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16. Abstract

The Clean Air Act Amendments (CAAAs) and the Congestion Mitigation Air Quality (CMAQ) program established in the Intermodal Surface Transportation Efficiency Act (ISTEA) mandate the evaluation of transportation control measure (TCM) emission impacts. These mandates have created an important role for the proper documentation and cost-effective evaluation of TCM emission impacts in the transportation planning process.

There is currently no commonly accepted standard for monitoring or evaluating TCM impacts. This report summarizes a database compiled for this study on the use of TCMs and their documented travel and emission impacts. The entire database is also provided in the appendix of this report. The TCM evaluation methodologies currently available were also reviewed. The methods reviewed include the use of comparative empirical data, network-based models, and sketch-planning tools.

Overall, it was concluded that the current database on TCM impacts is inadequate, and that the different characteristics of TCMs, and the intended (or limited) nature of their impacts, currently require the use of several methods for a complete impact evaluation. In fact, none of the methods reviewed can analyze all the TCMs identified in the CAAAs. It was also concluded that the current state-of-the-practice in TCM impact evaluation must be improved and that the use of sketch-planning tools is currently the most promising approach.

It is recommended that a standardized TCM impact monitoring and data collection program be initiated in Texas and nationwide, and that sketch-planning tools, although currently the most appropriate and cost effective approach to TCM impact evaluation, still need further study and improvements to their evaluation capabilities.

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THE USE AND EVALUATION OF TRANSPORTATION CONTROL MEASURES

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IMPLEMENTATION STATEMENT

This research will assist metropolitan planning organizations and state departments of transportation to effectively evaluate the impacts of transportation control measures (TCMs). The research includes a compilation of data on the use of TCMs within the United States and their travel and emission impacts. A review of the different methods used to evaluate the impact of TCMs was also done. The methods reviewed include the use of comparative empirical data and several types of network-based modeling and sketch-planning tools. It was concluded that none of the methods currently available could analyze the impacts of all TCMs, and that there is a need to increase the amount of data available on TCM impacts in order to verify the reliability of these models, and improve their input default values. Overall, it was found that sketch-planning tools were the most comprehensive and cost effective methods currently available. Finally, it is recommended that a TCM impact monitoring and data collection system be implemented, and that the methods currently available continue to be improved.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation. Additionally, this report is not intended for construction, bidding, or permit purposes. Raymond A. Krammes, P.E. (Registration Number 66413), was the Principal Investigator for the project.

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SUMMARY

The purpose of this report is to document the summary of a database of TCM use and impact information and to review several methods currently available to evaluate the travel and emission impacts of TCMs. The methods evaluated include the use of comparative empirical data, network-based modeling, and sketch-planning tools. Each method was analyzed with respect to its advantages and disadvantages, which TCMs it could evaluate, and the type and availability of the input data it required. In addition, the effect a lack of TCM impact data has on the reliability of each method is discussed. A complete version of the database compiled for this study is included in the appendix of this report.

Overall, a review of the methods currently available found that they all have advantages and disadvantages, and that none of them can evaluate the impacts of all the TCMs identified in the Clean Air Act Amendments (CAAAs) of 1990. It was concluded that more data on the impact of TCMs must be collected in order to improve the reliability of the evaluation methods and verify their results. An increased database would improve the values used as defaults in the TCM evaluation methods currently available.

It is recommended that a data collection and monitoring program be implemented in Texas and nationwide. It is also recommended that research continue on the improvement and standardization of the current state-of-the-practice in TCM impact evaluation. Currently, the use of sketch-planning tools, although their results are considered gross estimations, are considered the most comprehensive and cost effective TCM evaluation methods available.

CHAPTER I

INTRODUCTION

BACKGROUND

The Clean Air Act Amendments (CAAAs) of 1990 and the Congestion Mitigation Air Quality (CMAQ) program established in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 mandate the evaluation of transportation control measure (TCM) emission impacts. These mandates have created an important role for the proper documentation and cost effective evaluation of TCM emission impacts in the transportation planning process.

The CAAAs identify and require the use of TCMs in ozone non-attainment areas classified as severe or extreme, and carbon monoxide non-attainment areas classified as serious, severe, or extreme. Currently, Houston/Galveston is the only area in Texas that meets these requirements. The other non-attainment areas in Texas, Dallas/Fort Worth, Beaumont/Port Arthur, and El Paso, must consider the implementation of TCMs as a contingency measure if the area cannot demonstrate reasonable progress toward the mandates of the CAAAs.

The TCMs that are used in these areas can be applied to both the supply and demand sides of the transportation system to "reduce vehicle trips, vehicle use, vehicle-miles-traveled, vehicle idling, or traffic congestion for the purposes of reducing motor vehicle emissions" (*1*). The TCMs identified and defined by the CAAAs are:

- Trip Reduction Ordinances,
- Employer-Based Transportation Management Programs,
- Work Schedule Changes,
- Areawide Rideshare Incentives,
- Improved Public Transit,
- High Occupancy Vehicle Facilities,
- Traffic Flow Improvements,

- Parking Management,
- Park-and-Ride/Fringe Parking,
- Bicycle and Pedestrian Programs,
- Special Events,
- Vehicle Use Limitations/Restrictions,
- Accelerated Retirement of Vehicles,
- Activity Centers,
- Extended Vehicle Idling, and
- Extreme Low-Temperature Cold Starts.

The CMAQ program encourages the use of TCMs in all non-attainment areas, and requires an evaluation of their emission impacts. The funding of the TCM projects in this program is contingent upon the assessment and documentation of their air quality benefits. Thus, the use of the most appropriate and cost effective method is very important. Texas has been allocated 170 million dollars in CMAQ funds over six years (fiscal years 1992-1997).

The enactment of the CAAAs and the establishment of the CMAQ program has placed a larger emphasis on the accurate and cost effective evaluation of the emission impacts of TCMs. In order to meet the requirements of these mandates many areas will need to monitor growth rates, track vehicle miles traveled (VMT), and forecast the impacts of transportation projects in more precise and quantitative terms than have been necessary in the past (*2*); however, because there is no commonly accepted procedure or methodology for TCM impact evaluation, the metropolitan planning organizations (MPOs) or responsible agency will need to choose the method they feel is the most appropriate and cost-effective. This choice is complicated by the limited capabilities of the evaluation methods currently available, and the lack of data on the characteristics of implemented TCMs and their impacts. This report addresses these issues, and it is intended to assist the MPO or responsible agency with their choice of a TCM evaluation method.

PROBLEM STATEMENT

The contribution of mobile sources to the air quality problem in the United States is being addressed by the CAAAs and ISTEA (CMAQ Program). These laws require and/or encourage the use of TCMs, and they require the documentation of their impacts. Therefore, to comply with the requirements of these laws and make sound TCM investment decisions, the estimation and evaluation of TCM travel and emission impacts is a necessity. There are three basic methods for this type of analysis: empirical data comparison, network-based modeling (simulation and travel demand models), and sketch-planning tools. There is a need to evaluate their capabilities, and the reliability of their results. In most cases, the lack of data on actual TCM impacts forces these methods to rely on unverified default values for input, and to limit the reliability of their impact assessment and evaluation abilities. Therefore, there is also a need to implement a monitoring and data collection program on TCM impacts.

OBJECTIVES/SCOPE

This study had several objectives. The first objective was to evaluate and assess the structure and capabilities of several TCM evaluation methods currently available. This evaluation included an assessment of their adequacy and ability to estimate TCM travel and emission impacts, discussions of which TCMs they could evaluate, and the type and availability of the input they required. Another objective of the study was to discuss the reliability of the results produced by each analysis method and identify any data they may need to improve that reliability. A third objective of the study was to provide an initial database of TCM use and their travel and emission impacts by location and type. The need for this information, and its continual update, was also discussed. Finally, the most encompassing and cost effective TCM evaluation method was identified, and recommended for continued use, improvement, and further investigation.

The scope of this study was limited to the evaluation of what was considered an adequate representation of the TCM evaluation methods currently available and a summary of the TCM impact data that has been published. Because there is currently no universally accepted, or universally applicable, TCM evaluation procedure, this report evaluates three different methods. The methods evaluated include the use of comparative empirical data, network-based traffic simulation and travel demand models, and sketch-planning tools such as the Travel Demand Management (TDM) Model, TCM Tools, and the Systems Applications International (SAI) method. Each of these TCM evaluation techniques is discussed and qualitatively evaluated with respect to its usefulness.

This report is organized into four chapters. The first chapter provides a general overview of why the use of TCMs and the evaluation of their impacts is increasingly important. Chapter II includes a discussion of the information currently available about TCM use and their impacts, and Chapter III is an evaluation of the TCM evaluation methods previously identified (i.e., empirical data comparison, network-based modeling, and sketch-planning tools). Chapter IV presents conclusions and recommendations based on the results of the evaluation.

CHAPTER II

CURRENT TCM USE AND IMPACTS

The complete documentation of the characteristics of implemented TCMs and their travel/emission impacts is needed for several reasons. First, a comprehensive database provides the TCM analyst with better and more applicable data to use as default values in many of the TCM evaluation methods currently available. The reliance of these methods on unverified default values limits their ability to estimate and evaluate the actual effectiveness of an implemented TCM. Second, a database on TCM impacts improves the ability of an analyst to measure the validity of the results produced by the TCM evaluation methods. The information in the database gives the analyst a better perspective on the magnitude of an expected impact, which allows the identification of an unreasonable analysis result. The perspective of the agencies responsible for the allocation of TCM funding will also be improved, and this will allow them to make more cost effective decisions. Finally, the information on the impacts of TCMs which is collected from one location can also be used as a tool to predict the possible impacts of implemented TCMs at similar sites. This type of TCM evaluation method, therefore, could be improved with an expanded TCM information and impact database. Overall, all of the advantages and uses explained above indicate that the continuous monitoring and collection of TCM information is a necessary component to their adequate evaluation.

DATABASE SUMMARY

A portion of this study included the compilation of details on TCM programs and their travel and emission impacts. The database includes information on each of the TCMs identified by the CAAAs. Overall, it consists of the three tables (A-I, A-II, and A-III) and the typology listing included in the appendix. The first table (A-I) identifies the TCMs implemented by city and population. The second table (A-II) segments each of the TCMs into sub-categories (identified in the typology) and lists the type of program by its location. The third table (A-III) presents the details of each TCM program. This chapter summarizes the database contained in the appendix of this report.

TCM Usage

Table 1 is a summary of the TCMs implemented within designated Metropolitan Statistical Areas (MSAs), and several cities with no such statistical designation (Non-MSAs). The MSAs are segmented by population, and the TCMs included are the measures identified in the CAAAs. Several patterns in TCM use can be discerned from an analysis of this table. For example, a large proportion of the TCMs whose implementation has been documented is in MSAs with large populations. This pattern is not unexpected because these areas have the most significant congestion and air quality problems and may have implemented TCMs before the CAAAs required them. The initial reason for the implementation of the TCMs in the area may have been to combat traffic congestion rather than to improve air quality. These two goals are not mutually exclusive, however, because the reduction in congestion can lead to improved air quality.

Table 1 indicates that the four TCMs implemented most often are traffic flow improvements, high occupancy vehicle (HOV) lanes, employer-based transportation management, and vehicle use limitation/restrictions. This pattern is not surprising because traffic flow improvements have a long history of use and their impacts are easily measurable. In addition, traffic flow improvements were one of the most prevalent type of projects (36 percent of the program obligations) funded through the CMAQ program in fiscal year 1992 (*3*). In spite of their normally large construction costs, HOV lanes are the second most implemented TCM. As with traffic flow improvements, however, many of these projects were implemented for reasons other than air quality improvement, and there is significant experience with the measurement of their impacts.

Employer-based transportation management programs are the third most frequently used TCM. These programs can include many different actions and be voluntarily implemented or mandated. Their situation is also somewhat unique due to additional legislative requirements on their use. In fact, the CAAAs require severe (e.g., Houston/Galveston) or extreme ozone non-attainment areas to implement employer-based trip reduction programs (known as "Employer Trip Reduction" (ETR) and "Employee Commute Options" (ECO) programs). Participation in these programs is mandatory for employers in these areas with more than 100 employees. Many employer-based

TABLE 1. TCM USE BY MSA AND NON-MSA*

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Programs	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
TRANSPORTATION CONTROL MEASURES USED IN MSAs GREATER THAN 1,000,000 POPULATION																
Phoenix, AZ	X	X	X	X		X	X									
Los Angeles - Anaheim - Riverside, CA	X	X	X	X	X	X	X	X	X		X	X	X		X	
Sacramento, CA	X			X			X	X							X	
San Diego, CA						X	X									
S. F. - Oakland - San Jose, CA	X	X	X	X		X	X	X				X				
Denver - Boulder, CO	X	X	X		X	X	X					X				
Hartford - New Britain - Middletown, CT		X		X				X	X							
Washington, DC - MD - VA	X	X	X	X			X	X				X				
Miami - Fort Lauderdale, FL						X						X				
Orlando, FL						X		X			X					
Atlanta, GA						X	X		X							
Chicago - Gary - Lake County, IL - IN - WI		X	X			X	X	X	X							
Indianapolis, IN						X										
Boston - Lawrence - Salem, MA - NH			X			X	X	X	X		X	X				
Baltimore, MD						X		X								
Detroit - Ann Arbor, MI							X									
Minneapolis - St. Paul, MN - WI		X	X			X	X	X	X			X				
Kansas City, MO - KS		X														
St. Louis, MO									X							
New York - Northern New Jersey - Long Island, NY - NJ - CT		X	X	X		X	X					X				
Cincinnati - Hamilton, OH - KY - IN							X									
Cleveland - Akron - Lorain, OH									X							
Columbus, OH							X									
Portland - Vancouver, OR - WA				X	X	X	X	X				X				
Philadelphia - Wilmington - Trenton, PA - NJ - DE - MD						X	X		X			X				
Pittsburgh - Beaver Valley, PA						X	X									
Providence - Pawtucket - Fall River, RI - MA							X					X				
Dallas - Fort Worth, TX		X				X	X									
Houston - Galveston - Brazoria, TX		X	X			X	X		X							
San Antonio, TX						X	X	X	X							
Norfolk - Virginia Beach - Newport News, VA					X		X									
Seattle - Tacoma, WA	X	X	X	X		X	X	X	X	X	X					
Milwaukee - Racine, WI							X		X							

*Continued on the Next Page

TABLE 1 (CONT'D). TCM USE BY MSA AND NON-MSA

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Programs	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
TRANSPORTATION CONTROL MEASURES USED IN MSAs WITH POPULATION FROM 250,000 to 999,999																
Tucson, AZ					X		X			X						
Oxnard - Ventura, CA	X	X														
Melbourne - Titusville - Palm Bay, FL					X											
Honolulu, HI			X			X	X	X				X				
Des Moines, IA							X									
Ft. Wayne, IN							X									
Louisville, KY					X	X	X					X				
Albuquerque, NM							X									
Albany - Schenectady - Troy, NY			X							X						
Syracuse, NY							X									
Toledo, OH									X							
Eugene - Springfield, OR								X								
Allentown - Bethlehem - Easton, PA - NJ												X				
Harrisburg - Lebanon - Carlisle, PA						X										
San Juan, PR						X										
Charleston, SC							X									
Knoxville, TN			X								X					
Memphis, TN - AR - MS												X				
Austin, TX							X									
Beaumont - Port Arthur, TX																
El Paso, TX																
Madison, WI			X			X	X	X		X		X				
TRANSPORTATION CONTROL MEASURES USED IN MSAs WITH POPULATION FROM 100,000 to 249,999																
Gainesville, FL							X									
Lake Charles, LA							X									
Kalamazoo, MI												X				
Sioux Falls, SD							X									
Amarillo, TX		X														
TRANSPORTATION CONTROL MEASURES USED IN NON-MSAs																
Fairbanks North Star Borough, AK																X
El Segundo, CA		X	X													
San Ramon, CA		X														
Ottawa-Carleton, Canada						X										
Golden , CO		X														
Idaho Springs, CO							X									
Danville, IL												X				
Atchison, KS												X				
Salisbury, MD												X				
Maplewood, MN		X														
Minnetonka, MN		X														
Ft. Lee, NJ						X										
Nutley, NJ		X														
Princeton Area, NJ		X														
Corning, NY		X														
Tarrytown, NY							X									
Kent, OH					X											
Lehigh, PA							X									
Brattleboro, VT		X														

transportation management programs have already been implemented and evaluated. Inclusion of all the employers with programs within the database in this report was impossible although a significant number have been included. Therefore, the use of this TCM is most likely higher than indicated. A good reference for additional employer-based transportation management program examples is a report prepared by the COMSIS Corporation and the Institute of Transportation Engineers (*4*).

The use of vehicle use limitation/restriction programs is the fourth most frequently used TCM. These programs too are often motivated not only by air quality but also by other community goals such as downtown revitalization and aesthetics. Many of the projects may cover only a small number of city blocks and have only a limited effect on the entire MSA. In addition, Tables 2 and 3 show that the travel and emissions impacts of these programs are rarely measured. Thus, it would appear that many metropolitan areas are implementing this type of TCM without knowing the overall impacts.

The least used TCMs, and characteristically the least familiar to the Metropolitan Planning Organization (MPO) or other implementing agency, are activity center design measures, extreme temperature cold starts, accelerated retirement of vehicles, and extended vehicle idling. These TCMs are either new, poorly defined, hard to differentiate as a TCM, considered to have a limited impact on travel and emissions, or are applicable in only particular areas of the United States.

