct. 19 Wave 4	Oct. 92 Wave 5
Have you heard of Public Awareness Information Center?					
Yes	11%	9%	23%	18% .	21%
NO	89	91	77	82	79
Total	100%	100%	100%	100%	100%
Sample Size	100	133	119	100	100

Sources of Information About Public Information Center:

- A speaker visited the office;
- Road signs - 2;
- Caltrans has a telephone number;
- Roadside signs with a telephone number;
- News on TV - 2;
- San Ramon Valley Times Newspaper;
- Newspaper;
- Magazine;
- Management;
- Mail . 2;
- Radio;
- Billboard - 4; and
- Phone numbers.

* Respondents who used corridor four times or more per week.

Source: *Awareness* and Imagery *Tracking* Study " Wave 5, DuDell & Associates; November 1992.

Wilbur Smith Associates; March 1993

an **attempt** was made to determine where respondents learned about the Center, the sample was *too* **small** to draw definitive conclusions from the resuits.

We recommend that future surveys include a question on alternate modes or routes similar to question 4 on the Penn001 survey (following Page A-8).

in addition to the series of tracking surveys, the public information consultant has been keeping detailed records *of* the number of visits to the Public Information Center, telephone hot line calls, Speakers Bureau and portable exhibit engagements, and media releases over time. The trends are summarized in Tables A-9 through A-11. In their current form these statistics track activity only; however, if analyzed in conjunction with the implementation of different public information elements, they might provide data on relative effectiveness. By tracking visits and calls daily and pinpointing key public information events or releases along this timeline, project planners should be able to get a better handle on cause and effect relationships. Public Information Center staff and telephone hotline operators could also directly ask visitors and callers where they heard about the phone number or information center.

Mailback cards requesting additional information which can be included on brochures or newsletters mailed to the community can also be used to gauge a particular information element' s effectiveness in reaching the public. The I-680/SR-24 public information team used this technique once, with minimal success.

When questioned about the extent of their use of alternative transportation, more respondents indicated they had used alternative modes less during the last year. However, no attempt was made to find out why, Following up with: ' Why did you use alternative transportation less?' or ' What encouraged you to use alternative transportation more?' might provide responses which could help target the public information campaign. Responses to the question about factors influencing respondents' alternative transportation use provides some input which might be used to focus the public information campaign. For example, in both Waves 4 and 5, respondents indicated that improved bus routes and more BART runs were the two factors most likely to influence a change in mode. These responses provide input on the relative influence of different TDMs (Transportation Demand Measures), but also on the most effective targets for a focused public information campaign.

I-5 American River Crossing

Construction Cost:	$3.5 million
Project Duration:	Three to six months in 1991
Average Daily Traffic:	67,700 northbound
Public information Campaign Cost: .	$725,000[6]

This was a relatively short-term project, which was completed in two phases. Three lanes remained open during Stage 1; two lanes remained open during Stage 2 One of the principal objectives of the TMP developed as part of this project was to produce a public awareness campaign that would inform the public about the project. The public information campaign consisted of the following elements:

[6] **Cost data was available on pad advertising and supplemental flyers only.**

Table A-Q

PUBLIC INFORMATION CENTER ACTIVITY
Caltrans Traffic Management Plan Effectiveness Study

Month	<-- Number of Hotline Calls -->			<-- Number of Visitors -->		
	1991	1992	1993	1991	1992	1993
December	352	193	366	148	107	173
January	360	252	466	153	145	166
February	347	235		88	168	
March	262	279		117	170	
April	356	384		139	228	
May	418	318		145	310	
June	338	468		110	337	
July	316	347		143	235	
August	306	349		103	272	
September	273	401		80	298	
October	382	361		105	225	
November	224	382		114	200	
Total	**3,934**	**3,969**		**1,445**	**2,695**	

Note:

Twelve month fiscal year:
December 1990 - November 1991; and
December 1991 - November 1992

Source: I-680/SR-24 Project Manager, Public Information Office.

Wilbur Smith Associates: March 1993

Table A-10

I-680/SR-24 **SPEAKERS BUREAU**
1992 ACTIVITY
Caltrans Traffic Management Plan Effectiveness Study

Month	Number of Engagements	Number in Audience
December	-0-	-0-
January	1	25
February	2	75
March	3	115
April	3	100
May	5	135
June	6	170
July	1	10
August	4	230
September	2	125
October	7	715
November	3	280
Total	**37**	**1,980**

Source: I-680/SR-24 Public Information Office, Project Manager.

Wilbur Smith Associates: March 1993

Table A-11

I-680/SR-24 MEDIA RECORDS - 1992**
Caltrans Traffic Management Plan Effectiveness Study

Month	Number of Construction Reports Alerts .	Number of Inquiries	Radio & TV/	Print Stories
			Number of Items/Estimated Audience	
December, 1991	4	6	0/0	10/ 1,900,000
January, 1992	6	8	**	17, 2,800,000
February .	4	8	**	10/ 1,600,000
March	5	13	**	19/ 2700,000
April	7	36	8/ 3,300,000	28/4,800,000
May	4	14	2/ 800,000	16/ 2400,000
June	6	16	4/ 900,000	20/ 4,500,000
July	a	27	6/ 700,000	27/ 4,700,000
August	9	32	4/ 500,000	19/ 4,700,000
September	8	15	12/ 1,700,000	23/ 5,900,000
October	6	Ia	7/ 1,500,000	9/ 2600,000
November, 1992	9	30	5/ 800,000	23/ 8,200,000
Total	79	223	48/10,200,000	221/46,800,000

** Extensive use of project video and community interest show on cable television stations. viewer numbers not available.

Source: I-680/SR-24 Public Information Office Project Manager.

Wilbur Smith Associates: March 1993

- Brochures explaining the project and transportation alternatives were distributed to state and local agencies, businesses and residents. The brochure was illustrated with maps indicating alternate routes. *Over 200,000 copies were distributed. (No cost available.)

- **Paid Advertising** (both radio and newspaper) was used to alert commuters about **the** project and alternate routes. Ultimately, six radio stations and six local newspapers were contracted to disseminate information to the public. (Cost: $99,700).

- **Special Bulletins** were printed which contained information on transit, shuttle service, guaranteed ride home, HOV ramps, and "Chevron" bucks, TMP elements developed after brochures (described above) went to print. These special bulletins were mailed to 3,000 businesses in the project area for distribution to employees. Over 100,000 bulletins were printed. (No cost available.)

- **Additional Flyers** were developed to target specific groups (i.e. bicyclists, truckers, carpoolers, transit users, etc.). In all, six special flyers were produced; 110,000 copies of each were printed and distributed. (Cost: $25,000.)

- Toll-Free Telephone Information Hotline gave callers general information using touch-tone options as well as direct operator assistance. (No cost available.)

In order to determine the effectiveness of the campaign in raising awareness and changing travel behavior, panel-back telephone surveys were conducted prior to project initiation and at the conclusion of the project. **A** panel-back survey involves the collection of data over time from the sample respondents. Four hundred commuters were interviewed during the pre-project stage: 308 of these persons were interviewed during the post-test.

The specific research objectives of the surveys were to:

- Determine what (if any) changes in awareness level of the I-5 American River Bridge occurred during the months of the public awareness campaign: .

- Determine common sources of information:

- Determine what (if any) changes in commute patterns occurred during the months of the public awareness campaign;

- Assess the likelihood of commuters continuing their changed transportation mode;

- Determine the public's perception of Sacramento Rideshare's marketing efforts over the course of the campaign: and

- Determine the public's perception of Caltrans regarding communication with the public, speed of bridge repair, efforts to minimize delays, and availability of alternative modes and routes.

Although it was originally proposed to conduct the surveys using a random-digit-dialing telephone sample, this methodology was supplemented by use of a reverse street directory to compensate for the high incidence of non-working numbers in the study area.

As with the I-680/SR-24 surveys, the I-5 surveys indicated that most respondents received their information from only one or two sources. As shown in Figure A-1, TV news spots were almost twice as effective as the next highest source of information (radio news). Between 58 and 55 percent **of** survey respondents cited TV as their primary source of information in pre- and post-construction project surveys, respectively, compared with radio news which was cited by between 30 and 38 percent of respondents in the same survey.

In factoring all the sources of information into four main categories (newspapers, electronic media, business-based, interpersonal), the analysts demonstrated the value of multiple communication channels. For example, awareness of transportation alternatives was especially high among respondents who had been exposed to multiple sources of information. All of those naming four or more sources of information were aware of specific alternatives, compared with 68 percent of those mentioning only a single information source.

As shown in Table A-12 carpools and alternative routes were by far the most often cited alternatives respondents recalled being available to avoid the i-5 disruption. This finding reflected in part the extensive media coverage given to these two options.

The survey results indicated that one or more of three messages was conveyed to the public through the public information campaign:

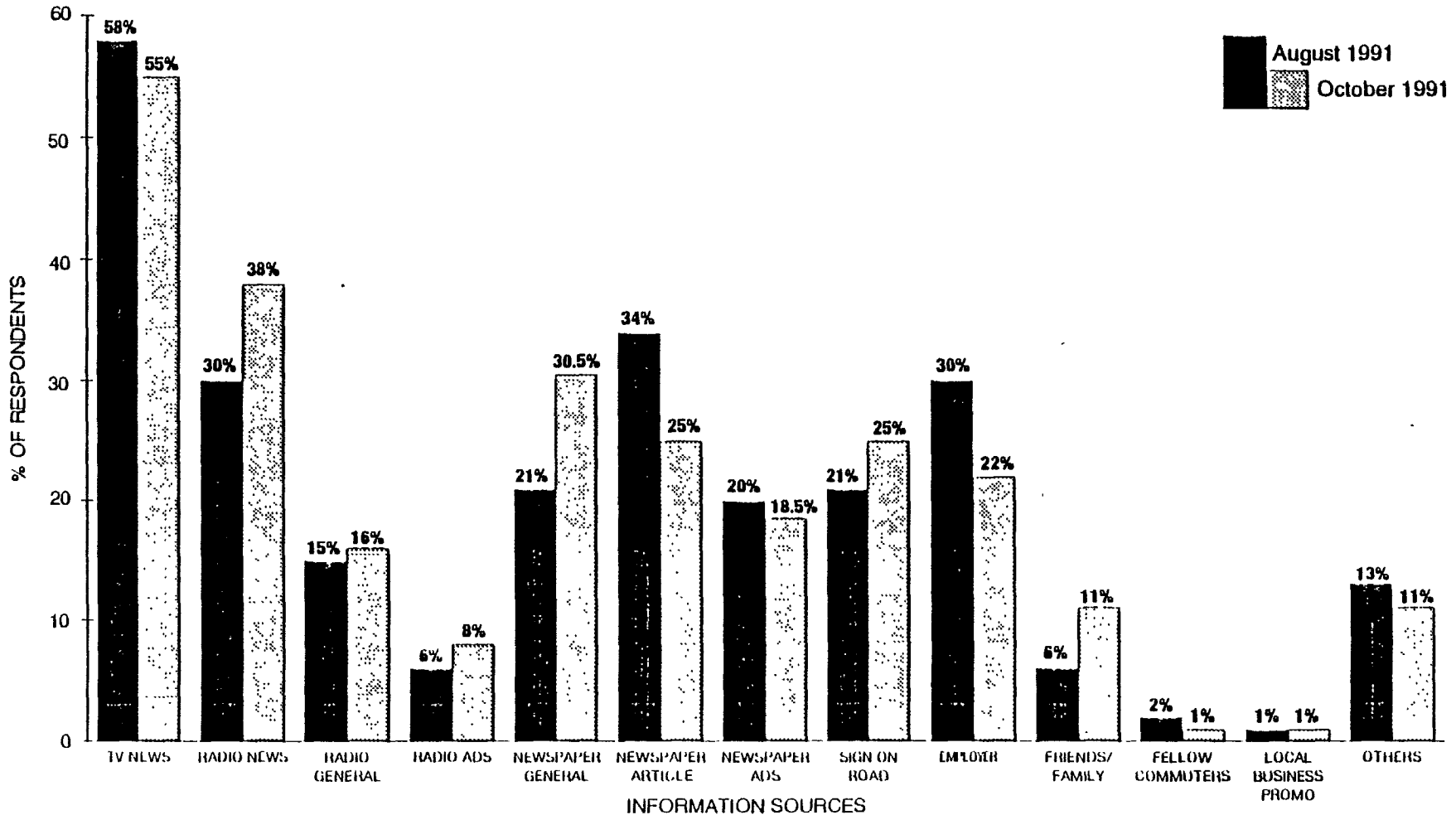
1. Avoid the problem:
2. Take advantage of financial incentives or
3. Increase reliance on conventional solutions to traffic congestion of any type.

The survey resultsalso pointed to the possibility that the duration of the project may be a factor as to where people get their information and how effective it is. For example, the specificity of respondents' answers relating to newspapers as an information resource declined during the course of the project. At the beginning, one-third of the respondents indicated a specific newspaper article as an information source compared with about one-fifth who cited newspapers in general. At the conclusion of the project, these percentages were reversed, probably reflecting the extensive newspaper coverage and Interest at the project outset which declined as the project progressed.

Lodge Freeway Reconstruction Project - Detroit, Michigan

Construction Cost:	$54.0 million
Project Duration:	Two years (1986-W)
Average Daily Traffic:	127,000
Public Information Campaign Cost: . .	$610,000

This reconstruction project involved a 7.8-mile section of this 9-mile, 6-lane urban freeway which is a major route into downtown Detroit. The project was phased over two years and involved shoulder widening, improvements to the drainage system, construction of a barrier wall for safety, resurfacing, and interchange improvements. The public information campaign, which was judged a success by project staff and personnel, media, employers and the public, included the following elements:



SOURCE Meta Information Services Summary for Panel Back Study on Commuters on I 5 at American River Bridge 1991

Figure A-1

SOURCES OF COMMUTER INFORMATION ON I-5/AMERICAN RIVER CROSSING

Table A-12

KNOWLEDGE OF SPECIFIC TMP ALTERNATIVES
I-5 AMERICAN RIVER CROSSING
Caltrans Traffic Management Plan Effectiveness Studv

Alternatlve	<-- Percentage -->		
	Aug. 91	Oct. 91	Increase/(Decline)
Carpool	48.5	59.7	11.2
Alternative Routes	39.8	49.7	9.9
I Street On-Ramp	-0-	26	26
Discounted/Free Parking	6.0	7.5	1.5
Chevron Bucks	4.5	5.8	1.3
Change Work Hours	3.0	4.2	1.2
Guaranteed Ride Home	7.0	7.8	0.8
Other	*25*	*23*	(0.2)
Telecommuting	1.2	0.6	(0.6)
Vanpool	11.9	10.4	(1.5)
Park-and-Ride Lots	26.6	25.0	(1.6)
Free Park-and-Ride Shuttle	26.1	23.7	(2.4)
Bicycle/Walk	10.9	8.1	(2.8)
RT Bus/Light Rail	29.9	25.3	(4.6)

Source: Meta Information Services, Summary for Panel-Back *Study of Commuters on l-5 at American River Bridge,* 1991.

Wilbur Smith Associates: March 1993

- **Medla Briefings** provided by a full-time specialist to provide frequent construction and traffic updates. Particular emphasis was given to getting timely information to **existing** helicopter traffic reporters. (Budget: $15,000.)

- **Telephone Hotline** provided frequently updated taped messages on project status and expected traffic delays. (Included in Speakers Bureau budget.)

- **Public Service Announcements** described the project, and provided information on hotline and alternate routes. (Budget: $60,000.)

- **Brochures,** targeted to specific user groups, were distributed by the Task Force and a local radio station. Over 750 brochures were distributed. (Budget: $75,000.)

- **Speakers Bureau** offered specialists to narrate slide program to community groups. The public also received information about the project from specially trained public contact personnel such as telephone operators, food service and hotel personnel, etc. (Budget: $20,000.)

- **Paid Advertisements** highlighted special events though much less than the anticipated budget amount was actually used for this purpose. (Budget: $300,000.)

Public information campaign project management and promotional support including development of a campaign theme was funded at about $65,000.

In addition to the public information campaign cost, opinion surveys were funded at $75,000 One poll was taken at the stan of construction as a baseline and to provide guidelines in developing the focus of the public information campaign. The results of the first poll indicated that the public was primarily concerned that there be 'no surprises' about what will happen and when. This input was instrumental in designing the overall public relations campaign.

Another poll was conducted mid-way through the project to gauge the effectiveness of the public information campaign. Eight hundred freeway users were interviewed, using the random digit-dial technique. The specific objectives and findings of the second poll were as follows:

Objective: Determine user attitudes about the first year of the project.

Findings – The majority (55%) of those surveyed indicated that the project caused them relatively little inconvenience. Almost 60 percent of the survey respondents had a positive opinion of government efforts to minimize disruptions. About 40 percent of the survey respondents used the freeway less often during construction than before; however, more than one-half of the motorists surveyed used the freeway just as often during construction as they did prior to construction. More than 90 percent of survey respondents indicated that the project had little impact on their destinations. Over 75 percent indicated they frequently or sometimes used alternate routes instead of the freeway.

Objective: Determine whether first year of project had changed user attitudes.

Findings – Motorists found the project caused more inconvenience than they first anticipated (87% experienced inconvenience vs. 48% who had anticipated inconvenience). Similarly, almost 80 percent reported they used alternate freeway or surface routes vs. between 50 and 60 percent who had anticipated doing so.

Objective: Determine effectiveness of Motorist Information Program.

Findings – Almost 60 percent of motorists surveyed rated the information program and the government's management of the project as either excellent or good. Motorists' primary information sources were TV (80%); newspapers (71%): radio (69%); freeway signs (69%): word of mouth (63%). Letters or flyers were cited by fewer than 10% of respondents as an information resource. Awareness of specific TMP elements varied widely among respondents. Only about 33 percent were aware of the telephone hotline: even fewer (8 percent) were'aware of the free tow service. Motorists were more aware of the changeable message signs (70%), logo/theme (42%) and TV announcements (63%).

Objective: Deterrnine expected reactions to on-going project.

Findings – Over 60 percent of the motorists surveyed indicated that they would use the Lodge Freeway either somewhat or a lot less frequently during Phase II, than they had during Phase I. The survey indicated which alternate routes would be used most often and which trip types might decrease as a result of the Phase II project. Seventy percent of the motorists indicated they would consider using Southfield/Detroit express bus service. Motorists experienced only slightly more inconvenience during Phase II than they experienced during Phase I.

Objective: Determine motorist needs for knowledge.

Findings – More than 80 percent of those surveyed had not heard about the Phase II construction. When asked how they would most prefer to get information about the project, the results were mixed: TV (35%), radio traffic reports (29%), newspapers (23%).

A particularly striking finding of the survey was that only about 20 percent of the motorists surveyed were aware of Phase II of the project despite the $239,000 public information campaign waged in Phase I. The survey was useful in identifying not only where motorists actually received information about the project but also where they would prefer to get information. Planners could then focus on these resources to publicize Phase II.

In addition, using data from the polls and experience gained during the project, the media consultants responsible for developing the public information campaign provided detailed evaluations and recommendations at the conclusion of the project for possible future use. A summary of their conclusions regarding each of the elements of the Lodge Motorist Information program is presented below.

Campaign Theme – The ability to generate a unifying theme, 'Lodge*ability', and color scheme was considered to be an unqualified success. If at all possible, TMPs should strive to come up with a catchy phrase or slogan to capture the public's attention.

Media Relations Support – Proactive media relations made it possible to treat the freeway project as ' hard' news. Therefore, the project did not have to be sold. Early rapport was established with traffic reporters and editorial writers, highlighted with special luncheons for traffic reporters and editorial briefings. Because newspapers and TV often give principal play to material supported by graphic exhibits, a map of the project was generated to provide to the media along with text material. A single point of contact for the media from the TMP staff was also very beneficial, ensuring consistency of information.

Printed Materials – There was little interest in a wide variety of printed materials such as posters, inserts, mailers, etc. for this project Brochures showing a map of alternative routes were the most effective of the printed materials generated. The Task Force pulled together for the project helped define what was useful and what was not, based on input members received from their various constituencies.

Public Service Announcements – The effectiveness of these announcements was mixed. The short duration of these messages limited their usefulness to convey detailed information. Their primary strength was to emphasize other elements of the TMP such as the hot-line or the plan to keep one side of the freeway open at all times, neither of which were well known to the public. One radio station made an effort to track response to the public service announcements by offering the alternative route brochure (described above) to anyone who requested one: the station received over 1,000 requests.