Documented Travel Impacts of TCMs

Table 2 is a summary of which TCM programs have had their travel impact information measured or estimated. The entries in Table 2 are categorized exactly like Table 1. A comparison of these two tables clearly shows that the patterns for the collection of TCM impact data is similar to the pattern of TCM implementation. The most travel impact data have been collected for the TCMs most often implemented. These are, as previously discussed, the type of TCMs that have been used in the past, are the most understood, and are often implemented for reasons other than improving air quality. The one exception to the similarity in the patterns is that vehicle use limitation/restriction TCMs are implemented in many areas, but their travel impacts are rarely measured. On the other end of the spectrum,

TABLE 2. TRAVEL IMPACT DATA AVAILABLE BY MSA AND NON-MSA*

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Programs	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
TRANSPORTATION CONTROL MEASURES USED IN MSAs GREATER THAN 1,000,000 POPULATION																
Phoenix, AZ	X	X		X												
Los Angeles - Anaheim - Riverside, CA	X	X	X	X	X	X	X	X		X		X	X			
Sacramento, CA				X			X									
San Diego, CA						X	X									
S. F. - Oakland - San Jose, CA	X	X	X	X	X	X	X	X		X						
Denver - Boulder, CO					X	X	X									
Hartford - New Britain - Middletown, CT		X		X												
Washington, DC - MD - VA	X	X				X	X	X				X				
Miami - Fort Lauderdale, FL						X						X				
Orlando, FL						X										
Atlanta, GA							X		X							
Chicago - Gary - Lake County, IL - IN - WI						X	X									
Indianapolis, IN																
Boston - Lawrence - Salem, MA - NH						X	X									
Baltimore, MD						X										
Detroit - Ann Arbor, MI							X									
Minneapolis - St. Paul, MN - WI		X				X	X		X							
Kansas City, MO - KS		X														
St. Louis, MO																
New York - Northern New Jersey - Long Island, NY - NJ - CT		X				X	X									
Cincinnati - Hamilton, OH - KY - IN																
Cleveland - Akron - Lorain, OH																
Columbus, OH																
Portland - Vancouver, OR - WA				X		X	X	X								
Philadelphia - Wilmington - Trenton, PA - NJ - DE - MD																
Pittsburgh - Beaver Valley, PA						X										
Providence - Pawtucket - Fall River, RI - MA							X									
Dallas - Fort. Worth, TX						X	X									
Houston - Galveston - Brazoria, TX		X				X	X									
San Antonio, TX		X														
Norfolk - Virginia Beach - Newport News, VA																
Seattle - Tacoma, WA		X			X	X	X	X								
Milwaukee - Racine, WI							X									

*Continued on the Next Page

TABLE 2 (CONT'D). TRAVEL IMPACT DATA AVAILABLE BY MSA AND NON-MSA

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Programs	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
TRANSPORTATION CONTROL MEASURES USED IN MSAs WITH POPULATION FROM 250,000 to 999,999																
Tucson, AZ					X					X						
Oxnard - Ventura, CA		X														
Melbourne - Titusville - Palm Bay, FL																
Honolulu, HI			X			X	X									
Des Moines, IA							X									
Ft. Wayne, IN							X									
Louisville, KY						X										
Albuquerque, NM																
Albany - Schenectady - Troy, NY																
Syracuse, NY							X									
Toledo, OH																
Eugene - Springfield, OR								X								
Allentown - Bethlehem - Easton, PA - NJ																
Harrisburg - Lebanon - Carlisle, PA																
San Juan, PR						X										
Charleston, SC							X									
Knoxville, TN		X									X					
Memphis, TN - AR - MS																
Austin, TX							X									
Beaumont - Port Arthur, TX																
El Paso, TX																
Madison, WI								X								
TRANSPORTATION CONTROL MEASURES USED IN MSAs WITH POPULATION FROM 100,000 to 249,999																
Gainesville, FL							X									
Lake Charles, LA																
Kalamazoo, MI												X				
Sioux Falls, SD							X									
Amarillo, TX																
TRANSPORTATION CONTROL MEASURES USED IN NON-MSAs																
Fairbanks North Star Borough , AK																
El Segundo, CA																
San Ramon, CA		X														
Ottawa-Carleton, Canada						X										
Golden , CO		X														
Idaho Springs, CO																
Danville, IL																
Atchison, KS																
Salisbury, MD																
Maplewood, MN		X														
Minnetonka, MN		X														
Ft. Lee, NJ																
Nutley, NJ																
Princeton Area, NJ																
Corning, NY																
Tarrytown, NY																
Kent, OH					X											
Lehigh, PA																
Brattleboro, VT																

there are TCMs that have not been implemented as much, but the data on their travel impacts are collected on a more frequent basis. These include TCMs such as improved public transit, areawide rideshare incentives, bicycle and pedestrian programs, and trip reduction ordinances.

Documented Emission Impacts of TCMs

Table 3 is a summary of which TCMs have had their emission impacts measured or estimated. Although both the CAAAs and the CMAQ program require the measurement of TCM air quality impacts, Table 3 suggests that there is virtually no documented data on the emission impacts of implemented TCMs. This fact is not surprising given the methods currently available for doing this type of analysis and the limited experience with them. In addition, the accurate measurement of the limited emission impacts of some TCMs is difficult if not impossible, and many of the current TCM programs may not have existed for a long enough time to measure their impact. Finally, the implementing agency may not have the capability or the funding needed to measure these emission impacts. Of course, with the new legislation, the practice of not measuring or estimating these impacts will need to change.

The TCMs that have the most emission impact information available are similar to the most implemented TCMs (Table 1) and the TCMs that have had their travel impacts measured the most (Table 2). This pattern is not unexpected because emission impacts are often derived from travel/traffic impact estimates. The two TCMs with the most emission impact data available are HOV lanes and traffic flow improvements. The other TCMs that have a limited amount of emission impact data available include areawide rideshare incentives, improved public transit, parking management, vehicle use limitations/restrictions, and accelerated retirement of vehicles. Practically all of this data has been collected on TCM programs in the most populated MSAs. None of the other TCMs listed have any type of emissions impact data available.

SUMMARY

The documentation of TCM usage and travel/emission impacts has become increasingly important in the past several years. The chapter has discussed the current state of this documentation and has led to several conclusions. First, the size of the database must

TABLE 3. EMISSION IMPACT DATA AVAILABLE BY MSA AND NON-MSA*

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Programs	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
TRANSPORTATION CONTROL MEASURES USED IN MSAs GREATER THAN 1,000,000 POPULATION																
Phoenix, AZ												X				
Los Angeles - Anaheim - Riverside, CA				X		X	X						X			
Sacramento, CA																
San Diego, CA						X										
S. F. - Oakland - San Jose, CA																
Denver - Boulder, CO							X					X				
Hartford - New Britian - Middletown, CT																
Washington, DC - MD - VA						X										
Miami - Fort Lauderdale, FL																
Orlando, FL																
Atlanta, GA																
Chicago - Gary - Lake County, IL - IN - WI																
Indianapolis, IN																
Boston - Lawrence - Salem, MA - NH							X	X								
Baltimore, MD																
Detroit - Ann Arbor, MI																
Minneapolis - St. Paul, MN - WI																
Kansas City, MO - KS																
St. Louis, MO																
New York - Northern New Jersey - Long Island, NY - NJ - CT							X									
Cincinnati - Hamilton, OH - KY - IN																
Cleveland - Akron - Lorain, OH																
Columbus, OH																
Portland - Vancouver, OR - WA						X		X								
Philadelphia - Wilmington - Trenton, PA - NJ - DE - MD																
Pittsburgh - Beaver Valley, PA																
Providence - Pawtucket - Fall River, RI - MA																
Dallas - Fort. Worth, TX																
Houston - Galveston - Brazoria, TX																
San Antonio, TX																
Norfolk - Virginia Beach - Newport News, VA																
Seattle - Tacoma, WA																
Milwaukee - Racine, WI																

*Continued on the Next Page

TABLE 3 (CONT'D). EMISSION IMPACT DATA AVAILABLE BY MSA AND NON-MSA

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Programs	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low Temperature Cold Starts
TRANSPORTATION CONTROL MEASURES USED IN MSAs WITH POPULATION FROM 250,000 to 999,999																
Tucson, AZ					X											
Oxnard - Ventura, CA																
Melbourne - Titusville - Palm Bay, FL																
Honolulu, HI																
Des Moines, IA																
Ft. Wayne, IN																
Louisville, KY																
Albuquerque, NM																
Albany - Schenectady - Troy, NY																
Syracuse, NY																
Toledo, OH																
Eugene - Springfield, OR																
Allentown - Bethlehem - Easton, PA - NJ																
Harrisburg - Lebanon - Carlisle, PA																
San Juan, PR																
Charleston, SC																
Knoxville, TN																
Memphis, TN - AR - MS																
Austin, TX																
Beaumont - Port Authur, TX																
El Paso, TX																
Madison, WI																
TRANSPORTATION CONTROL MEASURES USED IN MSAs WITH POPULATION FROM 100,000 to 249,999																
Gainesville, FL																
Lake Charles, LA																
Kalamazoo, MI																
Sioux Falls, SD																
Amarillo, TX																
TRANSPORTATION CONTROL MEASURES USED IN NON-MSAs																
Fairbanks North Star Borough , AK																
El Segundo, CA																
San Ramon, CA																
Ottawa-Carleton, Canada																
Golden , CO																
Idaho Springs, CO																
Danville, IL																
Atchison, KS																
Salisbury, MD																
Maplewood, MN																
Minnetonka, MN																
Ft. Lee, NJ																
Nutley, NJ																
Princeton Area, NJ																
Corning, NY																
Tarrytown, NY																
Kent, OH																
Lehigh, PA																
Brattleboro, VT																

be increased. More data needs to be collected on the use of TCMs and their impacts. Also, the type of data and method used to collect it need to be standardized to avoid confusion. Currently, the type of impact data documented is different depending on where it is collected. A larger database with standardized data collection methods would improve the accuracy and reliability of the TCM evaluation methods discussed in the next chapter. Second, although the use of TCMs is usually documented, the measurement or estimation of their travel and emission impacts usually is not. While there are some TCMs that have had their travel impacts measured quite extensively, there are others that have never had their impacts documented. This virtual nonexistence of TCM impact data is even more pronounced with respect to emissions. The amount of information on TCM emission impacts must be increased because the evaluation and documentation of this data are required by both the CAAAs and the CMAQ program.

CHAPTER III

REVIEW OF TCM EVALUATION METHODS

The enactment of the CAAAs and the establishment of the CMAQ program places new burdens on MPOs to accurately evaluate the emission impacts of TCMs. The CAAAs contain detailed requirements for the estimation of these impacts and the evaluation of a TCM's conformity with the State Implementation Plan (SIP) for attaining air quality standards. TCMs conform with the SIP if they do not lead to additional violations of the National Ambient Air Quality Standards, make existing violations worse, or interfere with the attainment of the air quality standards. The MPOs in ozone non-attainment areas rated severe or worse and in carbon monoxide non-attainment areas rated serious or worse are required to include TCMs in their SIP, estimate their impacts, and evaluate their conformance. The only area in Texas that meets either of these criteria is Houston/Galveston. The other areas that have been identified as non-attainment in Texas are Dallas/Fort Worth, El Paso, and Beaumont/Port Arthur. These areas must evaluate TCM impacts only as a contingency measure if they are unable to demonstrate reasonable progress toward air quality attainment.

The CMAQ program encourages the use of TCMs in all non-attainment areas, and requires the estimation, evaluation, and documentation of their emission impacts. In fact, the funding of these projects, and thus their implementation, is contingent upon the assessment of their air quality benefits. The requirements of the CMAQ program and the CAAAs, therefore, make it essential that the TCM analyst make an informed decision about which impact analysis method to use. This chapter discusses the methods currently available.

Currently, there is no universally accepted method of TCM evaluation used to meet the requirements of the CAAAs and the CMAQ program. The methodologies that are available vary from simple manual computations to complex modeling practices. A review of these methods has been done to assist the analyst with choosing the correct one to use. The three methods reviewed include the use of comparative empirical data, network-based modeling, and sketch-planning tools. The structure and approach of each method is evaluated with respect to their adequacy and ability to estimate TCM travel and emission impacts, which TCMs they can evaluate, and the type and availability of the data they require for analysis.

COMPARATIVE EMPIRICAL DATA

The use of empirical data from the observed performance of TCMs implemented in similar locations has been suggested by *A Manual of Transportation-Air Quality Modeling for Metropolitan Planning Organizations* (*2*) as one method of impact analysis. In fact, it is considered one of the simplest ways to estimate the impacts of a planned TCM. This method uses a TCM experience and impact database, such as the one included in the appendix of this report, by applying the observed or measured percentage change in travel or emission activity to a local program. However, the size of the market impacted by the measure must be separately estimated, and the limited value of this method as a TCM evaluation tool must be kept in perspective.

The major advantage of applying impact data from another area to a local program is its simplicity. However, this is also its major disadvantage. Care must be taken when using this procedure for two reasons. First, the area from which the empirical data is taken must be similar enough to the local area to expect comparable results upon the implementation of the TCM. Second, the accuracy and reliability of the data that is used should be scrutinized and validated. This must be done because TCM impacts are difficult or impossible to measure directly, and there are several ways to collect or estimate the data.

In addition to the concerns described above, there are two other disadvantages to using this method of TCM evaluation. The first disadvantage is the current lack of data on TCM impacts. However, the continual update of the database included with this report should eliminate this problem. The other disadvantage of using this method is that neither the air quality agencies nor the environmental watchdog groups are likely to accept a TCM evaluation based solely on a comparison with experiences in another region. The success or failure of a TCM program depends on many local factors: area size, demographics, available infrastructure, and land use patterns. Therefore, the MPOs and other responsible agencies will most likely require or adopt a more rigorous method to evaluate TCM impacts. The other methods currently available include the extension of existing traffic and transportation analysis models (e.g., traffic simulation models and travel demand models), and the use of sketch-planning tools (e.g., TDM Model, TCM Tools, and SAI methods). The adequacy of these methods to evaluate TCM impacts is discussed in the following sections of this report.

NETWORK-BASED MODELING

The impact of TCMs on a transportation system is complex and often difficult to analyze. Network-based modeling is generally preferred over other methods involving manual calculations or spreadsheet analysis when the number and complexity of TCMs to be evaluated is large (*5*). Network-based models include traffic simulation and travel demand models. These models, unlike spreadsheet models, are typically very large programs consisting of complex algorithms and requiring considerable expertise to use effectively.

Several network-based modeling tools available to transportation professionals for traffic simulation and demand forecasting have been recommended as tools for TCM analysis (*2*). The use of these tools can be challenging because their design does not typically include features that enable a straight forward study of TCM impacts.

TCMs primarily directed at improving the traffic flow conditions can be reasonably evaluated using traffic simulation models including CORFLO, FRESIM (the successor of INTRAS), FREQ, NETSIM, PASSER II and III, and TRANSYT-7F. Each of the simulation models has different capabilities and is useful for evaluating different measures.

The TCMs that primarily modify demand dimensions like trip frequency, mode choice, destination choice, and route choice are the most difficult to evaluate. The traditional travel demand modeling process is a frequently suggested method for evaluating these TCMs (*2*, *5*). However, there are several limitations in the travel demand modeling process that render the task of evaluating TCM effectiveness very difficult.

TCMs directed at controlling emissions from off-highway vehicles, including reducing extended vehicle idling at drive-through restaurants, cannot be readily modeled with either the travel demand or traffic simulation models. However, queuing models used for the design of these facilities may be used to evaluate this class of TCMs.

In the following sections, the strengths and weaknesses of simulation models and the travel demand modeling process with respect to the evaluation of TCM effectiveness are discussed in more detail.

Traffic Simulation Models

Traffic simulation models are either microscopic or macroscopic. Microscopic simulation models track individual vehicle movement using car-following logic. In contrast, macroscopic simulation models track the flow of the traffic stream rather than individual vehicles; they estimate traffic flow variables including speed, travel time, and delay in a network for the given traffic control and demand conditions. There are many simulation models available to analyze the different types of facilities and control systems in existence.

There are several advantages that traffic simulation models provide over other types of tools used for TCM analysis. When properly calibrated, traffic simulation models are generally able to provide better estimates of traffic flow conditions than travel demand models. The traffic flow conditions (i.e., vehicle speed) produced as the principal output of calibrated traffic simulation models are generally comparable to actual field measurements. On the other hand, the vehicle speeds produced by travel demand models are estimated as an intermediate step in predicting traffic demand, and those vehicle speed estimates are not intended for direct use or to necessarily reflect actual conditions. The speeds estimated by travel demand models represent an average speed over the analysis period (typically 24 hours) which is not very meaningful.

Traffic simulation models also have the advantage of being capable of explicitly representing most traffic control devices (including traffic signals, stop signs, and yield signs) without having to employ surrogate measures to account for the controls as in travel demand models. For example, a change in the signal timing must be represented by adjusting the travel time or capacity in a travel demand model. However, it should be noted that all traffic simulation models are not capable of simulating all traffic control devices. The choice of which traffic simulation model to use in the evaluation of a particular TCM, therefore, is dependant upon what traffic control devices it may involve.

Another advantage of traffic simulation models is that they can represent the road network in more detail than a travel demand model. This facilitates the simulation of the interaction of traffic on various classes of facilities like arterials and freeways.

The total emissions from a vehicle trip is a function of several factors including the speed profile of the vehicle and idling time. Therefore, better estimates of the speed profile and idling time of the vehicle would result in better estimates of emissions. Many microscopic simulation models are capable of generating such information. It should be noted that trip end emissions, cold start emissions, and diurnal emissions also contribute considerably to the overall vehicular emissions. These components of vehicular emissions cannot be readily estimated using a simulation model.

Despite these advantages, simulation models are not an obvious choice for TCM analysis because of several limiting factors. Table 4 shows the measures most frequently undertaken to improve traffic flow and the simulation tools capable of analyzing them. It can be seen from the table that a variety of simulation tools would have to be used to evaluate all the measures. Such analysis would require considerable time and other resources. For example, PASSER II is designed to optimize and evaluate arterial signal timing, whereas PASSER III is designed to optimize and evaluate diamond interchanges. Similarly, FRESIM is designed for simulating freeways and the adjacent frontage roads only, whereas CORFLO can simulate freeways and all arterials including frontage roads.

Simulation models are not responsive to shifts in travel demand. These models use traffic volumes provided by the analyst to evaluate TCMs, but over a period of time the demand patterns of these traffic volumes will change because of the traffic flow improvements produced by the implementation of the TCM(s). Traffic simulation models, therefore, do not provide the ability to evaluate both the spatial and temporal traffic demand impacts necessary to completely understand the air quality improvement potential of a TCM.

Some of the simulation models are not equipped with an emissions estimation capability, thus limiting their application for evaluating the emissions benefits of TCMs. For example, the freeway component of CORFLO (called FREFLO), PASSER II, PASSER III, and TRANSYT-7F cannot estimate emissions. In the models that are capable of estimating emissions, the emissions data used is an area of concern. The data are often very old, as in the arterial component of CORFLO (called NETFLO), and are usually not specifically applicable

TABLE 4. TCMs ANALYZED BY TRAFFIC SIMULATION MODELS (*6, 7, 8, 9, 10, 11*)

Control Measure	CORFLO	INTRAS	FREQ	NETSIM	PASSER II	PASSER III	TRANSYT-7F
Intersection Signal Improvements	No	No	No	Yes	Yes	Diamond	Yes
Arterial Signal Improvements	Yes	No	No	Yes	Yes	No	Yes
Area Signal Improvements	Yes	No	No	Yes	No	No	Yes
Eliminate Unnecessary Controls	Corridor	No	No	Arterial	No	No	No
Restriping to Increase Lanes	Corridor	Freeway	Freeway	Arterial	Arterial	No	Arterial
One Way Streets	Yes	No	No	Yes	Yes	No	Yes
Turn Lane Installation	Corridor	Freeway	Freeway	Arterial	Arterial	Diamond	Arterial
Turning Movement Restrictions	Yes	No	No	Yes	Yes	Diamond	Yes
Reversible Traffic Lanes	Corridor	Freeway	Freeway	Arterial	Arterial	No	Arterial
Intersection Widening	No	No	No	No	No	No	No
Road Widening	Corridor	Freeway	Freeway	Arterial	Arterial	Diamond	Arterial
Improved Traffic Control Devices	Corridor	Freeway	Freeway	Arterial	Signals	Signals	Signals
Grade Separation	Yes	No	No	Yes	No	No	Yes
Incident Detection and Management Systems	No	Yes	No	No	No	No	No
Lane Use Restr. by Vehicle Type	No	Freeway	No	Arterial	No	No	No
Freeway Diversion and Advisory Signing	No	No	No	No	No	No	No
Ramp Metering	No	Yes	Yes	No	No	No	No
Integrated Surveillance and Control	No	No	No	No	No	No	No
Parking Restriction	Yes	No	No	Yes	Yes	No	Yes
Motorist Advisory	No	No	No	No	No	No	No
Peak Period Pricing	No	No	No	No	No	No	No

to the characteristics of the region, or VMT and vehicle fleet mixtures. This data, therefore, may not be acceptable to the United States Environmental Protection Agency (EPA) for evaluation of the TCMs in the SIP.

In network-based simulation models, including CORFLO, FRESIM, and NETSIM, a considerable amount of calibration effort is required to obtain reasonable estimates of traffic variables and thus emissions. For example, FRESIM has nearly 20 embedded parameters that can be changed at the user's option to calibrate the model to local conditions. It is well known that calibration is among the more difficult tasks in any modeling effort. This is a significant drawback in the application of these models for TCM evaluation.

It is clear from the previous discussion that although simulation models may be the preferred tools for evaluating TCMs involving traffic flow improvements, they also have several limitations. Moreover, since simulation models are not responsive to shifts in demand, they are not suitable for evaluating the many TCMs aimed at modifying demand dimensions like trip frequency, mode choice, route choice, and destination choice. Travel demand models may provide an alternative network-based modeling tool for evaluating these TCMs.

Travel Demand Models

The purpose of travel demand models is to infer from the spatial distribution of activities the amount, type and location of travel that a population will undertake. A typical urban transportation modeling system is used to predict, based on the demographic and economic data, the number of trips made within a region by type (work, non-work, etc.) and time of day, the mode of travel used to make these trips, and the routes taken through the transportation network by these trips. Many metropolitan areas develop these models for use in regional planning.

Travel demand models are used by many metropolitan areas to estimate VMT and overall growth in vehicular travel. Such estimates are used to prepare the mobile source emission inventories required in the SIP. The use of travel demand models by a MPO for TCM evaluation would obviate the need for any additional effort on their part except for the regional modeling necessary to estimate their mobile emission impacts.

The advantage to using travel demand models is that they can analyze the impact of most TCMs. For instance, TCMs involving transit extensions, HOV lanes, parking cost changes, and toll changes can generally be adequately represented. However, many other TCMs including bicycle facilities, rideshare programs, and traffic flow improvements cannot be adequately represented in travel demand models due to a lack of appropriate descriptive variables. Such TCMs can be represented through surrogate variables. Table 5 shows the recommended strategies used to represent some TCMs in travel demand models (*5*).

TABLE 5. STRATEGIES FOR REPRESENTING TCMs IN TRAVEL DEMAND MODELS (*5*)

Control Measure	Strategy
Areawide rideshare incentives	● Increase time due to meeting pool members at a park and ride lot or other locations. ● Reduce time and cost due to HOV use and ridesharing. ● Reduce access time at destination to represent preferential parking. ● Change auto occupancy.
Improved public transit	● Reduce transit travel time and/or wait time. ● Reduce transit passenger cost. ● Change transit network to reflect improvements in service.
High occupancy vehicle lanes	● Recode the network with HOV links parallel to existing links. ● Reduce travel time and cost for rideshare vehicles between zones connected by HOV lanes.
Parking management	● Increase parking costs. ● Increase link capacity and speeds to reflect parking restraints or reduce travel time and cost for nonscheduled road users. ● Increase access (walk) time at destination to represent parking restraints.
Bicycle and pedestrian programs	● Reduce trip generation rates for shorter trips.
Vehicle use limitations/ restrictions	● Set infinitely high impedance values for specific links, or delete links from the network.
Traffic flow improvements	● Adjust travel times, turn penalties, parking, and capacities for individual links and nodes.

Another advantage of using travel demand models for TCM evaluation is that they account for the redistribution of vehicular demand on the network due to the changes in traffic flow conditions resulting from the implementation of a TCM. For example, when traffic conditions on a particular route improve because of traffic flow improvement measures, the travel demand modeling process assigns more trips to the route because of the reduced travel time on that route. As mentioned earlier, traffic simulation models do not estimate this shift.

Although travel demand models provide these advantages, many agencies responsible for TCM analysis have resorted to other analysis methods because of their limitations. For example, representing TCMs by an indirect means (i.e., the use of surrogate variables) as mentioned previously is often difficult because the relationship between the actual variable and the surrogate variable is generally difficult to quantify.

In addition, even if TCMs are adequately represented by surrogate variables, there are other concerns in applying travel demand models for TCM evaluation. One of the primary concerns is the scale of the modeling. Traditional travel demand models are designed to study regional and corridor level impacts of major infrastructure developments. TCMs, in contrast, generally affect very small areas of a metropolitan region, and/or induce small travel demand shifts. Therefore, the scale of the regional transportation systems represented by a travel demand model are often too large to support TCM evaluation.

As mentioned earlier, emissions estimates are sensitive to variations in speed. The speeds estimated by regional travel demand models represent average traffic flow conditions on the links within the network. Therefore, they often do not represent the actual variations and magnitude of the speeds and densities on those links. This fact limits the accuracy of a travel demand model to estimate emissions, and hence their capability to evaluate TCMs.

Regional travel demand models can also make large errors in estimating traffic volumes and speeds on individual network links. It is common for even the best procedures to make errors of over 30 percent in link volumes and over 50 percent in speeds (*8*). The magnitude of these errors by themselves greatly exceed the magnitude of the travel impacts of most TCMs.

Finally, travel demand models are not equipped to predict shifts in demand due to employer- based transportation management programs, and similar programs initiated by the local government. These programs typically include on-site transportation coordinators or strong rideshare matching outreach activities which cannot be represented in regional demand models. Only those activities that alter the modal availability or change the time and cost of a travel mode uniformly across all the users in a particular class (e.g., all service employees) can be evaluated using the regional travel demand models.

This discussion about network-based models as a means of TCM impact assessment indicates that despite their complexity, these tools are not fully equipped to represent various control measures in their entirety or estimate their total emissions impact. As a result, some agencies have used less complicated methodologies for TCM evaluation. These methodologies are discussed in the following section.

SKETCH-PLANNING TOOLS

Sketch-planning tools are a more formal impact analysis process than the use of similar TCM experiences to estimate the expected travel and emission impacts of a TCM. They are gross estimation techniques that use either manual or computerized methods to predict the impact of TCMs before they are implemented. Typically, they employ regional travel data generated through the travel demand modeling process or other means, in conjunction with the characteristics of the TCM to estimate their regional emission impacts. Some sketch-planning tools recently developed include the TDM Evaluation Model developed by COMSIS Corporation, TCM Tools developed by Sierra Research, Inc. and JHK & Associates for the San Diego Association of Governments (SANDAG), and a methodology developed by Systems Applications International (SAI) for the EPA. Each of these models is discussed in the following sections.

TDM Model

The TDM Model was developed by the COMSIS Corporation to analyze demand management measures that impact home-based work trips. The model estimates changes in vehicle trips, VMT, and modal split resulting from demand management measures. The TDM model is based on a disaggregate logit mode choice model (i.e., the pivot point model). For some of the TCMs that cannot be analyzed using the mode choice model, COMSIS Corporation has provided look-up tables constructed from empirical data (*12*).

The default coefficients of the logit equation used in this model to calculate modal split are synthesized based on the values for approximately 20 metropolitan areas of varying location, character and size. Hence, the default coefficients are national averages and can be used in all regions of the United States in the absence of more localized data. If local data are available, these default values can be modified by the user to allow a better analysis of the transportation system. The TDM Model can be used for regional, sub-regional, or site specific analysis of TCMs. Trip tables by purpose and mode, and highway distance matrices are required as input to use this model. The model is structured to directly read the trip tables produced by the regional travel demand models used in most metropolitan areas.

A major disadvantage of the TDM Model is that it does not directly estimate emissions. The model output, however, can be used to estimate emissions using other software. Other disadvantages to the model are that it can analyze only TCMs that are demand based and affect commute trips, and it does not readily allow the addition of TCMs that are not already coded into the software.

TCM Tools

TCM Tools was developed for the San Diego Association of Governments (SANDAG) by Sierra Research, Inc. with support from JHK & Associates in 1991. This model is referred to as the SANDAG method in this report. The SANDAG method estimates the travel, emissions, and cost effectiveness of several TCMs that may be used by regional planning agencies and air pollution agencies in California (*13*).

Overall, the SANDAG method is structured into a transportation module, an emissions module, and a cost-effectiveness module. The transportation and cost-effectiveness modules are spreadsheet based, and the emissions module is a FORTRAN program that combines the travel impacts of the transportation module with the emissions factor data from EMFAC7E and BURDEN7C in order to develop an estimate of emissions benefits of each TCM. The travel impacts module estimates the changes in trips, VMT, and vehicle speeds that can be expected after the TCM is implemented. Inputs to the model include baseline travel characteristics, TCM-specific parameters, and its underlying assumptions.

The SANDAG method is simple to use and requires only a rudimentary knowledge of the Lotus 1-2-3 spreadsheet program. Unlike the TDM Model, this model does not require regional travel information in the form of trip tables by purpose and mode, and highway distance matrices. The model requires only regional averages of certain travel variables. The addition of new TCMs to the model framework is possible.

The SANDAG method has several limitations. It uses several elasticities based on empirical data from experiences in California. Therefore, the method relies heavily on default values. These default values, however, may be modified by the user to reflect local conditions. Another disadvantage of the method is that the model is only applicable on an areawide basis. Subarea analysis is not possible. Another limitation of the method is that the emission rates, which are based on emission factor models used only in California, cannot be changed by the user to reflect more applicable local rates. But, a modified version of the method, which can be used nationally, is expected to be released in the fall of 1994. An evaluation of the SANDAG method also found that the regional information that it requires is not easily understood and, very often, is difficult to obtain. Finally, the user or analyst must also provide the model with TCM participation rates such as the number of people switching travel modes and the number of employees telecommuting. This type of information is not always available and can be difficult to estimate. It should be noted that the TDM Model estimates this information through the use of a mode choice model.

SAI Method

The SAI method was developed by Systems Applications International for the EPA for use by transportation planning organizations across the country (*14*). It is partly based on the concepts of the SANDAG method. However, it is limited to the evaluation of travel and emission impacts of TCMs and does not estimate the cost effectiveness of TCM implementation.

The SAI method provides a step-by-step procedure to estimate the impacts of selected TCMs on trips, VMT, and vehicle speed. The input requirements are similar to the SANDAG model. However, the input variables used in this method provide a better description of the overall scope of a TCM. In addition, the method does not require that these input variables be programmed or entered into any supporting software like the SANDAG method.

One advantage of the SAI method is that it is applicable to all regions of the country. In addition, the procedures used in this method could potentially be used to develop similar impact estimation and evaluation techniques for the other TCMs identified in the CAAAs. Also, any emission rates can be employed in this method. A process of estimating the combined impacts of several TCMs, which are not necessarily additive, is also provided in this methodology. In contrast, the SANDAG methodology is designed for individual TCM analysis only. Another advantage of the SAI method is that there are fewer variables needed to describe the necessary regional averages, and they are easier to understand.

The SAI method has some of the same limitations as the SANDAG method. For instance, TCM participation rates must also be provided as input to this model. This method, like the SANDAG method, is also only applicable on an areawide basis. However, the SAI method does provide a general framework that can be used to develop analysis methods for additional TCMs.

As part of this study, the methodology necessary for the analysis of TCMs other than those shown in Table 6 is being developed. The entire method was coded into a spreadsheet-based software program as part of this study. Also, a cost analysis module was added to the SAI methodology. These enhancements to the SAI method will be documented in a subsequent report.

The TCMs analyzed by the three methods discussed are shown in Table 6. The table does not include new TCMs that are currently being added to the SAI methodology. It is clear from the table that these methods do not encompass the entire range of TCMs listed in the CAAAs.

Despite being simpler than network-based modeling tools, sketch-planning tools are not easy to use because of the extensive input data they require to describe the baseline travel characteristics. Some of these input data are very difficult to obtain. The primary problem with both the SANDAG and SAI methods is that they require the user to input the number

TABLE 6. TCMs ANALYZED BY SKETCH-PLANNING TOOLS

TDM Model	SANDAG	SAI
● Transit improvements ● Ridesharing ● Parking management ● Work schedule changes ● HOV lanes ● Trip reduction ordinances	● Transit improvements ● Ridesharing ● Parking management ● Work schedule changes ● HOV lanes ● Trip reduction ordinances ● Traffic flow improvements ● Vehicle use limitations/restrictions ● Bicycle improvements ● Activity centers /Land use management	● Transit improvements ● Ridesharing ● Parking management ● Work schedule changes ● HOV lanes

of participants before beginning an analysis of TCM programs such as ridesharing or telecommuting. The lack of an information database on the participation rates of these programs as a function of the strategies implemented reduces the applicability of the methods to a what-if kind of analysis. This type of analysis demands a considerable amount of judgment from the analyst.

The indirect changes in demand resulting from TCMs is also not treated sufficiently, if at all, within these methods. For example, the overall effect of a latent demand resulting from traffic flow improvements is not fully considered. While the SAI method does calculate the latent demand caused by some TCMs, it does not use these calculations in its results. Therefore, where such effects are considered, the analyst must supply the information regarding its total effect on travel.

SUMMARY

The emission impacts of a TCM can be evaluated using several different methodologies. This chapter contains the review of several TCM evaluation methods currently available. The review of these methods has shown that the variety of TCMs, and their intended (or limited) impacts on mobile source emissions, currently require the use of several different evaluation tools. This fact is exacerbated by the limited capabilities of the evaluation methodologies currently available and the lack of applicable TCM impact data that can be used as input default values in the models. None of the methods discussed in this report can evaluate all sixteen TCMs identified in the CAAAs.

The standardization of the most appropriate evaluation method to use for each TCM would improve not only the reliability of their results, but it would also allow a comparison of these results from different areas with similar characteristics. In general, the use of empirical data comparison is not considered adequate as an evaluation method, and network-based modeling is considered too labor intensive. Sketch-planning tools, on the other hand, because of their gross nature and simplified evaluation methods, are easy to use and more appropriate for use with the impact data currently available. The use of sketch-planning tools, therefore, is currently the most promising approach available for the evaluation of TCMs.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

The use of TCMs and the estimation and evaluation of their impacts is becoming increasingly important within the United States. This report has identified why this is happening and discussed the need to collect more information on TCMs and their impacts. An initial database of TCM information, including their travel and emission impacts, is part of this report. This database is summarized, and its importance and different uses are explained. In addition, the capabilities and adequacy of three TCM evaluation methods are evaluated. The methods evaluated include the use of comparative empirical data, network-based models, and sketch-planning tools. The effect on the reliability of these methods from the lack of data on TCM impacts is also discussed.

CONCLUSIONS

Several conclusions were reached based on a summary of the current TCM database and an evaluation of TCM evaluation methods:

1. The current database of TCM impacts is inadequate. The size of the database needs to be increased, and the reliability of the data collected must be improved through the standardization of the data collection and impact monitoring procedures currently used. This information can be used to increase the accuracy and reliability of the results produced by TCM evaluation methods and to improve their evaluation and assessment capabilities. It can also provide the analyst with an idea of the size of impact to expect from an implemented TCM and allow the identification of an unreasonable software prediction.
2. TCMs should be monitored wherever they are implemented. In the past, information on the travel and emission impacts of TCMs was rarely collected. The implementation of a monitoring program should increase the amount of data available on TCM impacts and improve TCM evaluation capabilities.

3. Currently, the different characteristics of the TCMs identified in the CAAAs, and the intended (or limited) nature of their impacts, require the use of several different evaluation methods. The use of any one of the methods currently available has its advantages and disadvantages, and none of them can analyze all sixteen of the TCMs identified in the CAAAs.
4. The state-of-the-practice with respect to TCM evaluation needs to be improved and standardized. An improved ability to analyze the travel and emission impacts of each TCM identified in the CAAAs (hopefully with one tool) would be very beneficial. In addition, it should help the analyst choose the most cost-effective TCMs to implement. The identification of a standard evaluation method for each TCM will also improve the reliability of their results. An analyst would no longer have to check the type or basis of the analysis technique used. Standardization would also allow a more direct comparison of the impact data calculated for two areas with similar features.
5. Sketch-planning tools seem to have the most promise in terms of their ability to analyze a large number of TCMs. Because of the gross nature of their analysis, the input data required for sketch-planning tools are more easily collected and available, and their use is not as labor intensive as network-based modeling. The use of comparative empirical data comparison as an evaluation tool is not adequate.

RECOMMENDATIONS

Based on the database summary and the review of the TCM evaluation methodology, the following actions are recommended:

1. Initiate a standardized TCM impact monitoring and data collection program in Texas and nationwide. Data should be collected after implementation of a TCM, and it should consist of the information identified in this report as necessary for the proper use of the TCM analysis tools currently available. The information collected should be added to the national database included in the appendix of this report.
2. The capabilities of all the TCM evaluation methods that were reviewed limit their use. Each method should be studied further and improved.

a. The use of comparative empirical data as an analysis tool is not recommended. However, this information can be used by the analyst to gain some perspective on the magnitude of the impact that can be expected from an implemented TCM. The data can also be used as input for the other TCM evaluation methods and improve their reliability.

b. The use of network-based models, although specific in nature, are currently not constructed to estimate the limited effect of TCMs. In addition, because of their construction, these models can only be used to analyze some TCMs, and they usually require more specific input data than is currently available about the TCMs they can evaluate. Finally, because of their labor intensive nature, the use of these methods to analyze the impacts of TCMs is generally not cost effective.

c. Sketch-planning is gross in nature, but also the most promising and cost effective of the TCM evaluation methods currently available. In general, it is the most appropriate analysis method to use with respect to the level of input data currently available, but due to the general lack of TCM impact data (addressed in recommendation number one) they must use default values in some cases. Sketch-planning tools are also very cost effective because their gross analysis methods usually mean more time is spent analyzing the potential impacts of different TCM programs, rather than implementing the model.

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APPENDIX A

TCM TYPOLOGY AND DATABASE

TCM TYPOLOGY[1,2]

[1]Cambridge Systematics, Inc. *Transportation Control Measure Information Documents*. U. S. Environmental Protection Agency, Office of Mobile Source Emissions, Planning and Strategies Division: Ann Arbor, MI, March 1992.

[2]Douglas S. Eisinger, et al. *Transportation Control Measures: State Implementation Plan Guidance*. Prepared for the U. S. Environmental Protection Agency: Washington, D. C., September 1990.