Advertising – Paid ads were used to make sure there was **a** controlled flow of basic information about the project to the broadest possible audience. Ads were timed to coincide with key project events, such as closing one-half of the freeway. In general, the advantage of paid newspaper advertising is that it is not limited by the time constraints imposed by radio and television, yet has mass coverage not available to other printed materials such as brochures which require a one-to-one distribution process. Nonetheless, the Task Force, elected not to target advertising to direct the flow of traffic to the special events facilities impacted by the project, instead redirecting a major portion of the budget for advertising to other public relations efforts.

Promotion – This element included the Community Implementation Task Force and a 24-hour hotline. The Task Force was considered to be a vital element in the ultimate success of the public information campaign. As noted above, the Task Force was used as a sounding board as the public information campaign was developed and suggested refinements during the course of the project based on input from various constituencies. Public contact briefings were held for people who directly interacted with the public (such as bellhops, parking and security personnel) to expand the TMP outreach. The hotline, which used a frequently updated taped message, logged an average of more than 800 calls per month.

Speakers Bureau – This element has the benefit of offering the opportunity of immediate one-on-one interaction between project spokespersons and the public. Presentations can be tailored to specific audiences and can easily be updated as the project progresses. To be most effective, the slide presentation should be put together by outside consultants specializing in the medium.

Monitoring and Evaluation – The Community Implementation Task Force was an important element in monitoring the overall effectiveness of the public information campaign. The public opinion polls taken before and during the project were critical in identifying who the audience was and the principal' concerns about the project An attempt to secure ongoing feedback from a group **of** 24 motorists called the Lodge Consumer Panel ultimately failed because of the overall TMP's success. These motorists, who were selected to reflect existing patterns of Lodge freeway usage, lost interest in attending meetings because there were no problems to discuss. Although the Consumer Panel was not well received in this case, Lodge planners still consider it a useful tool in some instances, with mail contacts preferred to telephone contacts

FINDINGS AND RECOMMENDATIONS

The four public information campaigns reviewed in this Appendix point to some obvious conclusions which can be immediately applied to future TMPs. However, just as importantly, the analysis also highlights significant gaps in the data which TMP planners must work to fill before a definitive determination can be made on the most cost-effective public information element.

Principal Information Sources About Highway Reconstruction Projects

Since survey data clearly indicate that the mass media are the primary information resources used by the public, it is incumbent upon TMP coordinators to cultivate media relations early during the TMP planning phases. This will not only ensure that accurate preliminary information about the upcoming reconstruction project is released, but also establish a reputation for accuracy and openness

The media can have a tremendous impact on the success of major, multi-phased highway construction projects. Outdated, inaccurate **or** conflicting information can generate unnecessary concern and public aggravation. On the other hand, if the project warrants treatment as a hard news item, the media can be a valuable ally by providing ongoing information about the project and free, widely disseminated publicity about the various transportation alternatives developed to mitigate project impacts. It is, therefore, very important that information be thoughtfully presented to media sources so that the information is:

- Accurate and up-to-date:
- Easy to understand;
- Illustrated with clear and useful graphics:
- Amenable to input or comment from the public by some means (perhaps a hotline, mail-back response card or central contact person).

Early involvement of aerial traffic reporters or columnists specializing in transportation issues can establish a valuable network of information feedback and often innovative media campaigns that cost the TMP little. Experience on some major highway reconstruction projects indicates that, depending on the severity of the proposed disruption, an early brainstorming session with the media presenting them with 'Here's the *problem. . "* what can we do about it?" will result in many useful, creative ideas. In fact, to the extent that the objectives of the TMP public information campaign can be melded with media self-interest, local TV or radio stations or newspapers are often willing to underwrite certain costs. For example, a local radio station may be willing not oniy to publicize alternate routes on its morning news traffic report, but may be willing to publish a brochure which listeners can request which illustrates the route and highlights the station's morning news traffic report feature. In this way, both the radio station and the TMP can benefit.

Highway advisory signs are also very effective in giving the public specific information about project phasing, lane closures, alternate routes, etc. Very often the public receive a broad overview of the project through the mass media and then rely on roadside advisories to help them with spur-of-the-moment decision-making. Therefore, the roadside advisories should be well-placed and, most importantly, accurate.

Relative Effectiveness of Various Public Information Measures

A TMP which emphasizes the information resources cited above (which appear to be the public's preferred sources of information about highway reconstruction projects) merely insures that the message is disseminated. The relative effectiveness of these and other information measures in terms of actually encouraging the public to change travel behavior is another matter. While it would be useful to establish clear cause and effect relationships, this may be difficult to do, given the complex nature of travel behavior and human nature in general. Surveys, carefully worded and timed at critical points in the public information campaign, are probably the best means to track these relationships. However, comprehensive survey efforts can be both time-consuming and expensive; for this reason, special TMP survey efforts are probably only warranted for the most complex, multi-phased highway reconstruction projects, extending over a year or more. Other methods, such as focus groups or consumer panels, may be the most expedient option for projects of shorter duration.

In order for surveys to be useful in identifying the relative effectiveness of the TMP elements, a pre-project or benchmark survey is required. There must be a clear understanding of the existing travel characteristics in the corridor, including:

- Socio-economic characteristics of users (age, sex, income, ethnicity, etc.);
- Trip origin;
- Trip destination:
- Trip purpose:
- Travel mode:
- Preferred incentives to change mode: and
- Existing information sources.

Such a pm-project or benchmark survey should not only identify existing travel characteristics in the corridor but also encourage respondents to highlight concerns about the upcoming project. This will help TMP planners to structure the TMP's public information campaign to address those concerns.

Also, using this pre-project data, planners can target specific public information elements to specific sources. For example, if there is a predominant concern among Hispanic travelers, then these concerns could be targeted in Spanish language media

Once the public information campaign is underway, for major .TMPs the effectiveness of the various elements can be gauged in a number of ways:

- By timing interim follow-up surveys to coincide with new elements of the public information campaign. For example, in conjunction with **a** one-half price transit promotion, publicized through employer info kits, the mass media, TMP phone hotline and directly by the transit operator (either a telephone info line or bus schedule), transit users could be given a simple on-board survey a week or so after

the start of the promotion to determine if they heard about it, where they heard about it and whether or not it influenced their travel behavior.

- By using members of the TMP Task Force to provide qualitative input from their constituents. A multi-agency, multi-jurisdictional Task Force should be established for all TMP projects whether of short or long duration. A communications subcommittee or consumer panel can be set up as a subsection of this group to discuss various elements of the public information with affected agencies, community groups, etc. Input provided through these sources can be used to refine the public information campaign as necessary.

In order to collect more data on how various public information elements affect travel behavior, Caltrans should set aside a monitoring budget and plan specifically to build up a data base. Effectiveness should be measured both in terms of cost and ability to influence travel mode. Therefore, TMP coordinators need to keep accurate records on both development and implementation costs, including staff time and materials. If post-project surveys are administered to a statistically representative sample of the corridor population, then TMP planners should be able to identify which public information elements are most effective in terms of cost/vehicle removed from the corridor. The survey format used for the Philadelphia-Schuylkill Expressway (I-76) reconstruction project is an excellent model.

Summary of Key Findings

Key findings and recommendations on the effectiveness of TMP public information elements are summarized below:

- Use of the mass media (newspapers, radio and television) and highway advisory signs are the two most cost-effective public information resources. Therefore Caltrans should give first priority to these two elements. To the extent that a highway reconstruction project is a hard news Item, the media may seek out stories on the TMP, resulting in a relatively low cost incurred by the TMP. Low profile projects may require paid advertising in the media in order to get the message out. In either case, dissemination by the mass media insures the broadest possible audience.

- A single point of contact for the TMP is imperative to assure consistency of Information. This can either be a Caltrans staff person or a special public relations consultant. Clear, concise graphics and a ' catchy' slogan are also important to make sure the message gets picked up by the mass media

- Caltrans should utilize Task Force member cooperation and input to minimize the cost of the TMP public information campaign and avoid duplication by piggy-backing onto existing mass media, transit or. ridesharing publicity campaigns. For example, transit and rideshare agencies routinely update their support and promotional materials as their schedules or service change. As a rule, these materials are printed and distnbuted in large quantities. For little or no cost, these materials could reference the construction project, and highlight TMP elements such as transit routes, special fares, park-and-nde lots, etc. Similarly, brochures which are funded by the TMP should be developed in coordination with transit and

rideshare agencies and reference specific routes, fares, and info numbers as applicable.

- A public information/visitors center, speakers' bureau, and employer Information packets are useful as secondary resources. To the extent they can be implemented at minimum cost to the TMP by utilizing existing facilities or staff, they can be useful in broadening the scope of information coverage. For complex, multi-phased projects, they can also provide added depth to the TMP. For example, they are useful for improving community relations and in answering in-depth questions. However, they are relatively ineffective in reaching large numbers of individuals.

- A telephone hotline is essential for every project but does not have to beproject-specific if other resources are available and the project is not too complex. The hotline should be monitored during the TMP to ensure that resources are adequate and that questions are answered satisfactorily.

- Brochures appear to be the least cost-effective public information resource. Because of their relatively long lead time and cost to produce, brochures appear most practical for long-term, complex, multi-phased projects. if brochures are used at all, their distribution should be followed by some sort of monitoring effort to determine who saw them, what they learned from them, and if or how the brochures changed their travel behavior.

- Between10 and 20 percent of the TMP budget Is a good rule of thumb for the public information budget if the project is of relatively short duration (say 1-1/2 years or less). For longer, more complex projects, the public information element may reach 25% of the total TMP budget.

- In order to build up meaningful quantitative cost-effectiveness data on each of the public information elements, Caltrans should require that costs be tabulated fully and consistently for each public information element. Detailed costs to develop, produce, implement, and administer the various public information elements need to be compiled and compared with projected budgets.

Caltrans should set aside a percentage of the public information budget for monitoring its effectiveness through surveys similar to those discussed in this appendix. These surveys should quantify how respondents get information on the project and how they are using this information. These surveys should be standardized as much as possible to facilitate comparisons.

APPENDIX B

OVERVIEW OF PHASE I

This Appendii summarizes the findings and conclusions of the state-of-the-art review conducted in Phase I. The reader should refer to Working Paper #1: Overview of TMP Experience for a more comprehensive discussion.

In Phase I of this project the consultant team reviewed the existing state-of-the-art in Traffic Management Programs (TMPs) using published documents and interviews with selected TMP coordinators for input. The following TMPs were reviewed:

- Interstate 5 - American River Crossing, Sacramento, California (Caltrans District #3)
- I-680/SR-24 - Interchange Widening, Walnut Creek, California (Caltrans District #4) .
- I-80 Reconstruction, San Francisco Say Area, California (Caltrans District #4)
- U.S. 101 - Cuesta Grade Pavement Rehabilitation, San Luis Obispo County, California (Caltrans District #5)
- U.S. 101 - Ventura Freeway, Los Angeles County, California (Caltrans District #7)
- SR-85 - Coronado Bridge Resurfacing, San Diego, California (Caltrans District #11)
- I-5 - Santa Ana Freeway, Orange County, California (Caltrans District #12)
- U.S. 10 - Lodge Freeway Reconstruction, Detroit, Michigan
- I-5 - Ship Canal Bridge Resurfacing, Seattle, Washington
- I-76 - Schuylkill Expressway Reconstruction, Philadelphia, Pennsylvania
- Kennedy Expressway Reconstruction. Chicago, Illinois
- I-84/I-91 Interchange, Hanford, Connecticut
- I-394 Reconstruction, Minneapolis, Minnesota
- I-95 Reconstruction, Northern Dade, Broward, and Southern Palm Beach Counties, Florida

Figures B-1 and B-2 show the geographic location of each of these projects. Tables B-1A and B-1 B summarize in matrix format the various TMP strategies and elements utilized in each of the case studies. Where available, itemized costs for particular elements are included. However, these costs should be interpreted with caution. DOT staff time is often not fully accounted for in these costs. In addition, direct comparisons are difficult because in some cases specific elements are partially funded from other sources.

Planning and Selection Processes

In most cases within and outside California, there seemed to be no formal decision-making procedure utilized to determine whether or not a TMP was needed. The decision seemed to be intuitive, based on experience and a general understanding of the existing transportation setting. However, in virtually all cases it was evident that the decision of whether or not to develop a TMP should be made as early as possible in the project development process. Early in the project development process, TMP planners assessed Average Daily Traffic (ADT) as one parameter for determining whether or not a TMP was required. Table B-2 presents ADTs for the various case study projects reviewed in this background task. Average daily traffic volumes range from a high of 280,000 for the I-680IS.R. 24 project in Caltrans District 4 to a low of 50,000 for the Cuesta Grade project in District 5. Yet a TMP was prepared in each case. Often the community' s perception of traffic congestion, delay and safety is just as important a factor in the decision-making process as the quantitative data

Goals and Objectives

The goals and objectives of the TMPs range from broad, general directives to very specific percentage reductions in traffic or delays. Some goals and objectives were temporary, applicable only during the life of the reconstruction project. Others were developed to mitigate the impacts of the reconstruction project, but were considered to be permanent, long-term goals, extending well beyond the project duratron. Table B-3 presents an overview of the goals and objectives gleaned from the case studies.

All the case studies reviewed had some delineation of goals and objectives. Most had either an implicit or explicit goal to keep traffic moving smoothly. To the extent that these goals were expressed in quantitative terms, progress toward goal achievement could be measured. However, in many cases the goals and objectives were expressed in broad, qualitative terms which made monitoring and assessment of success difficult.

Selection **of individual Elements**

Most TMP elements were selected by a committee or subcommittee, in most cases after preliminary review and discussion with other OOT departments, affected communities, project contractor, etc. In one case, the Lodge Freeway project in Detroit, a survey was taken prior to selection in order to gauge community concerns and tailor the TMP elements accordingly.

In the majority **of** cases, there was no formal evaluation procedure preceding the selection of TMP elements. However, in some cases, formal evaluation procedures were used to calculate cost-effectiveness, safety, and delay factors, the results of which were used to compare and evaluate alternatives. 1 Once the potential TMP elements were identified, specific proposals were solicited to

I **A more detailed discussion of cost-effectiveness used to select TMP elements is contained in Chapter 6.**