TRIP REDUCTION ORDINANCES

- Special Use Permits
- Negotiated Agreements
- Trip Reduction Goals Program
- Mandated Ridesharing and Activity Programs
- Transportation Management Funds and Districts
- Requirements for Adequate Public Facilities
- Conditions of Approval for New Construction

EMPLOYER-BASED TRANSPORTATION MANAGEMENT PROGRAMS

- On-site Employer Transportation Coordinator
- Transit/Rideshare Services
    - Provide HOV Shuttle Services between Company Facilities
    - Centralized Vanpool/Carpool Matching Service
    - Rideshare/Transit Marketing/Information Programs
    - Designated Transportation Coordinator
    - HOV Priority Parking
    - Vanpool/Subscription Bus Financing
    - Subscription Buses or Buspooling
    - Midday and Park-and-Ride Shuttles
    - Guaranteed Ride Home
    - Use of Employer's Fleet
- Bicycle and Walking
- Employee Financial Incentives
    - Subsidize Transit Use
    - Transportation Allowances
    - Eliminate Employee Parking Subsidies
    - Charge for Drive-Alone Parking
    - Reduced Fares for HOV

Complementary Measures

- Trip Reduction Ordinances
- Parking Management
- Park-and-Ride lots
- HOV Facilities
- Pricing Strategies
- Indirect Source Review/Permit Program

WORK SCHEDULE CHANGES

- Telecommuting
  - Home
  - Satellite Work Center
  - Neighborhood Work Center
- Flextime
  - Daily Start/End Time
  - Number of Hours Worked
    - Per Day
    - Per Week
    - Per Pay Period
- Staggered Work Hours
- Compressed Work Week
  - 4-Day Week (10 Hour Work Days)
  - 5/4 Plan (80 Hours in 9 Days)

AREAWIDE RIDESHARE INCENTIVES

- Areawide Commute Management Organizations (Third Party Brokerages)
  - Carpool Matching Programs
  - Vanpool Programs
  - Shared Ride Taxi
  - Guaranteed Ride Home
- Transportation Management Associations (TMAs)
  - Operation of Ridesharing and Other Transportation Management Programs
  - Education
  - Informational Materials
  - Advocacy
  - Transportation Services Coordinators
  - Employee Surveys
  - Organization
    - Independent, Non-Profit Corporation
    - Existing Business Organization
- Tax Incentives and Subsidy Programs
  - State/Local Tax Exemptions for Vanpool or Transit Subsidies
  - Exemption of Ridesharing Vehicles from 'Common Carrier' Status
  - Safety Regulations for Vanpools, Buspools, Subscription Buses
  - Insurance Coverage
  - Liability Responsibility
  - Accelerated Depreciation Allowance for Employer-Provided Vanpools and Bicycling Facilities
  - State/Local Gas Tax Exemptions for Provision of Vanpool Benefits

Complementary Measures

- Park-and-Ride Lots
- Preferential Carpool/Vanpool Parking
- Transportation Management Associations
- HOV Facilities
- Employer-based Transportation Management Programs
- Trip Reduction Ordinances
- Pricing Strategies
- Public Awareness Programs

IMPROVED PUBLIC TRANSIT

- System/Service Expansion
  - Fixed Guideway Transit
  - Fixed Route and Express Bus Services
  - Circumferential and Local Bus Service
  - Paratransit Programs
- System/Service Operational Improvements
  - Feeder Bus Service
  - Express Bus Service
  - Bus Route and Schedule Modifications
  - Improved Transfers
  - Schedule Coordination
  - Bus Traffic Signal Preemption
  - Road Operational Changes
  - Operations Monitoring
  - Maintenance Improvements
  - Park-and-Ride Service
  - Subscription Bus Service
- Demand/Market Strategies
  - Employer Offered Incentives
  - Marketing and Information Programs
  - Peak/Off-Peak Transit Fares
  - Simplified Fare Collection
  - Reduce Fares
  - Monthly Passes
  - Unticket Programs
  - Passenger Amenities
  - Joint Development Activities

Complementary Measures

- Park-and-Ride Facilities
- Signal Timing/Preemption
- Pricing Strategies
- HOV Facilities
- Parking Restrictions

IMPROVED HIGH-OCCUPANCY VEHICLE FACILITIES

- Freeway
  - Exclusive (Separate Right-of-Way)
  - Barrier or Buffer Separated
  - Concurrent-flow
  - Contra-flow
  - Queue Bypass
- Arterial
  - Concurrent-flow
  - Contra-flow
  - Reversible Flow
  - Median Lane
  - Bus Street
  - Bus Tunnel
- Entrance Ramp Priority
- Parking Facilities

Complementary Measures

- Park-and-Ride/Fringe Parking Lots
- Transit Transfer Centers
- Transit Improvements
- Priority Access/Egress for Buses and Carpools
- Areawide Ridesharing
- Parking Management

TRAFFIC FLOW IMPROVEMENTS

- Traffic Signalization
  - Local Intersection Signal Improvements
  - Interconnected Arterial Signal Systems
  - Area Signal System
  - Equipment or Software Updating
  - Eliminate Unnecessary Signals and Stop Signs
- Traffic Operations
  - Additional Lanes Without New Construction
  - Intersection and Roadway Widening
  - One Way Streets
  - Turn Lane Installation
  - Turning Movement and Lane Use Restrictions
  - Reversible Traffic Lanes
  - Strengthen Curb Cut Controls
  - Improved Traffic Control Devices
  - Grade Separation
- Enforcement and Management
  - New Freeway Lane Using Shoulders or Reduced Lane Widths
  - Incident Detection and Management Systems
  - Freeway Diversion and Advisory Signing
  - Ramp Metering
  - Mainline Metering
  - Integrated Surveillance and Control
  - Enforcement
- Intelligent Vehicle and Highway Systems (IVHS)

Complementary Measures

- Restricting movements and/or cross traffic
- Removing or restricting parking to off-peak periods
- Removing unnecessary stop signs
- Removing recurrent bottlenecks from congested roadways
- Implementing motorist advisory
- Programs to expedite removal of disabled vehicles
- Provide pull-outs for disabled vehicles
- Peak period pricing

PARKING MANAGEMENT

- Preferential Parking for High Occupancy Vehicles
  - Garages and Lots
  - Metered Spaces
  - Rate Reduction
  - Reserved Spaces
- Public Sector Parking Pricing
  - Alter Rates
  - Long -vs- Short Term Parking
  - Impose New Prices
  - Tax the Provision of Free Private Parking
- Parking Requirements in Zoning Codes
  - Revise Maximum and Minimum Requirements
  - Allow Reductions in Minimum Requirements for Traffic Mitigation Actions
- On Street Parking Controls
  - Curb Parking Restrictions
  - Residential Parking Controls
  - Peak Hour Parking Ban and Enforcement
  - Reduced Legal Parking Spaces in High Congestion Areas
  - Increase Meter Fees
  - Increase Enforcement and Towing
- Commercial Vehicles
  - On-Street Loading Zones
  - Off-Street Loading Areas
  - Peak Hour On-Street Loading Prohibition
- Control of Parking Supply
  - Limit Construction of New Parking Facilities in Areas Served by Mass Transit
  - Limit Number of On- and Off-Street Parking Spaces in Designated Areas
  - Use of Zoning and Parking Regulations to Limit Capacity

PARK-AND-RIDE/FRINGE PARKING

- Construct New/Enlarged Dedicated Facilities on Public Property
- Use of Direct Ramps to Connect Park-and-Ride Lot with Freeway System
- Locate Personal Business Support Services at Park-and-Ride Lots Including Day-Care Centers, Financial Services, Convenience Stores, and Dry Cleaners
- Joint Use of Theater, Shopping Center, Church, Stadium Parking Facilities, as Available
- Parking at all Major Transit Stations
- Locate Fringe Parking to Serve Major Highway Facilities/Interchanges Near Central Business District
- Provide Transit/Shuttle Services to Park-and-Ride/Fringe Parking
- Priority Parking for HOVs at Major Parking Facilities
- Provide Bicycle Lockers/Storage at Parking Facilities

Complementary Measures

- HOV Lanes
- Parking Management Programs
- Improved Public Transit
- Employer-based Transportation Management Programs
- Areawide Ridesharing
- Automobile Use Restriction in the CBD
- Work Schedule Changes

BICYCLE AND PEDESTRIAN PROGRAMS

- Bicycle Facilities
  - Routes, Lanes, and Paths
    - Supportive Route Signalizations
    - Lane Striping
    - Repaving
    - Signing
  - Bicycle Plans and Maps
  - Bicycle Coordinators
  - Lockers, Racks, and Other Storage Facilities
  - Showers and Clothing Lockers
  - Integration with Transit
  - Ordinances
  - Education
  - Media and Promotion
- Pedestrian Facilities and Programs
  - Sidewalks and Walkways
  - Safe Facilities
    - Crosswalks
    - Walk Signals
    - Median Strips
    - Speed Ramps
    - Lighting
    - Clear Sight Lines
  - Sidewalk Environment/Furniture
    - Benches
    - Street Level Shops
    - Amenities
  - Connections with Transit
  - Education

TRAFFIC MANAGEMENT FOR SPECIAL EVENTS

- Remote Parking with Shuttle Service
- Public Transportation
- Highway Improvements
- Signage, Communication and Public Education/Information
- Traffic Flow Improvements
- Parking Management
- Pedestrian Access/Circulation
- Public and Private Coordination Committee
- Operations Response Teams
- Alternative Travel Schedules
- Rescheduling of Truck Travel

VEHICLE USE LIMITATIONS/RESTRICTIONS

- Route Diversion
  - Automobile Free Zones
  - Pedestrian Malls
  - Traffic Controls
- No-Drive Days
  - Voluntary
  - Required
- Control of Truck Movement
  - Designated Truck Routes
  - Truck Management Strategies
    - Sign Placement
    - Changeable Message Signs
    - Speed Restrictions
    - Additional Lanes
    - Lane Restrictions
  - Scheduling of Shipping/Receiving
  - Peak Period Truck Bans on Freeways or Major Arterials
  - Freight and Delivery Consolidation

ACCELERATED RETIREMENT OF VEHICLES

- Vehicle Eligibility
- Dollar Value of Payment
- Program Duration
    - Length of Buy-Back Period
    - One Time Program
    - Sequential Program
- Limitations on Number of Vehicles Bought
    - None
    - Maximum Number
- Retirement -vs- Tune Up
- Administration
    - Public Sector
    - Private Sector
    - Use of Credits in Emissions Banking and Trading

ACTIVITY CENTERS

- Design Guidelines/Regulations
  - Transit
  - Carpooling and Vanpooling
  - Pedestrians
  - Bicycling
- Parking Regulations and Standards
- Mixed Use Development Ordinances and Zones
- Site Plan Review Ordinances

EXTENDED VEHICLE IDLING

- Controls on Drive-Through Facilities
    - New Facilities
    - Existing Facilities
- Limitations on Idling of Heavy-Duty Vehicles
    - Trucks
    - Buses
    - Locomotives and Other Mobile Sources
- Vehicle Modifications

EXTREME LOW-TEMPERATURE COLD STARTS

- Vehicle Modifications
    - Block Heaters
    - Intake Manifold Heaters
    - Monolithic Fuel Injection Systems
    - Start or Warm-up Catalysts
    - Multipoint Fuel Injection Systems
- Parking Facility Electrical Outlets
    - Public Facilities
    - Private Employers
- Transit Use Incentives
- No-Drive Days
- Vehicle Fleet Operations

TABLE A - I

TCM APPLICATIONS BY MSA AND CITY

TABLE A-Ia. TCMs USED IN MSAs GREATER THAN 1,000,000 POPULATION

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Measures	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
Phoenix, AZ																
Maricopa County	X															
Mesa		X														
Phoenix		X	X	X		X	X									
Los Angeles - Anaheim - Riverside, CA																
Burbank												X				
Garden Grove							X									
Glendale		X														
Irvine		X														
La Habra		X														
Los Angeles	X	X	X	X	X	X	X	X	X		X		X		X	
Orange County		X				X										
Oxnard	X															
Newport Beach			X													
Pomona												X				
Riverside			X							X		X				
San Fernando Valley		X		X		X										
Simi Valley		X														
Ventura County	X															
Sacramento, CA																
Davis										X						
Placer County															X	
Sacramento				X			X	X							X	
Sacramento County	X															
San Diego, CA	X					X	X									
San Francisco - Oakland - San Jose, CA																
Alameda County		X														
Berkeley	X															
Concord		X														
Livermore		X														
Marin		X														
Oakland												X				
Palo Alto		X	X							X						
Pleasant Hill		X														
Pleasanton	X	X														
Redwood City							X									
San Francisco	X	X	X	X		X	X	X								
San Jose		X				X	X									
Santa Cruz								X								
Sunnyvale		X	X				X									
Walnut Creek		X														
Denver - Boulder, CO																
Denver	X		X		X	X	X					X				
Lakewood		X														
Hartford - New Britian - Middletown, CT																
Hartford		X		X		X		X	X							

TABLE A-Ia (CONT'D). TCMs USED IN MSAs GREATER THAN 1,000,000 POPULATION

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Measures	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
Washington, DC - MD - VA																
Alexandria, VA	X															
Arlington, VA							X									
Crystal City, VA			X													
Montgomery County, MD	X	X		X				X								
North Bethesda, MD	X			X												
Silver Spring, MD	X															
Washington, DC			X			X						X				
Miami - Fort Lauderdale, FL																
Miami						X										
Miami Beach												X				
Orlando, FL						X		X			X					
Atlanta, GA						X	X		X							
Chicago - Gary - Lake County, IL - IN - WI																
Chicago, IL		X	X			X	X	X	X							
Indianapolis, IN						X										
Boston - Lawrence - Salem, MA - NH																
Boston, MA				X		X	X	X	X		X	X				
Cambridge, MA			X													
Baltimore, MD						X		X								
Detroit - Ann Arbor, MI																
Detroit							X									
Minneapolis - St. Paul, MN - WI																
Minneapolis, MN		X	X	X		X	X	X				X				
St. Paul, MN		X	X	X			X		X							
Kansas City, MO - KS																
Kansas City, MO - KS																
Overland, KS		X														
St. Louis, MO									X							
New York - Northern New Jersey - Long Island, NY - NJ - CT																
Brooklyn, NY												X				
Long Island, NY							X									
New York City, NY			X	X		X	X	X	X							
Newark, NJ			X													
Queens, NY							X									
Cincinnati - Hamilton, OH - KY - IN																
Cincinnati, OH							X									
Cleveland - Akron - Lorain, OH									X							
Columbus, OH							X									
Portland - Vancouver, OR - WA																
Portland, OR				X	X	X	X	X				X				
Philadelphia - Wilmington - Trenton PA - NJ - DE - MD																
Philadelphia, PA						X	X		X			X				
Trenton, NJ									X							

TABLE A-Ia (CONT'D). TCMs USED IN MSAs GREATER THAN 1,000,000 POPULATION

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Measures	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
Pittsburgh - Beaver Valley, PA																
Pittsburgh, PA						X	X									
Providence - Pawtucket - Fall River, RI - MA																
Pawtucket							X									
Providence, RI												X				
Dallas - Fort. Worth, TX																
Dallas		X				X	X									
Fort Worth							X									
Houston - Galveston - Brazoria, TX																
Houston		X	X			X	X		X							
San Antonio, TX						X	X	X	X							
Norfolk - Virginia Beach - Newport News, VA																
Hampton							X									
Norfolk					X	X	X									
Seattle - Tacoma, WA									X							
Bellevue		X						X								
Kent		X														
Kirkland		X														
Seattle	X		X	X		X	X	X	X	X	X					
Milwaukee - Racine, WI																
Milwaukee							X		X							

TABLE A-Ib. TCMs USED IN MSAs WITH POPULATION FROM 250,000 TO 999,999

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Measures	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
Tucson, AZ					X		X			X						
Oxnard - Ventura, CA																
Oxnard, CA	X															
Ventura, CA		X														
Melbourne - Titusville - Palm Bay, FL																
Brevard County					X											
Honolulu, HI			X			X	X	X				X				
Des Moines, IA							X									
Ft. Wayne, IN							X									
Louisville, KY					X	X	X					X				
Albuquerque, NM							X									
Albany - Schenectady - Troy, NY																
Albany			X							X						
Syracuse, NY							X									
Toledo, OH									X							
Eugene - Springfield, OR																
Eugene								X		X						
Allentown - Bethlehem - Easton, PA - NJ																
Allentown, PA												X				
Harrisburg - Lebanon - Carlisle, PA																
Harrisburg						X										
San Juan, PR						X										
Charleston, SC							X									
Knoxville, TN			X					X			X					
Memphis, TN - AR - MS												X				
Austin, TX							X									
Beaumont - Port Authur, TX																
Beaumont																
El Paso, TX																
Madison, WI			X			X	X	X		X		X				

TABLE A-Ic. TCMs USED IN MSAs WITH POPULATION FROM 100,000 TO 249,999

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/ Fringe Parking	Bicycle and Pedestrian Measures	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
Gainesville, FL							X									
Lake Charles, LA							X									
Kalamazoo, MI												X				
Sioux Falls, SD							X									
Amarillo, TX		X														

TABLE A-Id. TCMs USED IN NON-MSAs

Location	Trip Reduction Ordinances	Employer-Based Transportation Management Programs	Work Schedule Changes	Areawide Rideshare Incentives	Improved Public Transit	High Occupancy Vehicle Lanes	Traffic Flow Improvements	Parking Management	Park-and-Ride/Fringe Parking	Bicycle and Pedestrian Measures	Special Events	Vehicle Use Limitations/ Restrictions	Accelerated Retirement of Vehicles	Activity Centers	Extended Vehicle Idling	Extreme Low-Temperature Cold Starts
Fairbanks North Star Borough , AK																X
El Segundo, CA		X	X													
San Ramon, CA		X														
Ottawa-Carleton, Canada						X										
Golden , CO		X														
Idaho Springs, CO							X									
Danville, IL												X				
Atchison, KS												X				
Salisbury, MD												X				
Maplewood, MN		X														
Minnetonka, MN		X														
Ft. Lee, NJ						X										
Nutley, NJ		X														
Princeton Area, NJ		X														
Corning, NY		X														
Tarrytown, NY							X									
Kent, OH					X											
Lehigh, PA							X									
Brattleboro, VT		X														

TABLE A - II

TCM APPLICATIONS BY MEASURE AND CITY

TABLE A-IIa. TRIP REDUCTION ORDINANCES

Location	Special Use Permits	Negotiated Agreements	Trip Reduction Goals Program	Mandated Ridesharing and Activity Programs	Trans. Management Funds and Districts	Requirements for Adequate Public Facilities	Conditions of Approval for New Construction
Maricopa County, AZ			X				
Berkley, CA					X		
Los Angeles, CA		X		X			
Oxnard, CA					X		
Pleasanton, CA				X			
Sacramento County, CA		X					
San Francisco, CA				X			
Ventura County, CA			X		X		
Denver, CO				X			
Montgomery County, MD		X				X	
North Bethesda, MD			X				
Silver Spring, MD			X		X		
Alexandria, VA			X				
Seattle, WA				X			

TABLE A-IIb. EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Location	On-Site Employer Transportation Coordinator	Transit/Rideshare Services: Provide HOV Shuttle Services between Company Facilities	Centralized Vanpool/Carpool Matching Service	Rideshare/Transit Marketing/Information Programs	Designated Transportation Coordinator
Rosarita Mexican Foods, Mesa, AZ	X		X		
Brown & Pain, P.A., Phoenix, AZ	X		X		
Childress Buick, Phoenix, AZ	X		X		
Sperry Flight Systems, Sperry Rand, Phoenix, AZ					
Aerospace Corp., El Segundo, CA					
Heller Financial, Glendale, CA	X		X		
Allergan Company, Irvine, CA			X		
Gotcha Sportswear, Irvine, CA	X		X		
Irvine Spectrum, Irvine, CA			X	X	X
IT Corporation, Irvine, CA	X		X		
Shur-lok Corporation, Irvine, CA	X		X		
City of La Habra, CA	X		X		
Lawrence Livermore National Laboratories, Livermore, CA			X		
ARCO, Los Angeles, CA					
Commuter Transportation Services, Los Angeles, CA	X		X		
UCLA, Los Angeles, CA		X	X		
Fireman's Fund Insurance Co., Marin, CA			X		
State Farm Insurance, Orange County, CA					
Varian, Palo Alto, CA			X		
Contra Costa Center, Pleasant Hill, CA					X
City of Pleasanton, Pleasanton, CA			X		X
Twentieth Century Corp., W. San Fernando Valley, CA			X		
Bank of America, San Francisco, CA					
Children's Hospital, San Francisco, CA					X
FMC Corp., San Jose, CA			X		X
Bishop Ranch, San Ramon, CA	X		X		
City of Simi Valley: Public Services Center	X		X		
Lockheed Missiles and Space Co., Sunnyvale, CA			X		
Kinko's Service Corporation, Ventura, CA	X		X		
Coors Company, Golden , CO			X	X	X
Cobe Labs, Lakewood, CO		X	X		X
Travelers Insurance Co., Hartford, CT					
Montgomery Ward, Chicago, IL					
Employees Reassurance Corp., Overland. KS					X
Rock Spring Park, Montgomery Co., MD	X		X		X
US Nuclear Regulatory Commission, Montgomery Co., MD			X		
3M Company, Maplewood, MN					X
Cenex Corporation, Minneapolis, MN					
General Mills, Minneapolis, MN					
Cargill, Inc., Minnetonka, MN					X
3M Company, St. Paul, MN					
Hoffman LaRoche Inc., Nutley, NJ					
FMC Corp., Princeton Area, NJ			X		X

TABLE A-IIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Location	Transit/Rideshare Services (Cont'd)						
	HOV Priority Parking	Vanpool/Subscription Bus Financing	Subscription Buses or Buspooling	Midday and Park-and-Ride Shuttles	Guaranteed Ride Home	Use of Employer's Fleet	Bicycle and Walking
Rosarita Mexican Foods, Mesa, AZ	X						X
Brown & Pain, P.A., Phoenix, AZ					X		
Childress Buick, Phoenix, AZ					X		X
Sperry Flight Systems, Sperry Rand, Phoenix, AZ		X					
Aerospace Corp., El Segundo, CA		X					
Heller Financial, Glendale, CA					X		X
Allergan Company, Irvine, CA	X	X					
Gotcha Sportswear, Irvine, CA					X		X
Irvine Spectrum, Irvine, CA		X					X
IT Corporation, Irvine, CA	X				X		X
Shur-lok Corporation, Irvine, CA					X		X
City of La Habra, CA		X			X		X
Lawrence Livermore National Laboratories, Livermore, CA	X	X					X
ARCO, Los Angeles, CA		X				X	
Commuter Transportation Services, Los Angeles, CA					X		
UCLA, Los Angeles, CA		X			X		
Fireman's Fund Insurance Co., Marin, CA		X					
State Farm Insurance, Orange County, CA							X
Varian, Palo Alto, CA							X
Contra Costa Center, Pleasant Hill, CA							X
City of Pleasanton, Pleasanton, CA							X
Twentieth Century Corp., W. San Fernando Valley, CA							
Bank of America, San Francisco, CA		X					
Children's Hospital, San Francisco, CA							
FMC Corp., San Jose, CA	X						
Bishop Ranch, San Ramon, CA							
City of Simi Valley: Public Services Center					X	X	X
Lockheed Missiles and Space Co., Sunnyvale, CA		X					
Kinko's Service Corporation, Ventura, CA	X				X		X
Coors Company, Golden , CO	X	X					
Cobe Labs, Lakewood, CO	X						
Travelers Insurance Co., Hartford, CT							
Montgomery Ward, Chicago, IL		X					
Employees Reassurance Corp., Overland, KS		X					
Rock Spring Park, Montgomery Co., MD	X	X					X
US Nuclear Regulatory Commission, Montgomery Co., MD	X						
3M Company, Maplewood, MN	X	X					
Cenex Corporation, Minneapolis, MN		X					
General Mills, Minneapolis, MN		X					
Cargill, Inc., Minnetonka, MN	X	X					
3M Company, St. Paul, MN		X					
Hoffman LaRoche Inc., Nutley, NJ		X					
FMC Corp., Princeton Area, NJ		X					

TABLE A-IIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Location	Employee Financial Incentives				
	Subsidize Transit Use	Transportation Allowances	Eliminate Employee Parking Subsidies	Charge for Drive-Alone Parking	Reduced Fares for HOV
Rosarita Mexican Foods, Mesa, AZ					
Brown & Pain, P.A., Phoenix, AZ	X				
Childress Buick, Phoenix, AZ	X				
Sperry Flight Systems, Sperry Rand, Phoenix, AZ					
Aerospace Corp., El Segundo, CA					
Heller Financial, Glendale, CA					
Allergan Company, Irvine. CA					
Gotcha Sportswear, Irvine, CA	X				
Irvine Spectrum, Irvine, CA					
IT Corporation, Irvine, CA	X				
Shur-lok Corporation. Irvine, CA	X				
City of La Habra, CA					
Lawrence Livermore National Laboratories, Livermore, CA					
ARCO, Los Angeles, CA					
Commuter Transportation Services, Los Angeles, CA	X	X			
UCLA, Los Angeles, CA			X		
Fireman's Fund Insurance Co., Marin, CA					
State Farm Insurance, Orange County, CA	X	X			
Varian, Palo Alto, CA	X				
Contra Costa Center, Pleasant Hill, CA	X				
City of Pleasanton, Pleasanton. CA					
Twentieth Century Corp., W. San Fernando Valley, CA	X		X		X
Bank of America, San Francisco. CA					
Children's Hospital, San Francisco, CA					
FMC Corp., San Jose, CA	X				
Bishop Ranch, San Ramon, CA					
City of Simi Valley: Public Services Center	X	X			
Lockheed Missiles and Space Co., Sunnyvale, CA					
Kinko's Service Corporation, Ventura, CA					
Coors Company, Golden , CO					
Cobe Labs, Lakewood, CO					
Travelers Insurance Co., Hartford. CT					X
Montgomery Ward, Chicago, IL					
Employees Reassurance Corp., Overland, KS					
Rock Spring Park, Montgomery Co., MD	X				
US Nuclear Regulatory Commission, Montgomery Co., MD	X	X	X		X
3M Company, Maplewood, MN	X		X		
Cenex Corporation, Minneapolis, MN					
General Mills, Minneapolis. MN					
Cargill, Inc., Minnetonka. MN	X				
3M Company, St. Paul, MN					
Hoffman LaRoche Inc., Nutley, NJ					
FMC Corp., Princeton Area, NJ					

TABLE A-IIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Location	On-Site Employer Transportation Coordinator	Transit/Rideshare Services			
		Provide HOV Shuttle Services between Company Facilities	Centralized Vanpool/Carpool Matching Service	Rideshare/Transit Marketing/Information Programs	Designated Transportation Coordinator
Corning Glass Company, Corning, NY					
Cooper and Woodruff, Amarillo, TX					
Texas Instruments, Dallas, TX					
Panhandle Eastern Corporation, Houston, TX					
Irving Paper Mills, Brattleboro, VT					
Bellevue City Hall, Bellevue, WA			X		
CH2M HILL, Bellevue, WA			X		
Pacific Northwest Bell, Bellevue, WA			X		
Pacific Pipeline, Kent, WA	X		X		
Kirkland City Hall, Kirkland, WA	X		X		
Bonneville Power Administration, Seattle, WA	X		X		
Johnson & Higgins, Seattle, WA	X		X		
Puget Sound Blood Center, Seattle, WA	X		X		
U-PASS Demonstration Project, University of Washington and the City of Seattle			X		
William M. Mercer, Inc., Seattle, WA	X		X		
Walker, Richer & Quinn, Seattle, WA	X		X		

TABLE A-IIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Location	Transit/Rideshare Services (Cont'd)						
	HOV Priority Parking	Vanpool/Subscription Bus Financing	Subscription Buses or Buspooling	Midday and Park-and-Ride Shuttles	Guaranteed Ride Home	Use of Employer's Fleet	Bicycle and Walking
Corning Glass Company, Corning, NY		X					
Cooper and Woodruff, Amarillo, TX		X					
Texas Instruments, Dallas, TX		X					
Panhandle Eastern Corporation, Houston, TX		X					
Irving Paper Mills, Brattleboro, VT		X					
Bellevue City Hall, Bellevue, WA						X	
CH2M HILL, Bellevue, WA							
Pacific Northwest Bell, Bellevue, WA					X		
Pacific Pipeline, Kent, WA	X				X		
Kirkland City Hall, Kirkland, WA					X		X
Bonneville Power Administration, Seattle, WA		X					X
Johnson & Higgins, Seattle, WA					X	X	
Puget Sound Blood Center, Seattle, WA		X			X		X
U-PASS Demonstration Project, University of Washington and the City of Seattle					X		X
William M. Mercer, Inc., Seattle, WA	X				X	X	
Walker, Richer & Quinn, Seattle, WA		X					X

TABLE A-IIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Location	Employee Financial Incentives				
	Subsidize Transit Use	Transportation Allowances	Eliminate Employee Parking Subsidies	Charge for Drive-Alone Parking	Reduced Fares for HOV
Corning Glass Company, Corning, NY					
Cooper and Woodruff, Amarillo, TX					
Texas Instruments, Dallas, TX					
Panhandle Eastern Corporation, Houston, TX					
Irving Paper Mills, Brattleboro, VT					
Bellevue City Hall, Bellevue, WA	X		X		
CH2M HILL, Bellevue, WA	X	X	X		X
Pacific Northwest Bell, Bellevue, WA				X	X
Pacific Pipeline, Kent, WA	X				
Kirkland City Hall, Kirkland, WA	X				
Bonneville Power Administration, Seattle, WA	X				
Johnson & Higgins, Seattle, WA	X				
Puget Sound Blood Center, Seattle, WA	X				
U-PASS Demonstration Project, University of Washington and the City of Seattle	X				
William M. Mercer, Inc., Seattle, WA	X				
Walker, Richer & Quinn, Seattle, WA	X				

TABLE A-IIc. WORK SCHEDULE CHANGES

Location	Telecommuting	Flextime	Compressed Work Week	Staggered Work Hours
Best Western Hotel Chain, Phoenix, AZ	X			
Neighborhood Work Center, Phoenix, AZ	X			
Lerner Architectural Firm, CA	X			
Pacific Bell, CA	X			
Hughes Aircraft, El Segundo, CA	X			
Los Angeles County, Los Angeles, CA	X			
SCAQMD, Los Angeles, CA	X			
Rockwell Int'l, Newport Beach, CA	X			
Xerox Corporation, Palo Alto, CA		X		
(Multiple Employer), Riverside, CA				X
(Multiple Employers), San Francisco, CA		X		
Lockheed Company, Sunnyvale, CA				X
(Federal Employees), Denver, CO			X	
(Multiple Employers), Washington, DC				X
Telework Center Demonstration, HI				
(Multiple Employers), Honolulu, HI				X
Chadwell & Kayser Ltd., Chicago, IL	X			
U.S. DOT, Cambridge, MA		X		
Control Data Corp., Minneapolis, MN	X			
3M Company, St. Paul, MN				X
(Multiple Employers), Newark, NJ				X
NY State University, Albany, NY			X	
Lerner Architectural Firm, New York, NY	X			
(Multiple Employers)New York, NY				X
NYNEX, New York, NY	X			
Blue Cross/Blue Shield, SC	X			
Tennessee Valley Authority, Knoxville, TN		X		
(Multiple Employers), Houston, TX				X
(Multiple Employers), Crystal City, VA				X
Puget Sound Demonstration, WA	X			
(Multiple Employers), Seattle, WA		X		
(Multiple Employers), Madison, WI				X

TABLE A-IId. AREAWIDE RIDESHARE INCENTIVES

Location	Areawide Commute Management Organizations	Transportation Management Organizations	Tax Incentives and Subsidy Programs
Phoenix, AZ	X		
California			X
Los Angeles, CA	X		
Sacramento, CA	X		
San Francisco, CA	X		
San Fernando Valley, CA		X	
Hartford, CT	X		
Boston, MA	X		
Montgomery County, MD	X		X
North Bethesda, MD	X		
Minneapolis-St. Paul, MN			
New York City, NY	X		
Portland, OR	X		
Seattle, WA	X		

TABLE A-IIc. IMPROVED PUBLIC TRANSIT

Location	System/Service Expansion				System/Service Operational Improvements						
	Fixed Guideway Transit	Fixed Route and Express Bus Service	Circumferential and Local Bus Service	Paratransit Programs	Feeder Bus Service	Express Bus Service	Bus Route and Schedule Modifications	Improved Transfers	Schedule Coordination	Bus Traffic Signal Preemption	Road Operational Changes
Tucson, AZ		X					X				
Los Angeles, CA				X						X	
Denver, CO											X
Brevard County, FL				X							
Louisville, KY											X
Kent, OH										X	
Portland, OH								X			
Norfolk, VA											

TABLE A-IIc (CONT'D). IMPROVED PUBLIC TRANSIT

Location	System/Service Operational Improvements (Cont'd)				Demand/Market Strategies								
	Operations Monitoring	Maintenance Improvements	Park-and-Ride Service	Subscription Bus Service	Employer Offered Incentives	Marketing and Information Programs	Peak/Off-Peak Transit Fares	Simplified Fare Collection	Reduce Fares	Monthly Passes	Unticket Programs	Passenger Amenities	Joint Development Activities
Tucson, AZ													
Los Angeles, CA													
Denver, CO				X									
Brevard County, FL													
Louisville, KY													
Kent, OH													
Portland, OH													
Norfolk, VA				X									

TABLE A-IIf. HIGH-OCCUPANCY VEHICLE LANES

Location	Freeway				
	Exclusive (Separate ROW)	Barrier or Buffer Separated	Concurrent Flow	Contraflow	Queue Bypass
Phoenix, AZ			X		
Los Angeles, CA		X	X		
Orange County, CA			X		
San Diego, CA		X			
San Francisco, CA			X	X	
San Fernando Valley, CA					
San Jose, CA			X		
Ottawa-Carleton, Canada	X				
Denver, CO			X		
Hartford, CT		X			
Washington, DC		X	X		
Orlando, FL			X		
Miami, FL			X		
Atlanta, GA					
Honolulu, HI			X	X	
Chicago, IL					
Indianapolis, IN					
Louisville, KY					
New Orleans, LA					
Boston, MA		X			
Baltimore, MD					
Minneapolis, MN		X			
Ft. Lee, NJ			X		
New York City, NJ				X	
New York City, NY				X	
Harrisburg, PA					
Portland, OR					
Philadelphia, PA					
Pittsburgh, PA	X	X			
San Juan, PR					
Dallas, TX				X	
Houston, TX		X			
San Antonio, TX					
Seattle, WA			X		
Madison, WI					

TABLE A-IIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Location	Arterial						Entrance Ramp Priority	Parking Facilities
	Concurrent Flow	Contraflow	Reversible Flow	Median Lane	Bus Street	Bus Tunnel		
Phoenix, AZ								
Los Angeles, CA		X						
Orange County, CA								
San Diego, CA								
San Francisco, CA	X							
San Fernando Valley, CA								
San Jose, CA								
Ottawa-Carleton, Canada								
Denver, CO	X							
Hartford, CT								
Washington,-DC	X							
Orlando, FL								
Miami, FL	X	X	X		X			
Atlanta, GA					X			
Honolulu, HI								
Chicago, IL	X	X			X			
Indianapolis, IN		X						
Louisville, KY		X						
New Orleans, LA					X			
Boston, MA								
Baltimore, MD	X							
Minneapolis, MN								
Ft. Lee, NJ								
New York City, NJ								
New York City, NY	X							
Harrisburg, PA	X							
Portland, OR					X			
Philadelphia, PA					X			
Pittsburgh, PA		X			X			
San Juan, PR		X						
Dallas, TX	X							
Houston, TX	X							
San Antonio, TX		X						
Seattle, WA								
Madison, WI		X						

TABLE A-IIg. TRAFFIC FLOW IMPROVEMENTS

Location	Traffic Signalization	Traffic Operations						
		Additional Lanes w/o New Construction	Intersection and Roadway Widening	One-Way Streets	Turn Lane Installation	Turning Movement and Lane Use Restriction	Reversible Lanes	Strengthen Curb Cut Controls
Arizona	X							
Phoenix, AZ								
Tucson, AZ								
California	X							
Garden Grove, CA	X							
Los Angeles, CA								
Redwood City, CA	X							
Sacramento, CA	X							
San Diego, CA								
San Francisco, CA	X							
San Jose, CA								
Sunnyvale, CA	X							
Denver, CO	X							
Idaho Springs, CO								
Florida								
Gainesville, FL	X							
Atlanta, GA							X	
Honolulu, HI		X						
Des Moines, IA	X							
Chicago, IL								
Ft. Wayne, IN	X							
Louisville, KY								
Lake Charles, LA								
Boston, MA								
Detroit, MI								
Missouri	X							
Minneapolis, MN								
St. Paul, MN								
New Jersey								
New Jersey (I-80)								
Albuquerque, NM								
New York								
Long Island, NY								
New York, NY				X				
Queens, NY								
Syracuse, NY	X							
Tarrytown, NY								
North Carolina	X							

TABLE A-IIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Location	Traffic Operations (Cont'd)		Enforcement and Management	
	Improved Traffic Control Devices	Grade Separation	New Freeway Lanes Using Shoulders or Reduced Lane Widths	Incident Detection and Management Systems
Arizona				
Phoenix, AZ				
Tucson, AZ				
California				
Garden Grove, CA				
Los Angeles, CA				X
Redwood City, CA				
Sacramento, CA				
San Diego, CA				
San Francisco, CA				
San Jose, CA				
Sunnyvale, CA				
Denver, CO				
Idaho Springs, CO				
Florida				
Gainesville, FL				
Atlanta, GA				
Honolulu, HI				
Des Moines, IA				
Chicago, IL		X		X
Ft. Wayne, IN				
Louisville, KY				
Lake Charles, LA				
Boston, MA				
Detroit, MI				X
Missouri				
Minneapolis, MN				
St. Paul, MN				
New Jersey				
New Jersey (I-80)				X
Albuquerque, NM				
New York				
Long Island, NY				
New York, NY				
Queens, NY				
Syracuse, NY				
Tarrytown, NY				
North Carolina				

TABLE A-IIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Location	Enforcement and Management (Cont'd)					Intelligent-Vehicle Highway Systems
	Freeway Diversion and Advisory Signing	Ramp Metering	Mainline Metering	Integrated Surveillance and Control	Enforcement	
Arizona						
Phoenix, AZ	X	X				
Tucson, AZ		X				
California						
Garden Grove, CA						
Los Angeles, CA	X	X		X		
Redwood City, CA						
Sacramento, CA	X	X				
San Diego, CA		X				
San Francisco, CA	X	X	X			
San Jose, CA		X				
Sunnyvale, CA						
Denver, CO		X				
Idaho Springs, CO	X					
Florida	X					
Gainesville, FL						
Atlanta, GA						
Honolulu, HI						
Des Moines, IA						
Chicago, IL		X				
Ft. Wayne, IN						
Louisville, KY						
Lake Charles, LA	X					
Boston, MA						
Detroit, MI		X				
Missouri						
Minneapolis, MN		X				
St. Paul, MN		X				
New Jersey	X					
New Jersey (I-80)						
Albuquerque, NM	X					
New York				X		
Long Island, NY		X				
New York, NY						
Queens, NY	X					
Syracuse, NY						
Tarrytown, NY	X					
North Carolina						

TABLE A-IIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Location	Traffic Signalization	Traffic Operations						
		Additional Lanes w/o New Construction	Intersection and Roadway Widening	One-Way Streets	Turn Lane Installation	Turning Movement and Lane Use Restriction	Reversible Lanes	Strengthen Curb Cut Controls
Cincinnati, OH								
Columbus, OH								
Portland, OR	X							
Lehigh, PA								
Philadelphia, PA								
Pittsburgh, PA								
Pawtucket, RI	X							
Charleston, SC	X							
Sioux Falls, SD	X							
Texas	X							
Austin, TX								
Dallas, TX								
Fort Worth, TX								
Houston, TX								
San Antonio, TX								
Virginia								
Arlington, VA							X	
Hampton, VA								
Norfolk, VA								
Seattle, WA								
Madison, WI								
Milwaukee, WI	X							

TABLE A-IIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Location	Traffic Operations (Cont'd)		Enforcement and Management	
	Improved Traffic Control Devices	Grade Separation	New Freeway Lanes Using Shoulders or Reduced Lane Widths	Incident Detection and Management Systems
Cincinnati, OH				
Columbus, OH				
Portland, OR				
Lehigh, PA				
Philadelphia, PA				
Pittsburgh, PA				
Pawtucket, RI				
Charleston, SC				
Sioux Falls, SD				
Texas				
Austin, TX				
Dallas, TX				
Fort Worth, TX				
Houston, TX				
San Antonio, TX				
Virginia				
Arlington, VA				
Hampton, VA				
Norfolk, VA				
Seattle, WA				
Madison, WI				
Milwaukee, WI				