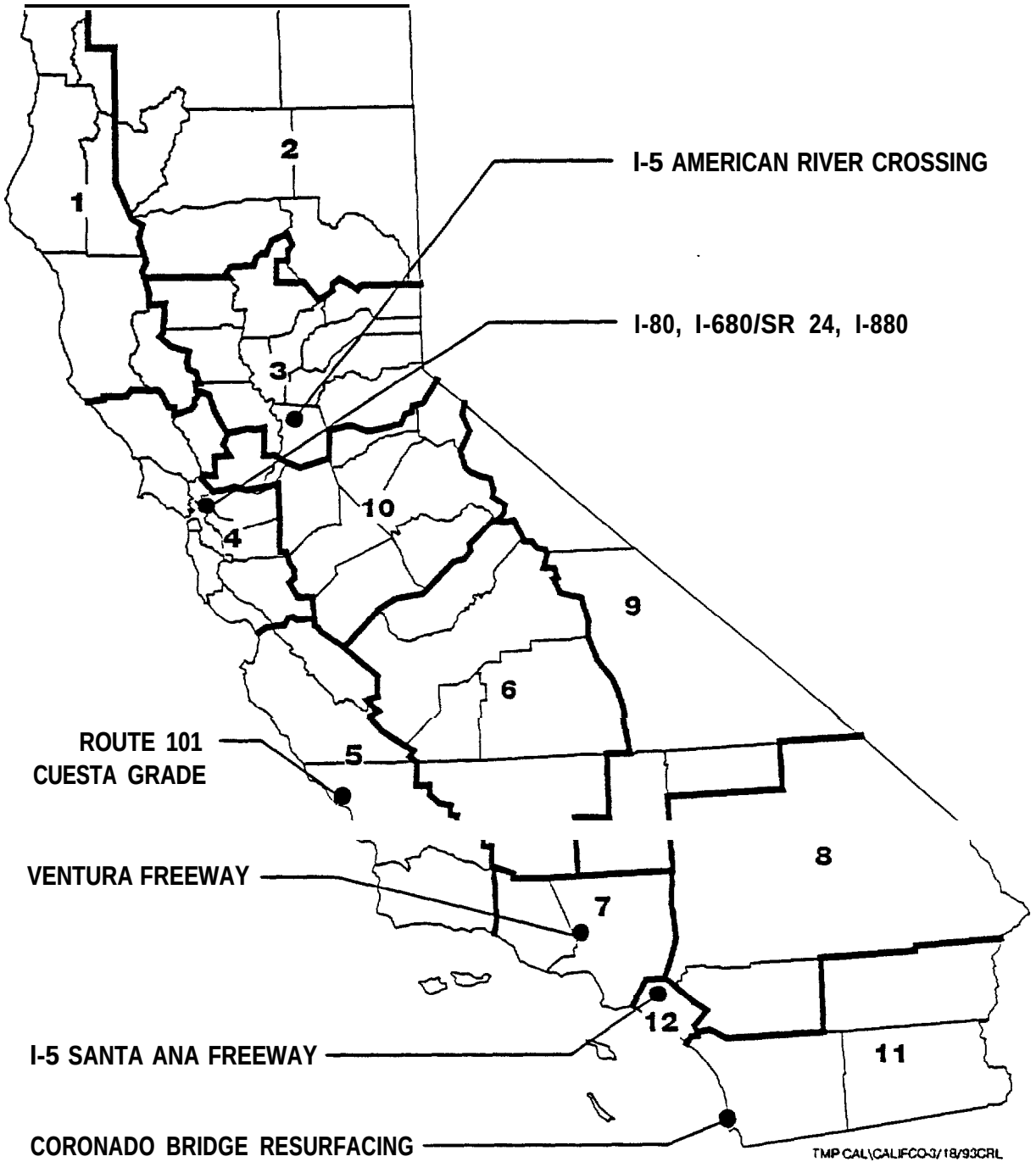


Figure B-1
TMP CASE STUDIES IN CALIFORNIA

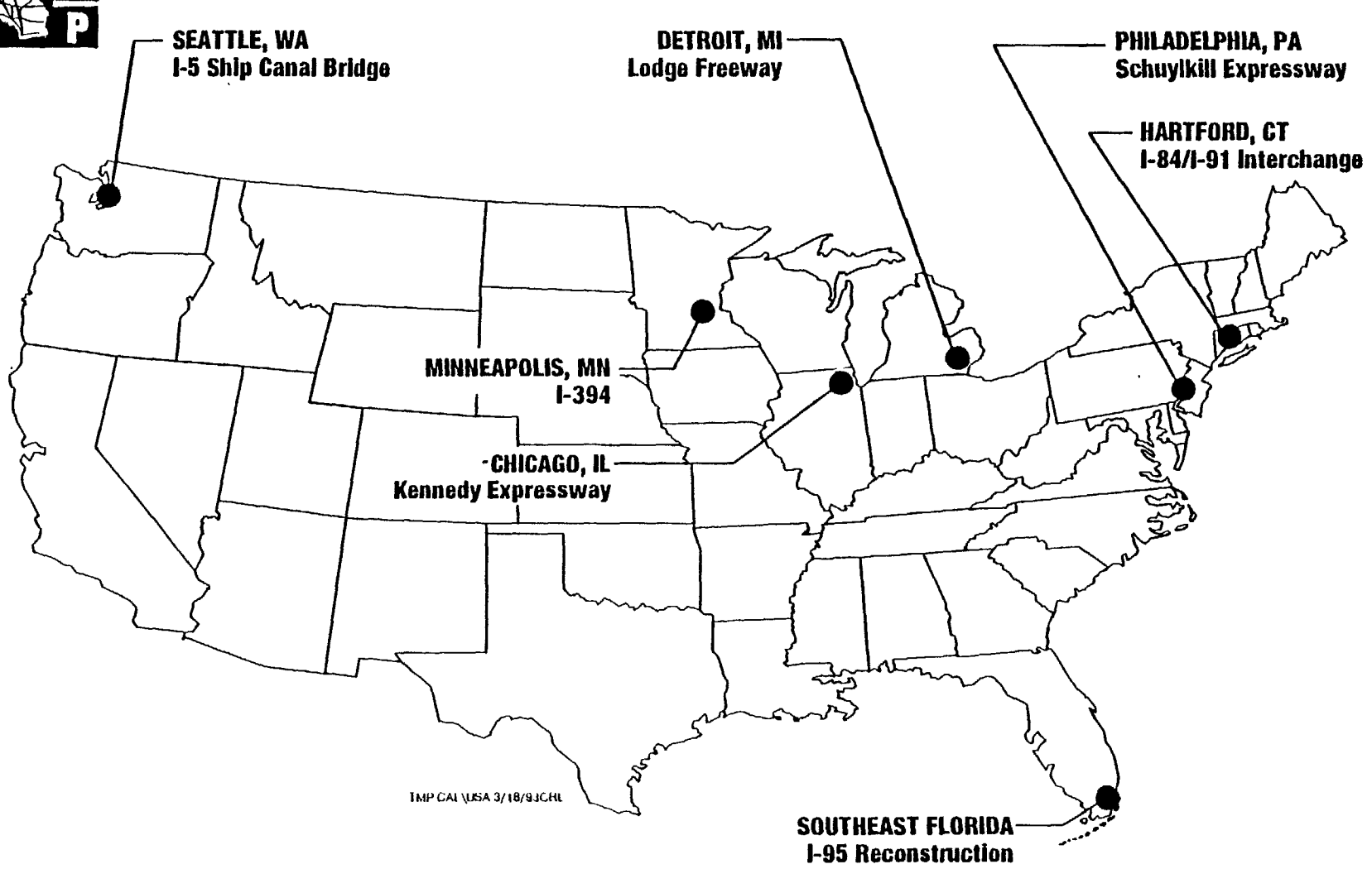


Figure B-2

TMP CASE STUDIES OUTSIDE OF CALIFORNIA

Table B-1A
(Page 1 of 2)
TRAFFIC MANAGEMENT PLAN ELEMENTS - CALIFORNIA
Caltrans Traffic Management Plan Effectiveness Study

District, Project and Construction Cost/ TMP Cost (in millions)	Traffic Management Plan Elements and Costs (in millions)					
	Public Information	Motorist Info.	Incident Management	Construction Strategies	Demand Management	Alternative Route Strategies
District #3 - I-5 American River Crossing $3 5/$1 085	Paid Advertising ..... $0.1 Flyers $0 025	CMS . $0 06 HAR . $0 024	Tow Trucks (State furnished) CCTV ..... $0 005 Sacramento Police . $0 025	Construction Zone Enforcement ..... $0 76 Work Barriers ..... $0 056 Contractor Controls/ Incentives $0 5	P&R Lots ..... $0.111 Carpool Incentives .. $0 006 Shuttle ..... $0 075 Increased Transit ... $0 012	HOV Ramps $0 01
District #4 - I-680 $270 0/$13 5	Newsletters, Video, Posters ..... $6 0 Public Info. Centers . . $0 2	CMS . $0 9 HAR .. $0.120	CCTV . $1 1 Loop Detectors .... $0 160 Tow Trucks $1 5		Carpool/Vanpool Rental P&R Lot Lease Transit Subsidies $2.5	Ramp Metering $1.02
District #4 - I-80 $230 0/$14 9	Public Information ... $1 6 Awareness Campaign Information Offices $0 3		CCTV/Loop Detectors} Tow Trucks} . .... $3 6 CMS/HAR}		P&R Lots ..... $1.2 Rideshare Incentives} Transit Enhancements} $5 9	Parallel Route Enhancements ..... $2 3 (signal synchronization; left-turn lanes, bus stop relocations, parking removal, striping, resurfacing)
District #5 Cuesta Grade $3 0/$0 250	Public Info Meetings} Mailers, Graphics} Hot Line,} . .... $0 05 Posters, Letters,} Heavy Media Coverage}	CMS . . $0 05 HAR	COZEEP . . . $0 05	Construction limited to between 9P and 6A daily 2 NB lanes open		54-mile detour for southbound traffic on SR-1

Abbreviations: CCTV = Closed Circuit Television; CMS = Changeable Message Signs, COZEEP = Construction Zone Enhanced Enforcement Program; HAR = Highway Advisory Radio; HOV = High Occupancy Vehicle, P&R = Park-and-Ride.

Table B-1A
(Page 2 of 2)
TRAFFIC MANAGEMENT PLAN ELEMENTS - CALIFORNIA
Caltrans Traffic Management Plan Effectiveness Study

District, Project and Construction Cost/ TMP Cost (in millions)	Traffic Management Plan Elements and Costs (in millions)					
	Public Information	Motorist Info.	Incident Management	Construction Strategies	Demand Management	Alternative Route Strategies
District #7 Ventura Freeway $20.0/$4.7	Marketing/Outreach} Brochure} . . . . . $0.59 VIP Info. Bureau} Toll-Free Hotline}	CMS} HAR}. . . $0.695	Service Patrol} Loop Detectors} CCTV} . . . . . $1.186 Aerial Surveillance}	Limited peak hour closures} Work barriers} . . . . . $0.961 Financial incentives}	Vanpool subsidies} Full-time traffic} . . . . . $0.05 management coordinator}	Street Modifications/Traffic} Control/Ramp Metering} Alternative Routes} $1.218
District #11 Coronado Bridge $3.5/$0.360	Mailers Brochures Town meetings	CMS*	CCTV* Service Patrols* COZEEP	Lane closure only at night	Staggered work hours Ferry subsidies . . . . . $0.126 Shuttle service . . . . . $0.006 Transit pass subsidies . . . . . $0.072 Transit upgrades . . . . . $0.1 Carpool parking subsidy $0.053	Signal modifications . . . $0.004
District #12 I-5/I-405 - I-5/SR-55 $73.0/$4.0	Phone hotline} Public Info. Center} . . $0.6 Brochures} Speaker's Bureau}	CMS} HAR} . . . . . *	CCTV . . . . . $0.13 Tow Trucks . . . . . $0.575 Aerial Surveillance . . . . $0.19 Traffic Control Officers $0.795	3 lanes in peak direction kept open	Rideshare incentives} Vanpool quick-start} Express bus service} . . $0.8	Reduced lane widths Intermittent ramp closures Alt. routes/signal modifications . . . . . $0.21 Local street improvements $0.7

Abbreviations. CCTV = Closed Circuit Television; CMS = Changeable Message Signs; COZEEP = Construction Zone Enhanced Enforcement Program, HAR = Highway Advisory Radio; HOV = High Occupancy Vehicle, P&R = Park-and-Ride

* = Funded from another source or in operation prior to TMP

Wilbur Smith Associates; May 1993

Table 8-18
(Page 1 of 2)
TRAFFIC MANAGEMENT PLAN ELEMENTS - OUT OF STATE
Caltrans Traffic Management Plan Effectiveness Study

City, Project and Construction Cost/ TMP Cost (in million)	Traffic Management Plan Elements and Costs (in millions)					
	Public Information	Motorist Information	Incident Management	Construction Strategies	Demand Management	Alternative Route Strategies
Detroit Lodge Freeway $54 0/(1)	Brochure) User Surveys) Media Coverage) ..... $0.61 Speakers' Bureau) 24-Hour Hotline)	HAR CMS	Radar Aerial Surveillance CCTV/Tow Service	Non-peak hour work periods All lanes open during rush hour Incentive/disincentive clauses	Car/vanpool incentives Employer coordinators Addition of 9 X-buses	Signal retiming Ramp improvements Street resurfacing New signing for reversible lane Dev. connector route
Seattle I-5 Ship Channel $8 2/(1)	Brochure) Public Meetings) 24-Hour Hotline) .... $0.1 Media Coverage)	HAR CMS		Contractor incentives/ disincentives	Carpool/vanpool Public transit improvements Flextime	Improvements to alternative routes HOV ramps
Philadelphia Schuylkill Freeway $225 0/$12 0(2)	Brochures 24-Hour Hotline Media Coverage		24-Hour Tow Service	Construction manager incentives/disincentives	Carpool/vanpool Transit improvements P&R lot expansion Alternative work schedules	Ramp closures/Alt. route improvements (signals added, routes widened, turn lanes added, parking recessed)
Chicago Kennedy Expressway $640/$29 0	Brochures) Media Coverage) ..... $1.6 24-Hour Hotline) User Surveys)	HAR) CMS) $0 972(4)	Loop Detectors	Phased construction 4 lanes open in both directions Dead lane for worker safety Construction strategies	Demand management strategies	Ramp closure Alt. route improvements $28 0

Abbreviations: CCTV = Closed Circuit Television; CMS = Changeable Message Signs, COZEEP = Construction Zone Enhanced Enforcement Program; HAR = Highway Advisory Radio; HOV = High Occupancy Vehicle; P&R = Park-and-Ride.

(1) Detailed TMP cost not available
(2) $1 2 million for public information, carpooling/vanpooling and alternative work schedules, $10 8 million for public transit improvements, par-and-ride lots and alternate route improvements. Cost of work zone actions included in construction cost
(3) Also includes miscellaneous construction elements
(4) Funded from another source or in operation prior to TMP

Table 8-18
(Page 2 of 2)
TRAFFIC MANAGEMENT PLAN ELEMENTS - OUT OF STATE
Caltrans Traffic Management Plan Effectiveness Study

City, Project and Construction Cost/ TMP Cost (in million)	Traffic Management Plan Elements and Costs (in millions)					
	Public Information	Motorist Information	Incident Management	Construction Strategies	Demand Management	Alternative Route Strategies
Hartford I-84/I-91 $90 0[1]	Flyers, Brochures,} Media Reports,} . . $0.195 Paid Advertising} Speakers bureau}	CMS HAR	Local Police State Troopers Tow Service Aerial Surveillance			Alt. routes (detours, total freeway closure in one direction) Used signals in place prior to construction
Minneapolis I-394 $400 0/$17 82	Marketing} Public Information} Hotline} . . . . . $1 0 Project Center} Meetings}	CMS Advance Signs Radio Spots	Highway Helper (Tow) Police Patrol	Truck prohibitions Periodic relocation of HOV lane . . . . . $9.095 Maintenance of HOV $0 42 Operation of HOV gates $0 299	New carpool lots . . . . . $0.163 Transit Operations . . . . . $1.705 Rideshare incentives . . . . $0.403 Interim HOV during construction . . . . . 4 729[3] P&R lots	
Miami I 95 $400 0/$26,78	Public Info Consultant} Public Info Office} Heavy Media Use} . . . $12 9 (news releases)} Letters, Brochures, Radio,} TV (initial} design/placement}	CMS Advance Warning Signs . . $1 821	Freeway Incident Mgmt Program (including service patrols, emergency stopping sites, and communications) $6 712	Maintain 6 traffic lanes Lane closures between 10P & 6A only Target milestones (4 lanes open by Xmas) Barrier screens $4 91	Rideshare matching} Additional P&R lots} Variable work hours} Tri-rail commuter} service} $2 238	Alt. route improvements Signal inter-connect, retiming $11 08

Abbreviations: CCTV = Closed Circuit Television; CMS = Changeable Message Signs, COZEEP = Construction Zone Enhanced Enforcement Program; HAR = Highway Advisory Radio, HOV = High Occupancy Vehicle; P&R = Park-and-Ride

(1) Detailed TMP cost not available
(2) $1 2 million for public information, carpooling/vanpooling and alternative work schedules, $10 8 million for public transit improvements, par-and-ride lots and alternate route improvements. Cost of work zone actions included in construction cost.
(3) Also includes miscellaneous construction elements
(4) Funded from another source or in operation prior to TMP

Wilbur Smith Associates, May 1993

Table B-2

PRE-TMP PROJECT AVERAGE DAILY TRAFFIC VOLUMES
Caltrans Traffic Management Plan Effectiveness Study

CALIFORNIA	
District #3 I-5 American River Crossing	67,700 northbound ADT
District #4 - I-630	280,000 ADT
District #4 - I-80	260,000 ADT
District #5 - Cuesta Grade	50,000 ADT, 5,000 peak hour
District #7 - Ventura Freeway	**265,000** ADT eastbound to 1405, 175,000 ADT in 2-1/4-mile-long 6-lane section.
District #11 - Coronado Bridge	65,000
District #12 - I-5/I-405 - I-5/SR-55	133,000 - 206,000 ADT
OTHER STATES	
Detroit - Lodge Freeway	127,000 ADT
Seattle - I-5	210,000 ADT
Philadelphia - Schuylkill Freeway	80,000 - 143,000 ADT
Chicago - Kennedy Expressway	250.000 ADT for mainline and reversible lanes
Hartford - I-84/I-91	230,000 ADT
Minneapolis - I-395	99,000 ADT
Miami - I-95	145,000 - 174,000 ADT; 200,000 ADT in peak season

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Table B-3
(Page 1 of 2)

GOALS AND OBJECTIVES OF TRAFFIC MANAGEMENT PROGRAM
Caltrans Traffic Management Plan Effectiveness Study

Qualitative	Quantitative
CALIFORNIA	
Caltrans District A3 - American River Crossing	
Ensure optimum operatlonal capacity of freeway and alternative routes Promote ride sharing to reduce traffic volume. Promote public awareness. Establish construction constraints to minimlze traffic disruption.	
Caltrans District #4 - I-680	
	Maintain pre-construction speeds through interchange: reduce traffic through interchange by 10 percent
Caltrans District #4 I-80	
Maintain smooth traffic flow: coordinate traffic mitigation with cities. regional agencies end other reconstruction projects: prepare for temporary road closures. Achieve permanent mode shift from single occupancy vehicles to transit.	
Caltrans District #5 - Cuesta Grade	
Mitigate community impacts; maximize safety of workers and traveiing public.	
Caltrans District #7 - Ventura Freeway	
Not to make traffic congestion worse: encourage ridesharing.	
Caltrans District #11 - Coronado Bridge	
	Reduce traffic by 50 percent.
Caltrans District #12 - I-5/I-405 - I-5/SR-55	
Keep congestion no worse during construction than before.	Maintain existing level of service

Table B-3
(Pago 2 of 2)

GOALS AND OBJECTIVES OF TRAFFIC MANAGEMENT PROGRAM
Caltrans Traffic Management Plan Effectiveness study

Qualitative	Quantitative
OTHER STATES'	
Detroit - Lodge Freeway/US-101	
Minimize negative impacts during construction on retail establishments, entertainment and sports complexes. restaurants, employers, health care facilities, Wayne State U. and other organizations depending on freeway. Keep traffic moving smoothly.	
Seattle - I-5 ship Channel	
Complete high quality project while minimizing negative impacts, keep public informed, encourage commute altematives.	3% reduction northbound: 10% reduction southbound to keep traffic moving.
Philadelphia - Schuylkill Freeway	
	Fifty percent reduction in peak hour traffic through closure *of* ramps to local driven.
Chlcago - Kennedy Expressway	
	Decrease traffic by 5,000 vehicles during rush hour (or 20%) through encouraging use of alternatlve routes, alternative travel modes, public information.
Hartford - I-84/I-91	
None specified	
Minneapolis - I-394	
Maintain vehicle throughput by increasing auto occupancy and transit use by traffic and incident management	Maintain LOS C or better In HOV lane, LOS D In mrxed flow.
Miami - I-95	
Maintain reasonable levels of service systemwide: predict capacity deficiencies before they occur; coordinate activities among major construction projects. advise commuters of alternative routes and travel modes. Encourage short-distance local users to keep off I-95 and use alternative routes.	

Wilbur Smrth Associates: March

implement them (from transit and rideshare agencies, for example). Based on these proposals, a cost-effectiveness study was completed to assess the effectiveness of the vanous elements in terms of vehicles removed from the traffic stream or delay savings. Using this methodology, the annual cost of delay was calculated and some elements were dropped early as a result of excessive cost, ' non-viability or funding constraints.

In some cases, a 'shotgun' approach was used after the preliminary analysis step. Many TMP strategies were implemented, but subsequently dropped if they didn't work. In other cases, outside Maintenance of Traffic (MOT) consultants were hired to identify potential TMP solutions following rigorous modeling or background data collection efforts.

Table 84 tabulates the frequency of use of various TMP elements used in the case studies. Since not all details were available in all the studies, the data are not totally precise. However, they do provide a good indication of the relative use of various TMP elements. As shown in Table 84, the TMP elements most often used were brochures, media releases, changeable message signs, tow service, rideshanng, transit service improvements and ramp closures.

Organizational Structure

Case study interviews indicate that effective TMPs require early involvement of a large number of public, private and community groups such as affected DOT departments, governmental agencies, County and municipal jurisdictions, interest groups, media, etc. The range of groups represented on highway reconstruction or rehabilitation project task forces can include:

- State DOT departments (usually traffic operations, rideshanng, construction, structures, public relations, maintenance and environmental);
- Federal Highway Administration (FHWA);
- State police or highway patrol:
- City police/fire departments:
- Construction contractor;
- Traffic management coordinator:
- Public relations consultant:
- Emergency traffic patrol:
- Regional or metropolitan planning organizations;
- Transit operators;
- Regional rideshare organizations:
- Chambers of Commerce:
- Transportation Management Associations:
- Media/traffic reporters;

Table B-4
(Page 1 of 3)
FREQUENCY OF TMP ELEMENTS IN CASE STUDIES
Caltrans Traffic Management Plan Effectiveness Study

Categorization	California	Out of State	Total
A - Public Information			
- Speakers' Bureau	2	2	4
- Brochures and Mailers	6	7	13
- Media Releases	3	7	10
- Public Information Center	3	2	5
- Paid Advertising	1	2	3
- Visual Information (videos, slide shows, etc.	2	2	4
- Telephone Hotline	2	5	7
B - Motorist Information			
- Signing	*	*	*
- Variable Message Signs	6	3	9
- Highway Advisory Radio	5	1	6
C - Incident Management			
- Traffic Police	4	3	7
- Tow Service	4	5	9
- Aerial Surveiilance	2	2	4
- Closed-Circuit TV	6	1	7
- Call Boxes	-0-	-0-	-0-
- Loop Detectors	3	1	4
- Accident Investigation Sites	-0-	1	1

* Not tabulated because of difficulty in differentiating from normal construction practice.

Table 84
(Page 2 of 3)
FREQUENCY OF TMP ELEMENTS IN CASE STUDIES
Caltrans Traffic Management Plan Effectiveness Study

Categorization	California	Out of State	Total
D - Construction Strategies			
- Variable Lanes	*	*	*
- Project Phasing	*	*	*
- Incentive/Disincentive Clauses	2	3	5
- Planned Lane Closures	*	*	*
- Ramp Closures	*	*	*
- Glare/Gawk Screens	2	1	3
- Truck Traffic Restrictions	-0-	1	1
E - Demand Management Strategies			
- Rideshare Incentives	5	4	9
- Rideshare Marketing	-0-	1	1
- Park-and-Ride Lots	3	2	5
- Transit Service Improvements	3	5	8
- Transit Incentives	1	-0-	1
- HOV Lanes	1	1	2
- Parking Management/Pricing	-0-	-0-	-0-
- Variable Work Hours	-0-	2	2

Table B-4
(Page 3 of 3)
FREQUENCY OF TMP ELEMENTS IN CASE STUDIES
Caltrans Traffic Management Plan Effectiveness Study

Categorization	California	Out of State	Total
E - **Alternate Route Strategies**			
- Ramp Metering	2	-0-	2
- Traffic Control Improvements (signals, police, etc.)	3	3	6
- Street Improvements (additional lanes, parking removal, etc.)	3	5	8
- Ramp Closure	2	3	5

* Not tabulated because of difficulty in differentiating from normal construction practices.