TABLE A-IIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Location	Enforcement and Management (Cont'd)					Intelligent-Vehicle Highway Systems
	Freeway Diversion and Advisory Signing	Ramp Metering	Mainline Metering	Integrated Surveillance and Control	Enforcement	
Cincinnati, OH	X					
Columbus, OH	X	X				
Portland, OR		X				
Lehigh, PA	X					
Philadelphia, PA	X					
Pittsburgh, PA	X					
Pawtucket, RI						
Charleston, SC						
Sioux Falls, SD						
Texas				X		
Austin, TX	X	X				
Dallas, TX	X	X				
Fort Worth, TX	X	X				
Houston, TX		X				
San Antonio, TX		X				
Virginia		X				
Arlington, VA	X					
Hampton, VA	X					
Norfolk, VA	X					
Seattle, WA		X				
Madison, WI						
Milwaukee, WI		X				

TABLE A-IIh. PARKING MANAGEMENT

Location	Preferential Parking for HOV		Public Sector Parking Pricing	Parking Requirements in Zoning Codes	On-Street Parking Controls	Commercial Vehicles	Control of Parking Supply
	Rate Reductions	Reserved Spaces					
Los Angeles, CA							X
Sacramento, CA							X
San Francisco, CA	X	X	X				X
Santa Cruz, CA					X		
Hartford, CT							X
Orlando, FL							X
Honolulu, HI			X				
Chicago, IL			X		X		X
Boston, MA							X
Baltimore, MD		X					
Montgomery County, MD		X					X
Minneapolis, MN	X						
New York, NY					X		
Portland, OR		X					X
Eugene, OR			X				
Knoxville, TN		X					
San Antonio, TX		X					
Bellevue, WA							X
Seattle, WA	X	X					X
Madison, WI			X				

TABLE A-IIi. PARK-AND-RIDE/FRINGE PARKING

Location	Dedicated Facilities	Direct Ramps	Locate Services at Lots	Joint Use	Major Transit Stations	Fringe Parking	Transit/Shuttle Services	Priority Parking for HOV	Bicycle Lockers/Storage
Los Angeles, CA				X			X		
Calgary, Canada	X				X	X	X		
Hartford, CT						X			
Chicago, IL							X		
Atlanta, GA							X		
Boston, MA									
St. Paul, MN							X		
St. Louis, MO						X			
Trenton, NJ						X			
New York, NY						X (Planned)			
Cleveland, OH						X	X		
Toledo, OH				X			X		
Philadelphia, PA						X			
San Antonio, TX	X		X						
Houston, TX	X		X						
Seattle, WA				X			X		
Milwaukee, WI						X			

TABLE A-IIj. BICYCLE AND PEDESTRIAN MEASURES

Location	Bicycle Facilities								
	Routes, Lanes and Paths	Bicycle Plans and Maps	Bicycle Coordinators	Lockers, Racks and Other Storage Facilities	Showers and Clothing Lockers	Integration with Transit	Ordinances	Education	Media and Promotion
Tucson, AZ	X	X	X					X	X
Davis, CA	X								
Palo Alto, CA	X								
Xerox Corporation, Palo Alto, CA				X	X				
Fleetwood Enterprises, Inc., Riverside, CA				X	X				
Empire State Office Plaza, Albany, NY				X	X				
Eugene, OR	X								
Seattle, WA				X		X		X	
Madison, WI	X						X	X	

(Cont'd)

Location	Pedestrian Facilities				
	Sidewalks and Walkways	Safe Facilities	Sidewalk Environment/ Furniture	Connections with Transit	Education
Tucson, AZ					
Davis, CA					
Palo Alto, CA					
Xerox Corporation, Palo Alto, CA					
Fleetwood Enterprises, Inc., Riverside, CA					
Empire State Office Plaza, Albany, NY					
Eugene, OR					
Seattle, WA					
Madison, WI					

TABLE A-IIk. SPECIAL EVENTS

Location	Remote Parking with Shuttle Service	Public Transportation	Highway Improvements	Signage, Communications, and Public Education/Information	Traffic Flow Improvements	Parking Management	Pedestrian Access/Circulation
1984 Olympics, Los Angeles, CA		X		X	X	X	
Orlando Centroplex, Orlando, FL		X		X	X	X	
Southeast Expressway, Boston, MA		X		X	X		
1982 World's Fair, Knoxville, TN	X	X	X	X		X	
Husky Stadium, Seattle, WA	X	X		X		X	

(Cont'd.)

Location	Public And Private Coordination Committee	Operations Response Team	Alternate Travel Schedules	Rescheduling of Truck Travel
1984 Olympics, Los Angeles, CA		X	X	
Orlando Centroplex, Orlando, FL				
Southeast Expressway, Boston, MA				
1982 World's Fair, Knoxville, TN	X			
Husky Stadium, Seattle, WA				

TABLE A-III. VEHICLE USE LIMITATIONS/RESTRICTIONS

Location	Route Diversion	No-Drive Days	Control of Truck Movement
Phoenix, AZ		X	
Burbank, CA	X		
Oakland, CA	X		
Pomona, CA	X		
Riverside, CA	X		
Denver, CO	X	X	
Washington, DC	X		
Miami Beach, FL	X		
Honolulu, HI	X		
Danville, IL	X		
Atchison, KS	X		
Louisville, KY	X		
Boston, MA	X		
Salisbury, MD	X		
Kalamazoo, MI	X		
Minneapolis, MN	X		
Brooklyn, NY	X		
Portland, OR	X		
Allentown, PA	X		
Philadelphia, PA	X		
Providence, RI	X		
Memphis, TN	X		
Madison, WI	X		

TABLE A-IIm. ACCELERATED RETIREMENT OF VEHICLES

Location	Vehicle Eligibility	Dollar Value of Payment	Program Duration			Limitations on Number of Vehicles Bought		Retirement vs. Tune Up	Administration		
			Buy-Back Period	One-Time	Sequential	None	Maximum		Public Sector	Private Sector	Credit for Emissions Banking and Trading
Los Angeles, CA		X				X			X		

TABLE A-IIn. ACTIVITY CENTERS

Location	Design Guidelines/Regulations	Parking Regulations and Standards	Mixed Use Development Ordinances and Zones	Site Plan Review Ordinances

TABLE A-IIo. EXTENDED VEHICLE IDLING

Location	Controls on Drive-Through Facilities	Limitations on Idling of Heavy-Duty Vehicles	Vehicle Modifications
Placer County, CA	X		
Sacramento, CA	X		
SCAQMD, CA		X	

TABLE A-IIp. EXTREME LOW-TEMPERATURE COLD STARTS

Location	Vehicle Modifications	Parking Facility Electrical Outlets	Transit Use Incentives	No-Drive Days	Vehicle Fleet Operations
Fairbanks North Star Borough, AK	X	X			

TABLE A - III

TCM APPLICATION DETAILS

LIST OF ABBREVIATIONS

ADT .... average daily traffic

AM Pk .... morning peak period

B .... billion

B:C .... benefit:cost

blk .... block(s)

Bsn .... businesses

Cons .... conserved

Emp .... employees

Est .... estimate

gal .... gallons

HOV .... high-occupancy vehicle

Hr .... hour

init .... initial

int .... intersection

JAC .... Jason A. Crawford (Texas Transportation Institute)

kg .... kilogram

km .... kilometers

kph .... kilometers per hour

ltr .... liter

M .... million

Mg .... megagram

mi .... mile

mon .... month

min .... minute

mph .... miles per hour

NA .... not available

net .... network

Oper .... operating

Pass .... passengers

Pd .... period

Pk .... peak

PM Pk .... evening peak period

Pop .... population

reg .... region(al)

sig .... signal

SOV .... single-occupant vehicle

Sq. .... square

V-H .... vehicle-hours

Veh .... vehicle

VKT .... vehicle kilometers traveled

VMT .... vehicle miles traveled

wkdy .... weekday

wrksta .... workstation

yr .... year

TABLE A-IIIa. TRIP REDUCTION ORDINANCES

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Special Use Permits											
Negotiated Agreements											
Community Redevelopment Agency, LA, CA	--	--	X	--	--	--	--	--	--	--	--
Sacramento County, CA	--	--	X	--	--	--	--	--	--	--	--
Montgomery Co., MD	--	--	X	--	--	--	--	--	--	--	--
Trip Reduction Goals Program											
Maricopa Assoc. of Governments, AZ	1988	--	X	--	--	--	--	--	--	--	--
San Diego, CA	1990	--	X	--	--	--	109	--	--	--	--
Ventura County, CA	1989	--	X	--	--	--	--	--	--	--	--
North Bethesda, MD	1986	--	--	X	--	0.0971 (0.0375)	--	--	--	--	--
Silver Spring, MD	--	--	X	--	--	--	--	--	--	--	--
Alexandria, VA	May-87	--	X	--	--	--	--	--	--	--	--
Mandated Ridesharing and Activity Programs											
Los Angeles, CA	1988	--	X	--	--	--	--	--	--	--	--
Pleasanton, CA	Oct-84	--	X	--	--	--	--	50,000 Pop.	--	--	--
San Francisco, CA	--	--	X	--	--	--	--	--	--	--	--
South Coast Area, CA	1-Jul-88	--	X	--	--	--	--	8,000 Bsn.	--	--	$106 to $382/Emp.
Denver, CO	--	--	X	--	--	--	--	--	--	--	--
Seattle, WA	--	--	X	--	--	--	--	--	--	--	--
Trans. Management Funds and Districts											
Berkeley, CA	--	--	X	--	--	--	--	--	--	--	--
Oxnard, CA	--	--	X	--	--	--	--	120,000 Pop.	--	--	--
Silver Spring, MD	1988	--	X	--	--	--	--	--	--	--	--
Ventura County, CA	1989	--	X	--	--	--	--	--	--	--	--
Requirements for Adequate Public Facilities											
Montgomery County, MD	--	--	X	--	--	--	--	--	--	--	--
Conditions of Approval for New Construction											

TABLE A-IIIa (CONT'D). TRIP REDUCTION ORDINANCES

Action/Example	Travel Impacts							
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)
Special Use Permits								
Negotiated Agreements								
Community Redevelopment Agency, LA, CA	--	--	--	--	--	--	--	--
Sacramento County, CA	--	--	--	--	--	--	--	--
Montgomery Co., MD	--	--	--	--	--	--	--	--
Trip Reduction Goals Program								
Maricopa Assoc. of Governments, AZ	--	--	--	--	--	--	--	--
San Diego, CA	-12.2% in 1991	--	--	--	--	--	--	--
Ventura County, CA	--	--	--	--	--	--	--	--
North Bethesda, MD	--	--	--	--	--	--	--	--
Silver Spring, MD	--	--	--	--	--	--	--	--
Alexandria, VA	--	--	--	--	--	--	--	--
Mandated Ridesharing and Activity Programs								
Los Angeles, CA	--	--	--	--	--	--	--	--
Pleasanton, CA	--	--	--	--	--	--	-41.5% (Pk. Hr., 1988)	--
San Francisco, CA	--	--	--	--	--	--	--	--
South Coast Area, CA	--	--	--	--	--	--	-8.4% ADT	--
Denver, CO	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--
Trans. Management Funds and Districts								
Berkeley, CA	--	--	--	--	--	--	--	--
Oxnard, CA	--	--	--	--	--	--	--	--
Silver Spring, MD	--	--	--	--	--	--	--	--
Ventura County, CA	--	--	--	--	--	--	--	--
Requirements for Adequate Public Facilities								
Montgomery County, MD	--	--	--	--	--	--	--	--
Conditions of Approval for New Construction								

TABLE A-IIIa (CONT'D). TRIP REDUCTION ORDINANCES

Action/Example	Travel Impacts (Cont'd) Mode Shift †	Rideshare *	Occ.	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Special Use Permits									
Negotiated Agreements									
Community Redevelopment Agency, LA, CA	--	--	--	--	--	--	--	--	3
Sacramento County, CA	--	--	--	--	--	--	--	--	1
Montgomery Co., MD	--	--	--	--	--	--	--	--	3
Trip Reduction Goals Program									
Maricopa Assoc. of Governments, AZ	-3% (20%)	--	--	--	--	--	--	--	1, 67
San Diego, CA	--	--	--	--	--	--	--	--	72
Ventura County, CA	--	--	--	--	--	--	--	--	71
North Bethesda, MD	--	--	--	--	--	--	--	--	3
Silver Spring, MD	--	--	--	--	--	--	--	--	3
Alexandria, VA	--	--	--	--	--	--	--	--	3
Mandated Ridesharing and Activity Programs									
Los Angeles, CA	--	--	--	--	--	--	--	--	2, 44
Pleasanton, CA	81% to 84% (NA)	--	--	--	--	--	--	--	1, 2, 34, 57, 65
San Francisco, CA	--	--	--	--	--	--	--	--	44
South Coast Area, CA	76% to 71% (NA)	14% to 18% (NA) [NA] {NA}	+4.05%/yr.	--	--	--	--	--	2, 45, 57
Denver, CO	--	--	--	--	--	--	--	--	44
Seattle, WA	--	--	--	--	--	--	--	--	18
Trans. Management Funds and Districts									
Berkeley, CA	--	--	--	--	--	--	--	--	1
Oxnard, CA	--	--	--	--	--	--	--	--	2
Silver Spring, MD	--	NA (NA) [19% to 26%] {NA}	1.08 to 1.17	--	--	--	--	--	69
Ventura County, CA	--	--	--	--	--	--	--	--	71
Requirements for Adequate Public Facilities									
Montgomery County, MD	--	--	--	--	--	--	--	--	1
Conditions of Approval for New Construction									

NOTE

† SOV (other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIb. EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees	Site (extent): Units	Site (extent): Parking	Site (extent): Fleet	Cost ($)
Rosarita Mexican Foods, Mesa, AZ	1989	--	--	X	--	--	229	--	--	--	--
Brown & Pain, P.A., Phoenix, AZ	1988	--	--	X	--	--	263	--	--	--	--
Childress Buick, Phoenix, AZ	1989	--	--	X	--	--	100	--	--	--	--
Sperry Flight Systems, Sperry Rand, Phoenix, AZ	--	--	--	X	--	--	--	--	--	10 vans	--
Hacienda Business Park, Alameda County, CA	--	--	X	--	--	--	8,000	--	--	--	--
Concord, CA	--	--	X	--	--	--	--	--	--	--	--
Aerospace Corporation, El Segundo, CA	--	--	--	X	--	--	--	--	--	11 vans	--
Heller Financial, Glendale, CA	1991	--	--	X	--	--	253	--	--	--	--
Allergan Company, Irvine, CA	--	--	--	X	--	--	1,300	--	--	--	--
Flour, Irvine, CA	--	--	--	X	--	--	5,200	--	--	--	--
Gotcha Sportswear, Irvine, CA	1987	--	--	X	--	--	175	--	--	--	--
Irvine Spectrum, Irvine, CA	--	--	X	--	--	--	17,000	--	--	--	--
IT Corporation, Irvine, CA	1990	--	--	X	--	--	145	--	--	--	--
Shur-lok Corporation, Irvine, CA	1989	--	--	X	--	--	174	--	--	--	--
City of La Habra, CA	1990	--	--	X	--	--	123	--	--	--	--
Lawrence Livermore National Laboratories, Livermore, CA	--	--	--	X	--	--	7,200	--	--	--	--
ARCO, Los Angeles, CA	--	--	--	X	--	--	1,500	--	--	--	--
Bechtel Power, Los Angeles, CA	--	--	--	X	--	--	7,000	--	--	--	--
Commuter Transportation Services, Los Angeles, CA	1977	--	--	X	--	--	117	--	--	--	--
UCLA, Los Angeles, CA	--	--	--	X	--	--	18,000	--	20,000	--	2,428,689/yr.
Fireman's Fund Insurance Co, Marin, CA	--	--	--	X	--	--	3,800	--	--	--	--
State Farm Insurance, Orange County, CA	--	--	--	X	--	--	--	--	--	--	--
Varian, Palo Alto, CA	--	--	--	X	--	--	5,000	--	--	--	--
Contra Costa Center, Pleasant Hill, CA	--	--	X	--	--	--	1,500	--	--	--	--
City of Pleasanton, Pleasanton, CA	Oct-84	--	X	--	--	--	--	--	--	--	--
Twentieth Century Corp., W. San Fernando, CA	--	--	--	X	--	--	1,150	--	--	--	--
Bank of America, SF, CA	--	--	--	X	--	--	10,000	--	--	--	--
Children's Hospital, SF, CA	--	--	--	X	--	--	1375	--	--	--	--
FMC Corp., San Jose, CA	--	--	--	X	--	--	5,000	--	--	--	--
Bishop Ranch, San Ramon, CA	--	--	X	--	--	--	12,500	--	--	--	--
City of Simi Valley: Public Services Center	1991	--	--	X	--	--	150	--	--	--	--
Lockheed Missles and Space Co. Sunnyvale, CA	--	--	--	X	--	--	20,000	--	--	--	--
Kinko's Service Corporation, Ventura, CA	1991	--	--	X	--	--	283	--	--	--	--
Walnut Creek, CA	--	--	X	--	--	--	--	--	--	--	--

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Action/Example	Travel Impacts							
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)
Rosarita Mexican Foods, Mesa, AZ	--	--	--	--	--	--	--	--
Brown & Pain, P.A., Phoenix, AZ	--	--	--	--	--	--	--	--
Childress Buick, Phoenix, AZ	--	--	--	--	--	--	--	--
Sperry Flight Systems, Sperry Rand, Phoenix, AZ	--	--	--	--	--	--	--	--
Hacienda Business Park, Alameda County, CA	--	--	--	--	--	--	-9.1% Veh. Trips	--
Concord, CA	--	--	--	--	--	--	--	--
Aerospace Corporation, El Segundo, CA	--	--	--	--	--	--	--	--
Heller Financial, Glendale, CA	--	--	--	--	--	--	--	--
Allergan Company, Irvine, CA	--	--	--	--	--	--	--	--
Flour, Irvine, CA	--	--	--	--	--	--	--	--
Gotcha Sportswear, Irvine, CA	--	--	--	--	--	--	--	--
Irvine Spectrum, Irvine, CA	--	--	--	--	--	--	--	--
IT Corporation, Irvine, CA	--	--	--	--	--	--	--	--
Shur-lok Corporation, Irvine, CA	--	--	--	--	--	--	--	--
City of La Habra, CA	--	--	--	--	--	--	--	--
Lawrence Livermore National Laboratories, Livermore, CA	--	--	--	--	--	--	--	--
ARCO, Los Angeles, CA	--	--	--	--	--	--	-19.1% Veh. Trips	--
Bechtel Power, Los Angeles, CA	--	--	--	--	--	--	--	--
Commuter Transportation Services, Los Angeles, CA	--	--	--	--	--	--	--	--
UCLA, Los Angeles, CA	-42,641/day (-26,496/day)	--	--	--	--	--	-5.5% Veh. Trips	--
Fireman's Fund Insurance Co, Marin, CA	--	--	--	--	--	--	--	--
State Farm Insurance, Orange County, CA	--	--	--	--	--	--	-22% (Veh. Trips/100 Emp.)	--
Varian, Palo Alto, CA	--	--	--	--	--	--	--	--
Contra Costa Center, Pleasant Hill, CA	--	--	--	--	--	--	--	--
City of Pleasanton, Pleasanton, CA	--	--	--	--	--	--	-4.8% Veh. Trips	--
Twentieth Century Corp., W. San Fernando, CA	--	--	--	--	--	--	--	--
Bank of America, SF, CA	--	--	--	--	--	--	--	--
Children's Hospital, SF, CA	--	--	--	--	--	16% to 20%	--	--
FMC Corp., San Jose, CA	--	--	--	--	--	--	--	--
Bishop Ranch, San Ramon, CA	--	--	--	--	--	--	-16.6% Veh. Trips	--
City of Simi Valley: Public Services Center	--	--	--	--	--	--	--	--
Lockheed Missles and Space Co. Sunnyvale, CA	--	--	--	--	--	--	--	--
Kinko's Service Corporation, Ventura, CA	--	--	--	--	--	--	--	--
Walnut Creek, CA	--	--	--	--	--	--	--	--

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

	Travel Impacts (Cont'd)			Emission Impacts					
Action/Example	Mode Shift†	Rideshare*	Occ.	CO kg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Rosarita Mexican Foods, Mesa, AZ	67% (33%)	--	--	--	--	--	--	--	71
Brown & Pain, P.A., Phoenix, AZ	76% (24%)	--	--	--	--	--	--	--	71
Childress Buick, Phoenix, AZ	77% (23%)	--	--	--	--	--	--	--	71
Sperry Flight Systems, Sperry Rand, Phoenix, AZ	--	--	--	--	--	--	--	--	43
Hacienda Business Park, Alameda County, CA	--	--	--	--	--	--	--	--	66
Concord, CA	73% (27%)	--	--	--	--	--	--	--	57
Aerospace Corporation, El Segundo, CA	--	--	--	--	--	--	--	--	43
Heller Financial, Glendale, CA	65% (35%)	--	--	--	--	--	--	--	71
Allergan Company, Irvine, CA	--	10% (9%) [NA] {NA}	--	--	--	--	--	--	46
Flour, Irvine, CA	--	+17% (+23%) [NA] {NA}	--	--	--	--	--	--	44
Gotcha Sportswear, Irvine, CA	60% (40%)	--	--	--	--	--	--	--	71
Irvine Spectrum, Irvine, CA	82% (18%)	--	--	--	--	--	--	--	46
IT Corporation, Irvine, CA	80% (20%)	--	--	--	--	--	--	--	71
Shur-lok Corporation, Irvine, CA	78% (22%)	--	--	--	--	--	--	--	71
City of La Habra, CA	60% (40%)	--	--	--	--	--	--	--	71
Lawrence Livermore National Laboratories, Livermore, CA	51% (49%)	NA (53) [NA] {NA}	--	--	--	--	--	--	19
ARCO, Los Angeles, CA	--	NA (55) [NA] {NA}	--	--	--	--	--	--	48, 66
Bechtel Power, Los Angeles, CA	50% (50 %)	--	--	--	--	--	--	--	48
Commuter Transportation Services, Los Angeles, CA	58% (42%)	--	--	--	--	--	--	--	71
UCLA, Los Angeles, CA	--	NA (65) [NA] {NA}	--	--	--	--	--	--	1, 66
Fireman's Fund Insurance Co, Marin, CA	--	840 (29) [4] {NA}	--	--	--	--	--	--	19
State Farm Insurance, Orange County, CA	--	--	--	--	--	--	--	--	48
Varian, Palo Alto, CA	82% to 63% (NA)	--	--	--	--	--	--	--	46
Contra Costa Center, Pleasant Hill, CA	78% to 70% (NA)	--	--	--	--	--	--	--	46, 57
City of Pleasanton, Pleasanton, CA	81% to 84% (NA)	--	--	--	--	--	--	--	46, 57, 65, 66
Twentieth Century Corp., W. San Fernando, CA	90% to 65% (NA)	6% to 31% (NA) [NA] {NA}	--	--	--	--	--	--	46
Bank of America, SF, CA	--	200 (9) [NA] {NA}	--	--	--	--	--	--	19
Children's Hospital, SF, CA	NA (+16%)	55 (3) [NA] {NA}	--	--	--	--	--	--	19, 37
FMC Corp., San Jose, CA	85% to 79% (NA)	--	--	--	--	--	--	--	46
Bishop Ranch, San Ramon, CA	55% to 70% (NA)	--	--	--	--	--	--	--	46, 57, 66
City of Simi Valley: Public Services Center	48% (52%)	--	--	--	--	--	--	--	71
Lockheed Missles and Space Co. Sunnyvale, CA	--	NA (NA) [NA] {2,000}	--	--	--	--	--	--	19
Kinko's Service Corporation, Ventura, CA	70% (30%)	--	--	--	--	--	--	--	71
Walnut Creek, CA	90% to 85% (NA)	--	--	--	--	--	--	--	57

NOTE

† SOV (Other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees	Site (extent): Units	Site (extent): Parking	Site (extent): Fleet	Cost ($)
Coors Company, Golden, CO	--	--	--	X	--	--	6,000	--	--	--	--
Rockwell International, Golden, CO	--	--	--	X	--	--	--	--	--	--	--
Cobe Labs, Lakewood, CO	--	--	--	X	--	--	1,300	--	--	--	--
Hartford, CT	--	--	X	--	--	--	--	--	--	--	--
Hartford Steam Boiler, Hartford, CT	--	--	--	X	--	--	--	--	--	--	--
Travelers Insurance Co., Hartford, CT	--	--	--	--	--	--	--	--	--	--	--
Montgomery Ward, Chicago, IL	--	--	--	X	--	--	--	--	--	6 vans	--
Employees Reassurance Corp., Overland Park, KS	--	--	--	X	--	--	575	--	--	--	--
Rock Spring Park, Montgomery Co, MD	--	--	X	--	--	--	12,000	--	--	--	--
US Nuclear Regulatory Commission, Montgomery Co., MD	--	--	--	X	--	--	2,450	--	--	--	35,506/yr.
Hallmark Cards, Kansas City, MO	--	--	--	X	--	--	5,000	--	--	--	--
3M Company, Maplewood, MN	--	--	--	X	--	--	12,000	--	--	--	--
Cenex Corporation, Minneapolis, MN	--	--	--	X	--	--	--	--	--	17 vans	--
General Mills, Minneapolis, MN	--	--	--	X	--	--	--	--	--	16 vans	--
Cargill, Inc., Minnetonka, MN	--	--	--	X	--	--	2,000	--	--	--	--
3M Company, St. Paul, MN	--	--	--	X	--	--	12,700	--	--	--	--
AT&T, Bedminister, NJ	--	--	--	X	--	--	3,500	--	--	--	--
Hoffman LaRoche Inc., Nutley, NJ	--	--	--	X	--	--	--	--	--	10 vans	--
FMC Corp., Princeton Area, NJ	--	--	--	X	--	--	700	--	--	--	--
Corning Glass Company, Corning, NY	--	--	--	X	--	--	--	--	--	10 vans	--
Tennessee Valley Authority, Knoxville, TN	--	--	--	X	--	--	4,200	--	--	--	--
Cooper and Woodruff, Amarillo, TX	--	--	--	X	--	--	--	--	--	9 vans	--
Texas Instruments, Dallas, TX	--	--	--	X	--	--	--	--	--	10 vans	--
Brown & Root, Houston, TX	--	--	--	X	--	--	4,400	--	--	--	--
Conoco, Houston, TX	--	--	--	X	--	--	2,300	--	--	--	--
Panhandle Eastern Corporation, Houston, TX	--	--	--	X	--	--	--	--	--	--	--
USAA, San Antonio, TX	--	--	--	X	--	--	4,500	--	--	--	--
Irving Paper Mills, Brattleboro, VT	--	--	--	X	--	--	--	--	--	6 vans	--
Bellevue City Hall, Bellevue, WA	--	--	--	X	--	--	450	--	--	--	--
CH2M HILL, Bellevue, WA	1985	--	--	X	--	--	400	--	--	--	--
Pacific Northwest Bell, Bellevue, WA	--	--	--	X	--	--	1,150	--	--	--	--
US WEST, formerly Pacific Northwest Bell, Bellevue, WA	1981	--	--	X	--	--	1,150	--	408	--	27,625/yr.
Pacific Pipeline, Kent, WA	1993	--	--	X	--	--	138	--	--	--	--
King County, WA	--	--	X	--	--	--	--	--	--	--	--

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

	Travel Impacts							
Action/Example	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)
Coors Company, Golden, CO	--	--	--	--	--	--	--	--
Rockwell International, Golden, CO	--	--	--	--	--	--	--	--
Cobe Labs, Lakewood, CO	--	--	--	--	--	--	--	--
Hartford, CT	--	--	--	--	--	--	-2.4% Veh. Trips	--
Hartford Steam Boiler, Hartford, CT	--	--	--	--	--	--	-13.6% Veh. Trips	--
Travelers Insurance Co., Hartford, CT	--	--	--	--	--	--	-25.4% Veh. Trips	--
Montgomery Ward, Chicago, IL	--	--	--	--	--	--	--	--
Employees Reassurance Corp., Overland Park, KS	--	--	--	--	--	--	--	--
Rock Spring Park, Montgomery Co, MD	--	--	--	--	--	--	-220 Peak Hour Veh. Trips	--
US Nuclear Regulatory Commission, Montgomery Co., MD	-20,231/day (-12,571/day)	--	--	--	--	--	--	--
Hallmark Cards, Kansas City, MO	--	--	--	--	--	--	--	--
3M Company, Maplewood, MN	--	--	--	--	--	--	--	--
Cenex Corporation, Minneapolis, MN	--	--	--	--	--	--	--	--
General Mills, Minneapolis, MN	--	--	--	--	--	--	--	--
Cargill, Inc., Minnetonka, MN	--	--	--	--	--	--	--	--
3M Company, St. Paul, MN	--	--	--	--	--	--	-9.7% Veh. Trips	--
AT&T, Bedminister, NJ	--	--	--	--	--	--	--	--
Hoffman LaRoche Inc., Nutley, NJ	--	--	--	--	--	--	--	--
FMC Corp., Princeton Area, NJ	--	--	--	--	--	--	--	--
Corning Glass Company, Corning, NY	--	--	--	--	--	--	--	--
Tennessee Valley Authority, Knoxville, TN	-48,129/day (-29,906/day)	--	--	--	--	--	--	--
Cooper and Woodruff, Amarillo, TX	--	--	--	--	--	--	--	--
Texas Instruments, Dallas, TX	--	--	--	--	--	--	--	--
Brown & Root, Houston, TX	--	--	--	--	--	--	--	--
Conoco, Houston, TX	--	--	--	--	--	--	--	--
Panhandle Eastern Corporation, Houston, TX	--	--	--	--	--	--	--	--
USAA, San Antonio, TX	--	--	--	--	--	--	--	--
Irving Paper Mills, Brattleboro, VT	--	--	--	--	--	--	--	--
Bellevue City Hall, Bellevue, WA	--	--	--	--	--	--	--	--
CH2M HILL, Bellevue, WA	--	--	--	--	--	--	-31.2% Veh. Trips	--
Pacific Northwest Bell, Bellevue, WA	--	--	--	--	--	--	--	--
US WEST, formerly Pacific Northwest Bell, Bellevue, WA	-28,988/day (-18,012/day)	--	--	--	--	--	-47.6% Veh. Trips	--
Pacific Pipeline, Kent, WA	--	--	--	--	--	--	--	--
King County, WA	--	--	--	--	--	--	--	--

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Action/Example	Travel Impacts (Cont'd) Mode Shift †	Rideshare*	Occ.	Emission Impacts CO kg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Coors Company, Golden, CO	84% (16%)	NA (18) [NA] {NA}	--	--	--	--	--	--	46
Rockwell International, Golden, CO	--	--	--	--	--	--	--	--	2
Cobe Labs, Lakewood, CO	--	--	--	--	--	--	--	--	46
Hartford, CT	--	--	--	--	--	--	--	--	66
Hartford Steam Boiler, Hartford, CT	--	--	--	--	--	--	--	--	66
Travelers Insurance Co., Hartford, CT	--	--	--	--	--	--	--	--	48, 66
Montgomery Ward, Chicago, IL	--	--	--	--	--	--	--	--	43
Employees Reassurance Corp., Overland Park, KS	83% (17%)	--	--	--	--	--	--	--	46
Rock Spring Park, Montgomery Co, MD	--	--	--	--	--	--	--	--	46
US Nuclear Regulatory Commission, Montgomery Co., MD	54% to 42% (NA)	--	--	--	--	--	--	--	1, 24, 26, 46
Hallmark Cards, Kansas City, MO	--	+26% (+12%) [NA] {NA}	--	--	--	--	--	--	44
3M Company, Maplewood, MN	90% (10%)	--	--	--	--	--	--	--	46
Cenex Corporation, Minneapolis, MN	--	--	--	--	--	--	--	--	43
General Mills, Minneapolis, MN	--	--	--	--	--	--	--	--	43
Cargill, Inc., Minnetonka, MN	87% (13%)	--	--	--	--	--	--	--	46
3M Company, St. Paul, MN	--	22% (9%) [NA] {NA}	--	--	--	--	--	--	4, 66
AT&T, Bedminister, NJ	--	+18% (+25%) [NA] {NA}	--	--	--	--	--	--	44
Hoffman LaRoche Inc., Nutley, NJ	--	--	--	--	--	--	--	--	43
FMC Corp., Princeton Area, NJ	--	--	--	--	--	--	--	--	46
Corning Glass Company, Corning, NY	--	--	--	--	--	--	--	--	43
Tennessee Valley Authority, Knoxville, TN	18% (82%)	NA (92) [28] {NA}	--	--	--	--	--	--	44
Cooper and Woodruff, Amarillo, TX	--	--	--	--	--	--	--	--	43
Texas Instruments, Dallas, TX	--	--	--	--	--	--	--	--	43
Brown & Root, Houston, TX	--	+11% (+33%) [NA] {NA}	--	--	--	--	--	--	44
Conoco, Houston, TX	--	+25% (+40%) [NA] {NA}	--	--	--	--	--	--	44
Panhandle Eastern Corporation, Houston, TX	--	--	--	--	--	--	--	--	JAC
USAA, San Antonio, TX	--	+23% (+33%) [NA] {NA}	--	--	--	--	--	--	44
Irving Paper Mills, Brattleboro, VT	--	--	--	--	--	--	--	--	43
Bellevue City Hall, Bellevue, WA	75% to 58% (NA)	--	--	--	--	--	--	--	46
CH2M HILL, Bellevue, WA	52% (48%)	--	--	--	--	--	--	--	11, 46, 66, 71
Pacific Northwest Bell, Bellevue, WA	--	65% (NA) [NA] {NA}	--	--	--	--	--	--	46
US WEST, formerly Pacific Northwest Bell, Bellevue, WA	25.7% (12.8%)	44.7% (1.8%) [NA] {NA}	--	--	--	--	--	--	1, 66
Pacific Pipeline, Kent, WA	69% (31%)	--	--	--	--	--	--	--	71
King County, WA	NA (+5.5%)	--	--	--	--	--	--	--	27

NOTE

† SOV (Other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees	Site (extent): Units	Site (extent): Parking	Site (extent): Fleet	Cost ($)
Kirkland City Hall, Kirkland, WA	1989	--	--	X	--	--	287	--	--	--	--
Boeing Company, Seattle, WA	--	--	--	X	--	--	--	--	--	--	--
Bonneville Power Administration, Seattle, WA	1989	--	--	X	--	--	100	--	--	--	--
Johnson & Higgins, Seattle, WA	1991	--	--	X	--	--	182	--	--	--	--
Puget Sound Blood Center, Seattle, WA	1987	--	--	X	--	--	200	--	--	--	--
Walker, Richer & Quinn, Seattle, WA	1989	--	--	X	--	--	206	--	--	--	--
William M. Mercer, Inc., Seattle, WA	1982	--	--	X	--	--	120	--	--	--	--
U-PASS Demonstration Project, University of Washington and the City of Seattle	Oct-91	--	X	--	--	--	--	--	--	--	2,467,000/yr.

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

	Travel Impacts							
Action/Example	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)
Kirkland City Hall, Kirkland, WA	--	--	--	--	--	--	--	--
Boeing Company, Seattle, WA	--	--	--	--	--	--	--	--
Bonneville Power Administration, Seattle, WA	--	--	--	--	--	--	--	--
Johnson & Higgins, Seattle, WA	--	--	--	--	--	--	--	--
Puget Sound Blood Center, Seattle, WA	--	--	--	--	--	--	--	--
Walker, Richer & Quinn, Seattle, WA	--	--	--	--	--	--	--	--
William M. Mercer, Inc., Seattle, WA	--	--	--	--	--	--	--	--
U-PASS Demonstration Project, University of Washington and the City of Seattle	--	--	--	--	--	--	-15% Veh. Trips to Campus	--

TABLE A-IIIb (CONT'D). EMPLOYER-BASED TRANSPORTATION MGMT. PROGRAMS

	Travel Impacts (Cont'd)			Emission Impacts					
Action/Example	Mode Shift †	Rideshare *	Occ.	CO kg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Kirkland City Hall, Kirkland, WA	68% (32%)	--	--	--	--	--	--	--	71
Boeing Company, Seattle, WA	--	--	--	--	--	--	--	--	2
Bonneville Power Administration, Seattle, WA	54% (46%)	--	--	--	--	--	--	--	71
Johnson & Higgins, Seattle, WA	23% (77%)	--	--	--	--	--	--	--	71
Puget Sound Blood Center, Seattle, WA	34% (66%)	--	--	--	--	--	--	--	71
Walker, Richer & Quinn, Seattle, WA	73% (27%)	--	--	--	--	--	--	--	71
William M. Mercer, Inc., Seattle, WA	33% (67%)	--	--	--	--	--	--	--	71
U-PASS Demonstration Project, University of Washington and the City of Seattle	33% to 23% (21% to 33%)	+21% (NA) [NA] {NA}	--	--	--	--	--	--	64

<u>NOTE</u>

† SOV (Other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIc. WORK SCHEDULE CHANGES

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. † of Employees	Units	Parking	Fleet	
Telecommuting											
Best Western Hotel Chain, Phoenix, AZ	--	--	--	X	--	--	53 (NA)	--	--	--	--
Neighborhood Work Center, Phoenix, AZ	--	--	--	X	--	--	--	--	--	--	--
Lerner Architectural Firm, CA	--	--	--	X	--	--	--	--	--	--	--
Pacific Bell, CA	--	--	--	X	--	--	--	--	--	--	--
Hughes Aircraft, El Segundo, CA	--	--	--	X	--	--	25 (NA)	--	--	--	--
SCAQMD, Los Angeles, CA	--	--	--	X	--	--	30 (NA)	--	--	--	--
Rockwell Intl., Newport Beach, CA	--	--	--	X	--	--	20 (NA)	--	--	--	--
Chadwell & Kayser Ltd., Chicago, IL	--	--	--	X	--	--	1 (NA)	--	--	--	--
Control Data Corporation, Minneapolis, MN	--	--	--	X	--	--	100 (NA)	--	--	--	--
NYNEX, New York, NY	--	--	--	X	--	--	18 (NA)	--	--	--	--
Lerner Architectural Firm, NY	--	--	--	X	--	--	--	--	--	--	--
Blue Cross/Blue Shield, SC	--	--	--	X	--	--	16 (NA)	--	--	--	--
Home											
California Telecommuting Pilot Project	1985	--	X	--	--	--	200 (NA)	--	--	--	--
Southern California Association of Governments	1986	--	--	X	--	--	18 (NA)	--	--	--	0.19/occasion
Puget Sound Demonstration, WA	--	--	X	--	--	--	200 - 300 (NA)	--	--	--	--
Work Center											
Los Angeles County, Los Angeles, CA	--	--	--	--	--	--	1,700 (NA)	123 wrksta.	--	--	--
Hawaii Telework Center Demonstration, HI	14-Jul-89	--	X	--	--	--	32 (NA)	--	--	--	--
Puget Sound Demonstration, WA	--	--	X	--	--	--	200 - 300 (NA)	--	--	--	--
Flex Time											
Xerox Corporation, Palo Alto, CA	--	--	--	X	--	--	--	--	--	--	--
Flextime Demonstration Project, San Francisco, CA	--	--	X	--	--	--	6,000 or 2.3% (NA)	--	--	--	--
San Francisco, CA	1979	--	--	--	--	--	15,000 (NA)	--	--	--	--
U.S. DOT, Cambridge, MA	--	--	--	X	--	--	600 (NA)	--	--	--	--
Tennessee Valley Authority, Knoxville, TN	--	--	--	--	--	--	--	--	--	--	--
Seattle, WA	1979	--	--	--	--	--	6,000 (NA)	--	--	--	--