Wilbur Smith Associates: March 1993

Table B-5

COST OF TRAFFIC MANAGEMENT PLAN STRATEGIES
Caltrans Traffic Management Plan Effectiveness Study

District/Project Construction Coats	<– Traffic Management Plan Strateiges (Cost In Thousands of Dollars and Percentage of Total) –>												Total TMP Cost ($000)	Percentage of Construction Cost
	Public Information		Motorist Information		Incident Management		Construction Strategies		Demand Management		Alt. Routs Strategies			
	cost	%of TMP	Cost	%of TMP	Cost	%of TMP	Cost	%of TMP	Cost	%of TMP	Cost	%of TMP		
District #3/I-5 American River Crossing *$3 5 million*	$125	11%	$84	8%	$30*	3%	$632	58%	$204	19%	$10	1%	$1,085	31%
District #4/I-660 - $270 million	$6,200	45%	$1,020	8%	$2.760	20%			$2,500	19%	$1,020	8%	$13.500	6 %
District #4/I-60 - $230 million	$1,900	13%	–		$3,600	24%			$7,100	48%	$2,300	15%	$14,900	8%
District #5/Cuesta Grade - $3 million	$50	20%	$50	20%	$50	20%	<-- Other costs not specified -->						$250	6%
Distrcit #7/Ventura Freeway . $20 million	$540	13%	S695	15%	$1,166	25%	$961	20%	$50	1%	$1,218	26%	$4,700	23%
District # 11/Coronado Bridge $3 5 million	In-house		·		·				$357	99%	$3	1%	*$360*	10%
District #12 -I-5/I-405 - I.5/SR-55 $73 million	$600	15%			St.690	42%			$800(1)	20%	$910	23%	$ 4,000	5%
Philadelphia/Schuylkill $223 million	$1,200	10%									$10,000	90%	$12,000	5%
Minneapolis/I-394 $420 million	$1,011	6%							$2,271	13%	$14,539	81%	$17,820	4 %
Miami/I-95 - $400 million	$12,900*	–	$1.832	7%	S6.712	25%	$4,810	18%	$2.236	8%	$11,080	42%	$24,700	7 %
Chicago Kennedy Expressway 1640 million	$1,600	5%	$972*	3%							$27.785	84%	$29,365	4 %

' = Partially funded from other sources

(1) Budgeted cost of program Total amount not spent.

Wilbur Smith Associates May 1933

- State truckers' associations:
- State automobile associations (AAA);
- City/County Board of Supervisors and staff;
- City and County public works and/or traffic engineering departments;
- City police departments:,
- City/County parks and recreation departments; and
- Citizens' interest groups (Farmers' Cooperative, Sierra Club, neighborhood organizations).

Most TMPs have organized Task Forces or oversight committees to provide input or coordinate various elements of each program. These task forces are usually established during the early planning or EIR phases of the project and are often large, some numbering 80 or more members. These task forces serve an important function during the goals and objectives formation process in terms of policy formation and guidance.

The most effective TMPs included regular Task Force meetings (at least monthly during the design phase) in order to involve the entire Task Force in the refinement of the TMP elements, even if specific recommendations or program elements are developed by specialized subcommittees. Experience shows that sign-off by the entire Task Force will expedite cooperation during the TMP implementation stage.

Once the construction project (and TMP) is underway, most Task Forces have selected smaller subcommittees to handle day-today issues, while keeping the overall Task Force apprised of project and TMP progress.

It has also proved beneficial to have those responsible for TMP implementation and coordination housed in the same building or close by those responsible for the highway construction project elements. This dose proximity facilitates regular interaction and coordination among the various team members and insures that problems can be quickly and effectively addressed as they occur.

TMP costs

Table B-5 summarizes costs of TMP strategies for those TMPs where detailed cost information was available. Costs of individual TMP elements (which are tabulated in the case studies contained at the end of this Appendix) were aggregated into the six strategy categories identified in Chapter 2. The percentage of money devoted to each category was tabulated and the total TMP cost was compared to total construction cost.

Although some TMP costs are not totally complete because of in-house effort or where costs were assigned to non-TMP accounts (e.g. police protection), the table shows that, in general, TMP costs range between 5 and 10 percent of construction cost.

Monitoring and Evaluation

Current practices in monitoring a TMP involve a variety of activities and resources. These include the following:

- Daily Traffic Reports are compiled from highway agency and contractor personnel, police and news media ground/air observations, loop detectors and Average Daily Traffic (ADT) counts by portable traffic counters, radar to monitor traffic speeds, closed circuit TV, and commuter vehicles equipped with CB radios, modular phones and two-way radios with a central dispatch.

- Incident Management is monitored on a daily basis by ground/air surveillance. and by highway service patrols and law enforcement agencies. Accident analyses delineate areas along the construction route where a high number of incidents occur.

- Project Task Forces that helped develop the TMP elements often monitor the progress of the program and react to problem areas. Generally each organization is charged with monitoring its function (e.g., *rideshare* agency to monitor Vanpool incentives).

- Project Coordinators interact daily throughout the project with various interested groups: engineers, contractors, DOT personnel, TMP Task Force, public relations, and the media Project Coordinators are able to act quickly when solutions are needed without being encumbered by slow committee processes.

- Community Feedback, using various strategies, provide agencies with valuable information to monitor public attitudes regarding a project. Strategies include: 7-day, 24-hour hotlines; telephone polls taken before, at the completion of each phase, and at the end of the project: and/or news media or direct mail surveys .

- Mode Split Studies help determine increases/decreases in ndeshare activity. Park-and-Ride lots are monitored and public transit boarding counts are taken periodically to measure rideshare activities.

- Field Reconnaissance by project personnel both prior to and during TMP implementation is important to help identify where problems are occurring, tailor the TMP elements accordingly and assess effectiveness.

Based on the case study interviews and review of the literature, certain techniques are more effective than others in monitoring and evaluating the effectiveness of particular TMP strategies. Our findings regarding monitoring techniques and evaluation by TMP strategy are discussed below.

Public Information

All persons contacted agreed that public information is a vital component of all TMPs. Wide dissemination of information about the upcoming project before construction starts helps to reduce traffic volumes through the construction zone and can also build public confidence and understanding of the project.

Public information campaigns should educate the public *on* the purpose (and benefits) of the project, the **scope** and schedule of the work, and alternatives (routes and modes) that are/will be available to the motorist.

Typically, the goals of the public information element are to:

1. Improve public awareness/understanding of project:
2. Modify travel habits: and
3. Reduce traffic congestion during the project.

Attempts to assess the effectiveness of the public information campaign in achieving the first goal, public awareness, usually focus on surveys. A more detailed discussion of Public Information elements and monitoring techniques is presented in Appendix A.

Motorist Information

Signing and highway advisory radio (HAR) are the main elements of this TMP strategy. None of the case studies indicated any monitoring of these individual elements. On a qualitative basis, signing and changeable message signs (CMS) were considered very effective by most TMP planners. These elements are obviously important components of any project where alternate routing is a practical alternative. Highway Advisory Radio (HAR) seemed to get a mixed reaction. Monitoring of signing can be accomplished indirectly by comparing traffic in the construction zone before and after signing, If signing were an independent variable. Monitoring of HAR could be done as part of an overall information survey by surveying motorists and asking how many use the service and what percentage of persons got their information through this medium.

Incident Management

Incident management, whether for TMPs or as a normal part of managing traffic in busy corridors, appears to be an effective part of virtually all TMPs. Virtually all TMP projects opt for a number of incident management elements. The case studies suggest that tow service can be effective if structured correctly, however, aerial surveillance was not used on a frequent basis, primarily because of cost. Police assistance is an important part of every TMP. Although TMPs surveyed generally did not evaluate the effectiveness of incident management techniques, one technique would be to compare incident response time for a TMP area to that in Other areas or to the same section of highway before the TMP. The magnitude and cost of reduced delay (if any) could then be evaluated.

Construction Strategies

Construction strategies are those strategies which can be carried out through the contract documents (plans, specifications and cost estimates) with the contractor during the construction. The objectives of construction strategies are to reduce construction time, to minimize traffic disruptions and to avoid potential safety problems in the construction. Typical elements include:

- Project phasing:
- Ramp closures:
- Reversible lanes:
- Glare/gawk screens: and
- Incentive/disincentive clauses.

Active involvement of the Construction Manager is a key part of the monitoring process. However, it does not appear that monitoring and evaluation of construction strategies is performed very often.

Demand Management

The case studies reveal few instances where individual demand management TMP elements were rigorously evaluated for effectiveness. The methodologies appear to stress an assessment of the number of 'products' produced and activities taking place (i.e., Vanpools formed, total amount of incentives distributed, etc.), and less on the mitigating effects of these 'products'. Table B-6 summarizes methods that have been or could be used to monitor and evaluate demand reduction strategies.

Alternate Route Strategies

Reducing traffic through the construction zone by diverting traffic to alternate routes is a potentially very effective, though somewhat risky strategy, if a feasible alternative route can be found. The key to effective monitoring and evaluation of the alternate route strategy is to monitor traffic volumes, delays and accidents on both the main and the alternate route and to base the evaluation on the operation of the system as a whole.

Overall TMP Evaluation

Many of the TMPs collected data to indicate the overall effectiveness of the TMP to fulfill the goals of the project (generally to ensure that delays were limited). Data collected included:

- Traffic volumes on ramps, mainline and adjacent arterial streets;
- Vehicle occupancy data by vehicle type on freeway and surface streets;
- Travel time, speed, and delay data on freeway and local streets.

Cost-Effectiveness

Generally, DOTs do not use cost-effectiveness considerations to select among broad TMP project alternatives and goals. The usual approach to TMP planning is to set a goat based on traffic flow, not cost/benefit considerations, and then assemble TMP strategies to meet the goal. After establishing traffic-related goals, some DOTs (though not very many) used cost-effectiveness analysis to help select among TMP strategies for achieving the goal. TMP managers sometimes make decrsrons about expanding or

Table B-6

POTENTIAL METHODS OF MONITORING AND EVALUATING DEMAND REDUCTION STRATEGIES(1)
Caltrans Traffic Management PlanEffectiveness Study

TMP Element	Potential Monitoring and Evaluation Measures	Data Collection Methodology	Time Period
Rideshare Incentives	Utilization by current ridesharers	Vehicle Occupancy Counts	Quarterly
		Survey employees at major work centers	
Rideshare Marketing	Freeway-users awareness of TMP and Public Information Program incentives	Phone surveys of freeway commuters	Quarterly
Park-and-Ride Lots	Facility utilization	Periodic car counts during construction period	Monthly
	AVR of facility users	Survey distributed to commuters who use facilities	Quarterly
	Mode utilization (AVR) before use of Park and Ride facilities		
Transit Service Improvements	Ridership levels: Pre-TMP and during project	On-Board Counts	Daily
	Revenue/mile and passenger	Survey of transit riders	Quarterly
	AVR for previous transportation mode		
	Previous route		
Transit Incentives	Utilization by current transit users	Survey of transit riders	Quarterly
High Occupancy Vehicle (HOV) Lanes	Utilization levels: Pre-TMP and during project	Loop detectors, traffic counts	Monthly
	Previous mode and AVR	Telephone surveys	Quarterly
		Written surveys	
Parking Management-/Pricing	Decrease in number of vehrcles using facility	Car counts	Quarterly
	Previous mode and AVR	Survey administered to HOVs	

(1) It is important to use controls In evaluating all TMP strategies. For example, ridesharing may increase because of gas prices. not TMP strategies. Thus, TMP evaluations should track key variables dunng the process.

Wilbur Smith Associates: March 1993

dropping TMP strategies based in part on cost-effectiveness considerations. The literature and case studies reveal some evidence on cost-effectiveness pertaining to at least some of the TMP strategies as follows:

Alternative Modes – Quantitative evaluation of the operation of alternative mode services appears to be the most common form of TMP since ridership is easily quantified, Many evaluations have shown that this may not be a very cost-effective strategy, either in terms of traffic diverted to alternative modes or cost per person-trip. It is important to note that cost per trip for rideshare, transit or feny service and cost per placement in rideshare services are not the desired cost-effectiveness measure. The principal cost factor to be evaluated should be cost of vehicle removed or, better, unit of delay avoided on the reconstructed facility. Once rideshare, transit and ferry services are evaluated on the basis of vehicles removed, some services may cost considerably more than others for the same effect or the cost-effectiveness of one service may be reduced by another.

Towing Services – Towing services probably are highly cost-effective where the volume of accidents or stalls is above average rates or anticipated to grow during the TMP, with an estimated benefit/cost ratio of 17/1. Cost per vehicle serviced ranges from about $50.00 to $1 50.00.2 Tow service can reduce average removal time for shoulder stalls by up to eight minutes. Another benefii of towing services may be reduction in secondary accidents, those coming after and due in part to other accidents or stranded vehicles.

Signal Timing – Another potentially cost-effective strategy is signal retiming on alternative routes to adjust to changing traffic flows. This strategy is estimated to be highly cost-effective, as long as costs per intersection are in the range of $500.3 Provided these savings are *correctly* projected, and assuming no additional annual operation or maintenance costs associated with the improvements, the improvement pay back period is very favorable.

Changeable Message Signs – Wiih annual operating costs (energy, maintenance and repair) for such signs ranging from $13,000 to $22,000 (in 1989 dollars), they may be highly cost-effective if they result in less motorist delay and if accidents involving motorists and/or highway workers are reduced. Unfortunately, neither the literature or case studies quantify delay or accident benefits from CMS.

Contractor Incentives -- Contractor incentives appear potentially cost-effective for large, long term projects. In congested corridors, one year of reductions in delay, vehicle operating costs, accidents and pollution associated with reconstruction may well justify the added contract cost. In another case, the contracting agency saved 70 days of reconstruction for 3450,000. Where major reconstruction takes place, this cost may be more than made up by savings in 70 days of additional delay, vehicle operating costs, pollution and accidents attributable to the reconstruction.

2 **Raymond Kramers, Gerald Ullman. Op. Cit.**

3 **Krammes, Ullman, Op.Cit.**

Cost-Effectiveness Parameters

This section discusses the analytical methods currently being used to calculate cost-effectiveness of TMP elements and related transportation improvements.

Benefit Measures – When DOTs carry out cost-effectiveness analysis of individual TMP elements, the usual indicator of benefit is reduction in delay time costs. Less common is quantification of benefits in terms of reduced vehicle operations, accidents of pollution. Reduction of accidents and associated costs during construction might also be important benefits of some TMP strategies. Thus, strategies which shorten the project time span and accident exposure or temporarily restrict truck traffic might be highly cost-effective. Such strategies include contractor incentives for shorter projects, prefabrication of certain construction elements, truck restrictions, gawk screens and towing services.

Estimating the costs of accidents involves two types of cost. One is the cost of delay imposed by reduced capacity. A spreadsheet is now available which estimates delay under typical accident scenarios.4 Other accident costs include property loss, medical and legal costs and earnings in the case of fatalities and injuries. These costs have been estimated per vehicle miie by type of facility, though the data are old and must be escalated by consumer price indices.5

Analysis Timeframe – TMP cost-effectiveness analysis does not usually take into account the timeframe for costs and benefits by using discount rates. Since the time over which costs and benefits occur varies considerably by TMP element, discounting can be an important approach. While some TMPs last several years, some TMP elements may be in place only a short time or intermittently, such as police control of intersections used to help motonsts adjust their travel patterns. At the other extreme, some TMP project elements result in improvements to local streets (e.g. channelization, signal improvements, etc.) lasting beyond the TMP. Without incorporating the long term benefiis of these improvements by discounting, TMP planners may be underestimating the benefit of these and other permanent improvements.

Furthermore, vehicle delay itself during TMP projects is a dynamic, not static variable. TMP planners might do well to consider a 'worst case' scenario where delay and accident reduction benefits last only for a few months and certain strategies (e.g. towing services and public relations campaigns) are intensified at points throughout the project.

Area of Analysis Another key issue is the geographic area encompassed by the cost-effectiveness analysis. As noted above, many TMPs set delay goals only in terms of the facriity being reconstructed. Yet, traffic diversion may result in delays on other facilities during reconstruction. A cost/benefit perspective encompassing major streets and highways in the corridor is important, especially where it is likely that capacity constraints on the reconstructed facility will be significant.

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4 ***Freeway Delay Calculation Program,*** **Jeff lindley. FHWA, Revised. April 1991.**

5 ***A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements,*** **American Association of State Highway and Transportation Officials, 1977.**

Areas Requiring Improvement

Discussions with DOT staff familiar with the TMP case studies reviewed identified a number of areas needing improvement in planning for an effective TMP.

- Need for better follow-up in the public information process. This will ensure that all Task Force members continue to be involved and are fully informed so there are no surprises when decisions are required.

- Need for dear delineation of lead responsibilities, particularly when a public relations consultant is on board. The messages being released to the public must be consistent not only in tens of the overall TMP strategy for the particular project, but also with standard DOT policy.

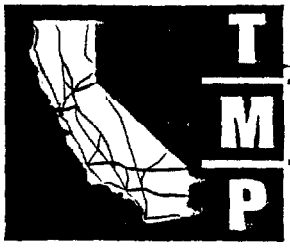
- Need to include construction contractor as a regular member of the TMP Task **Force.** This will ensure that the full committee has ongoing and timely access to accurate and reliable timelines as well as immediate input in terms of community concerns and problems encountered.

- Need to provide TMP coordinators with the necessary facilities to undertake their responsibilities effectively. Some TMP efforts were hampered in their early stages due to lack of adequate telephone, office facilities, or computers, or even relatively simple items such as power strips for hook-ups or a sign on the office door to direct the public.

- Need to develop close working relationship with the media in order to maximze the potential that newsworthy items related to the TMP are publicized. Some coordinators had concerns that despite the large amount of information that was disseminated to the media, little was actually published or broadcast. Many local TV stations and newspapers now have 'Traffic Reporters' or regular traffic or transportation-related feature columns. Close coordination with media staff directly responsible for these features could ensure better coverage.

- Need to address problem of latent demand. One of the functions of the TMP and the staff implementing it should be to continually monitor the effectiveness of the various elements and maximize interest and compliance through regular progress reports and briefings.

- Need to minimize accident potential through use of special pull-out areas for accident investigation, 'gawk' screens, etc.



APPENDIX C

Exhlblt 1

PRELIMINARY PROJECT DESCRIPTION

PROJECT CHARACTERISTICS	DATA	COMMENTS
Project Name:		
Duration of Construction (months)		
Length of Project (miles)		
Number of Major Construction Phases		
Urbanization (urban, suburban or rural)		
Trips (two-way ADT)		
Reduction in Vehicle Capacity (%)		
Viable Alternative Routes (poor or good)		
Expected Delay (vehicle-hour/day from TMP data sheet)		
Public/Media Exposure (low/medium/high)		
Political Sensitivity (low/medium/high)		
Affected Activity Centers/Employers (none/few/many)		
Proportion Trucks (percentage of traffic)		
Busihess Impacts (low/medium/high)		
Potential Increase in Accidents (low/medium/high)		
Special Factors (if any)		

EXHIBIT 2

LEVEL OF EMPHASIS FOR TMP ELEMENTS AND STRATEGIES

Strategy	Element	Level of Emphasis			Overall Emphasis for Strategy
		None	Low	High	
1. Public Information	Speakers Bureau				
	Brochures & Mailers				
	Media Releases				
	Public Information Center				
	Paid Advertising				
	Visuals				
	Telephone Hotline				
2. Motorist Information	Changeable Message Signs				
	Highway Advisory Radio				
3. Incident Management	Construction Zone Enhanced Enforcement Programs (COZEEP)				
	Tow Service				
	Aerial Surveillance				
	Closed-Circuit TV				
	Call-boxes				
	Loop Detectors				
4. Construction Strategies	Reversible and/or HOV Lanes				
	Project Phasing				
	Incentive/Disincentive Clauses				
	Ramp Closures				
	Glare/Gawk Screens				
	Truck Traffic Restrictions				

EXHIBIT 2

LEVEL OF EMPHASIS FOR TMP ELEMENTS AND STRATEGIES

Strategy	Element	Level of Emphasis			Overall Emphasis for Strategy
		None	Low	High	
5. Demand Management	Rideshare Incentives				
	Rideshare Marketing				
	Park and Ride Lots				
	Transit Service Improvements				
	Transit Incentives				
	HOV Lanes				
	Parking Management/Pricing				
	Variable Work Hours				
6. Alternate Route Strategies	Traffic Police				
	Ramp Metenng				
	Traffic Control				
	Street Improvements				
	Ramp Closures				

Exhlbit 3

CALCULATION OF TMP COST
Caltrans Traffic Management Plan Effectiveness Study

Strategy	Emphasls (L/M/H)	Estimated Unit Cost	ADT	ADTxYear	Cost/ . Strategy	Adjusted Cost/Strategy
Public Information						
Motorist Information						
Incident Management						
Construction Strategies						
Demand Management						
Alternate Route Strategy						
				Total		
Construction Cost						
Percent of Construction Cost						
Delay Cost Expected to be Mitigated by TMP (from TMP Data Sheet 2F)						

Remarks:

L/M/H = Low, medium, high.