NOTE

† Participating (Total Number)

TABLE A-IIIc (CONT'D). WORK SCHEDULE CHANGES

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare *	Occ.
Telecommuting											
Best Western Hotel Chain, Phoenix, AZ	--	--	--	--	--	--	--	--	--	--	--
Neighborhood Work Center, Phoenix, AZ	--	--	--	--	--	--	--	--	--	--	--
Lerner Architectural Firm, CA	--	--	--	--	--	--	--	--	--	--	--
Pacific Bell, CA	--	--	--	--	--	--	--	--	--	--	--
Hughes Aircraft, El Segundo, CA	--	--	--	--	--	--	--	--	--	--	--
SCAQMD, Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
Rockwell Intl., Newport Beach, CA	--	--	--	--	--	--	--	--	--	--	--
Chadwell & Kayser Ltd., Chicago, IL	--	--	--	--	--	--	--	--	--	--	--
Control Data Corporation, Minneapolis, MN	--	--	--	--	--	--	--	--	--	--	--
NYNEX, New York, NY	--	--	--	--	--	--	--	--	--	--	--
Lerner Architectural Firm, NY	--	--	--	--	--	--	--	--	--	--	--
Blue Cross/Blue Shield, SC	--	--	--	--	--	--	--	--	--	--	--
Home											
California Telecommuting Pilot Project	--	--	--	--	--	--	--	--	--	--	--
Southern California Association of Governments	-42/day (-26/day)	--	--	--	--	--	--	-4.9/day (-1.3/day)	--	--	--
Puget Sound Demonstration, WA	--	--	--	--	--	--	--	--	--	--	--
Work Center											
Los Angeles County, Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
Hawaii Telework Center Demonstration, HI	--	--	--	--	--	--	--	-29%	--	--	--
Puget Sound Demonstration, WA	--	--	--	--	--	--	--	--	--	--	--
Flex Time											
Xerox Corporation, Palo Alto, CA	--	--	--	--	--	--	--	--	--	--	--
Flextime Demonstration Project, San Francisco, CA	--	--	--	--	-6 to -9 min./trip	--	--	--	--	--	--
San Francisco, CA	--	--	--	--	--	--	--	--	--	--	--
U.S. DOT, Cambridge, MA	--	--	--	--	--	+1%	--	-9%	+9% (NA)	+2% (NA) [NA] {NA}	--
Tennessee Valley Authority, Knoxville, TN	--	--	--	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--

NOTE

† SOV (Other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIc (CONT'D). WORK SCHEDULE CHANGES

Action/Example	Emission Impacts: CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Telecommuting						
Best Western Hotel Chain, Phoenix, AZ	--	--	--	--	--	44
Neighborhood Work Center, Phoenix, AZ	--	--	--	--	--	44
Lerner Architectural Firm, CA	--	--	--	--	--	44
Pacific Bell, CA	--	--	--	--	--	22, 44
Hughes Aircraft, El Segundo, CA	--	--	--	--	--	44
SCAQMD, Los Angeles, CA	--	--	--	--	--	1
Rockwell Intl., Newport Beach, CA	--	--	--	--	--	44
Chadwell & Kayser Ltd., Chicago, IL	--	--	--	--	--	44
Control Data Corporation, Minneapolis, MN	--	--	--	--	--	44
NYNEX, New York, NY	--	--	--	--	--	44
Lerner Architectural Firm, NY	--	--	--	--	--	44
Blue Cross/Blue Shield, SC	--	--	--	--	--	44
Home						
California Telecommuting Pilot Project	--	--	--	--	--	1
Southern California Association of Governments	--	--	--	--	--	1
Puget Sound Demonstration, WA	--	--	--	--	--	1
Work Center						
Los Angeles County, Los Angeles, CA	--	--	--	--	--	1, 22
Hawaii Telework Center Demonstration, HI	--	--	--	--	--	1, 22
Puget Sound Demonstration, WA	--	--	--	--	--	1
Flex Time						
Xerox Corporation, Palo Alto, CA	--	--	--	--	--	2
Flextime Demonstration Project, San Francisco, CA	--	--	--	--	--	20, 24
San Francisco, CA	--	--	--	--	--	44
U.S. DOT, Cambridge, MA	--	--	--	--	--	31
Tennessee Valley Authority, Knoxville, TN	--	--	--	--	--	1
Seattle, WA	--	--	--	--	--	44

TABLE A-IIIc (CONT'D). WORK SCHEDULE CHANGES

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees †	Units	Parking	Fleet	
Staggered Work Hours											
Riverside, CA	1972	--	--	--	--	--	1,200 (NA)	--	--	--	--
Lockheed Company, Sunnyvale, CA	--	--	--	X	--	--	--	--	--	--	--
Washington, DC	--	--	--	--	--	--	200,000 (NA)	--	--	--	--
Honolulu, HI	1988	--	X	--	--	--	3,500 (7,100)	--	--	--	--
3M Company, St. Paul, MN	--	--	--	X	--	--	--	--	--	--	--
Newark, NJ	1973	--	X	--	--	--	1,000 (NA)	--	--	--	--
New York, NY	1970	--	X	--	--	--	220,000 (NA)	--	--	--	--
Houston, TX	--	--	--	--	--	--	--	--	--	--	--
Crystal City, VA	--	--	--	--	--	--	--	--	--	--	--
Madison, WI	--	--	--	--	--	--	5,000 (NA)	--	--	--	--
Compressed Work Week											
Denver, CO	--	--	--	--	--	--	7,000 (30,000)	--	--	--	--
NY State University, Albany, NY	--	--	--	X	--	--	NA (10,000)	--	--	--	--

NOTE
† Participating (Total Number)

TABLE A-IIIc (CONT'D). WORK SCHEDULE CHANGES

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare *	Occ.
Staggered Work Hours											
Riverside, CA	--	--	--	--	--	--	--	--	--	--	--
Lockheed Company, Sunnyvale, CA	--	--	--	--	--	--	--	--	--	--	--
Washington, DC	--	--	--	--	--	--	--	--	--	--	--
Honolulu, HI	--	--	--	--	-10%	--	--	--	--	--	--
3M Company, St. Paul, MN	--	--	--	--	--	--	--	--	--	--	--
Newark, NJ	--	--	--	--	--	--	--	--	--	--	--
New York, NY	--	--	--	--	--	--	--	--	--	--	--
Houston, TX	--	--	--	--	--	--	--	--	--	--	--
Crystal City, VA	--	--	--	--	--	--	--	--	--	--	--
Madison, WI	--	--	--	--	--	--	--	--	--	--	--
Compressed Work Week											
Denver, CO	--	--	--	--	--	--	--	--	--	--	--
NY State University, Albany, NY	--	--	--	--	--	--	--	--	--	--	--

NOTE

† SOV (Other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIc (CONT'D). WORK SCHEDULE CHANGES

Action/Example	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Staggered Work Hours						
Riverside, CA	--	--	--	--	--	44
Lockheed Company, Sunnyvale, CA	--	--	--	--	--	2
Washington, DC	--	--	--	--	--	44
Honolulu, HI	--	--	--	--	--	32
3M Company, St. Paul, MN	--	--	--	--	--	4
Newark, NJ	--	--	--	--	--	25
New York, NY	--	--	--	--	--	25
Houston, TX	--	--	--	--	--	44
Crystal City, VA	--	--	--	--	--	44
Madison, WI	--	--	--	--	--	44
Compressed Work Week						
Denver, CO	--	--	--	--	--	48
NY State University, Albany, NY	--	--	--	--	--	5

TABLE A-IIId. AREAWIDE RIDESHARE INCENTIVES

		Type			Site (extent)						
Action/Example	Implementation Date	Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees †	Units	Parking	Fleet	Cost ($)
Areawide Commute Management											
Organizations											
Maricopa County Vanpool Program, Phoenix, AZ	--	--	X	--	--	--	--	--	--	--	--
Commuter Transportation Services, Inc., formerly Commuter Computer, Los Angeles, CA	1974	--	--	--	--	--	250,000 (NA)	1,800 Bsn.	--	--	--
Sacramento, CA	--	--	X	--	--	--	--	--	--	--	--
Golden Gate Bridge, Highway and Transportation District, San Francisco, CA	1977	--	X	--	--	--	--	--	--	--	--
RIDES for Bay Area Commuters, San Francisco, CA	--	--	X	--	--	--	--	--	--	--	--
Greater Hartford Ridesharing Corporation, Inc, Hartford, CT	--	--	X	--	--	--	--	--	--	--	--
CARAVAN, Boston, MA	--	--	X	--	--	--	--	--	--	--	--
Montgomery County Rideshare, MD	--	--	X	--	--	--	--	--	--	--	--
Transportation Action Partnership of North Bethesda, Inc., MD	1987	--	X	--	--	--	--	--	--	--	--
RIDESHARE, Minneapolis-St. Paul, MN	--	--	X	--	--	--	--	--	--	--	--
New York City, NY	--	--	X	--	--	--	--	--	--	--	--
Metropolitan Area Carpool Project, Portland, OR	--	--	X	--	--	--	--	--	--	--	--
Engineering Dept. and Metro, Seattle, WA	--	--	--	X	--	--	--	--	--	--	--
Transportation Management											
Associations											
Werner Cener TMO, San Fernando Valley, CA	--	--	X	--	--	--	28,000 (40,000)	--	--	--	--
Tax Incentives and Subsidy Programs											
California	1988	--	X	--	--	--	--	--	--	--	--
Montgomery County, MD	--	--	X	--	--	--	--	--	--	--	--

NOTE

† Participating (Total Number)

TABLE A-IIId (CONT'D). AREAWIDE RIDESHARE INCENTIVES

Action/Example	Travel Impacts							
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh Removed	Fuel Cons. ltr (gal)
Areawide Commute Management								
Organizations								
Maricopa County Vanpool Program, Phoenix, AZ	-765,011 (-475,355)	--	--	--	--	--	--	-89,972 (-23,768)
Commuter Transportation Services, Inc., formerly Commuter Computer, Los Angeles, CA	-4.5B (-2.8B) from 1974-1992	--	--	--	--	--	--	-587M (-155M) from 1974-1992
Sacramento, CA	-9,280,300/yr. (-5,766,500/yr.)	--	--	--	--	--	--	-1,679,200/yr. (-443,600/yr.)
Golden Gate Bridge, Highway and Transportation District, San Francisco, CA	--	--	--	--	--	--	--	--
RIDES for Bay Area Commuters, San Francisco, CA	--	--	--	--	--	--	--	--
Greater Hartford Ridesharing Corporation, Inc, Hartford, CT	-80,000,000 (-50,000,000)	--	--	--	--	--	--	-11,000,000 (-3,000,000)
CARAVAN, Boston, MA	--	--	--	--	--	--	--	--
Montgomery County Rideshare, MD	--	--	--	--	--	--	--	--
Transportation Action Partnership of North Bethesda, Inc., MD	--	--	--	--	--	--	--	--
RIDESHARE, Minneapolis-St. Paul, MN	--	--	--	--	--	--	--	--
New York City, NY	--	--	--	--	--	--	--	--
Metropolitan Area Carpool Project, Portland, OR	--	--	--	--	--	--	-13,169/day	--
Engineering Dept. and Metro, Seattle, WA	--	--	--	--	--	--	--	--
Transportation Management								
Associations								
Werner Cener TMO, San Fernando Valley, CA	--	--	--	--	--	--	--	--
Tax Incentives and Subsidy Programs								
California	--	--	--	--	--	--	--	--
Montgomery County, MD	--	--	--	--	--	--	--	--

TABLE A-IIId (CONT'D). AREAWIDE RIDESHARE INCENTIVES

Action/Example	Travel Impacts (Cont'd) Mode Shift	Travel Impacts (Cont'd) Rideshare *	Travel Impacts (Cont'd) Occ.	Emission Impacts CO Mg (tons)	Emission Impacts O3 Mg (tons)	Emission Impacts HC Mg (tons)	Emission Impacts NOx Mg (tons)	Emission Impacts Overall Mg (tons)	References
Areawide Commute Management									
Organizations									
Maricopa County Vanpool Program, Phoenix, AZ	--	NA (13) [NA] {NA}	--	--	--	--	--	--	9
Commuter Transportation Services, Inc., formerly Commuter Computer, Los Angeles, CA	--	--	--	--	--	--	--	-70,000 (-80,000) from 1974-1992	1
Sacramento, CA	--	NA (NA) [NA] {1,310}	--	--	--	--	--	--	4
Golden Gate Bridge, Highway and Transportation District, San Francisco, CA	--	NA (35) [27] {NA}	--	--	--	--	--	--	19
RIDES for Bay Area Commuters, San Francisco, CA	--	NA (505) [NA] {29,000}	--	--	--	--	--	--	19
Greater Hartford Ridesharing Corporation, Inc, Hartford, CT	--	1,725 (180) [NA] {NA}	--	--	--	--	--	--	7
CARAVAN, Boston, MA	--	--	--	--	--	--	--	--	2
Montgomery County Rideshare, MD	--	--	--	--	--	--	--	--	1, 4
Transportation Action Partnership of North Bethesda, Inc., MD	--	--	--	--	--	--	--	--	1
RIDESHARE, Minneapolis-St. Paul, MN	--	--	--	--	--	--	--	--	2
New York City, NY	--	--	--	--	--	--	--	--	3
Metropolitan Area Carpool Project, Portland, OR	--	NA (NA) [NA] {22,007}	--	--	--	--	--	--	4
Engineering Dept. and Metro, Seattle, WA	--	--	--	--	--	--	--	--	3
Transportation Management									
Associations									
Werner Cener TMO, San Fernando Valley, CA	--	--	--	--	--	--	--	--	1
Tax Incentives and Subsidy Programs									
California	--	--	--	--	--	--	--	--	1
Montgomery County, MD	--	--	--	--	--	--	--	--	1

NOTE

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIe. IMPROVED PUBLIC TRANSIT

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
System/Service Expansion											
Fixed Guideway Transit											
Fixed Route and Express Bus Service											
Midvale Park/Drexel Heights, Tucson, AZ	Late 1980s	--	X	--	--	--	--	--	--	--	--
Northwest Area Express, Tucson, AZ	Late 1980s	--	X	--	--	--	--	--	--	--	--
Circumferential and Local Bus Service											
Paratransit Programs											
Ventura Freeway Vanpool Support Program, Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	300,000
Los Angeles County Route 14 Vanpool and Buspool Demonstration Project	Aug-91 to Jul-93	X	--	--	--	--	--	--	--	--	150, 535
Space Coast Area Transit, Brevard Co., FL	--	--	--	--	--	--	--	--	--	--	--
System/Service Oper. Improvements											
Feeder Bus Service											
Express Bus Service											
Bus Route and Schedule Modifications											
E. Valley Sweeper Service, Tucson, AZ	Late 1980s	--	X	--	--	--	--	--	--	--	--
Improved Transfers											
Portland, OR	--	--	--	--	--	--	--	--	--	--	--
Schedule Coordination											
Bus Traffic Signal Preemption											
Ventura Blvd., Los Angeles, CA	Jun-83	X	--	--	16 (10)	--	--	--	--	--	920,000
Kent State Univ., Kent, OH	--	--	X	--	--	--	--	--	--	--	--
Road Operational Changes											
Lincoln-Broadway Corridor, Denver, CO	1975	X	--	--	--	--	--	--	--	--	--
Louisville, KY	--	--	--	--	--	--	--	--	--	--	--
Operations Monitoring											
Maintenance Improvements											
Park-and-Ride Service											
Subscription Bus Service											
Denver RTD, Denver, CO	--	--	X	--	--	--	--	--	--	--	--
(Tidewater Regional Transit), Norfolk, VA	--	--	X	--	--	--	--	--	--	150 vans	--

TABLE A-IIIe (CONT'D). IMPROVED PUBLIC TRANSIT

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift	Rideshare *	Occ.
<u>System/Service Expansion</u>											
<u>Fixed Guideway Transit</u>											
<u>Fixed Route and Express Bus Service</u>											
Midvale Park/Drexel Heights, Tucson, AZ	--	--	--	--	--	187/day	-150/day	--	--	--	--
Northwest Area Express, Tucson, AZ	--	--	--	--	--	124/day	-150/day	--	--	--	--
<u>Circumferential and Local Bus Service</u>											
<u>Paratransit Programs</u>											
Ventura Freeway Vanpool Support Program, Los Angeles, CA	--	--	--	--	--	--	--	--	--	NA (23) [NA] {NA}	--
Los Angeles County Route 14 Vanpool and Buspool Demonstration Project	Est. -15,361,843/yr. (-9,545,388/yr.)	--	--	--	--	--	--	--	--	--	--
Space Coast Area Transit, Brevard Co., FL	--	--	--	--	--	--	--	--	--	--	--
<u>System/Service Oper. Improvements</u>				--							
<u>Feeder Bus Service</u>											
<u>Express Bus Service</u>											
<u>Bus Route and Schedule Modifications</u>											
E. Valley Sweeper Service, Tucson, AZ	--	--	--	--	--	39/day	-30/day	--	--	--	--
<u>Improved Transfers</u>											
Portland, OR	--	--	--	--	--	--	--	--	--	--	--
<u>Schedule Coordination</u>											
<u>Bus Traffic Signal Preemption</u>											
Ventura Blvd., Los Angeles, CA	--	--	-22%	--	+4%	--	--	--	--	--	--
Kent State Univ., Kent, OH	--	--	-10%	--	--	--	--	--	--	--	--
<u>Road Operational Changes</u>											
Lincoln-Broadway Corridor, Denver, CO	--	--	--	--	--	+10-13%	--	--	--	--	--
Louisville, KY	--	--	--	--	--	--	--	--	--	--	--
<u>Operations Monitoring</u>											
<u>Maintenance Improvements</u>											
<u>Park-and-Ride Service</u>											
<u>Subscription Bus Service</u>											
Denver RTD, Denver, CO	--	--	--	--	--	--	--	--	--	NA (137) [NA] {NA}	--
(Tidewater Regional Transit), Norfolk, VA	--	--	--	--	--	--	--	--	--	--	--

<u>NOTE</u>

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIe (CONT'D). IMPROVED PUBLIC TRANSIT

Action/Example	Emission Impacts					References
	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
System/Service Expansion						
Fixed Guideway Transit						
Fixed Route and Express Bus Service						
Midvale Park/Drexel Heights, Tucson, AZ	-5.4/10 mon. (-6/10 mon.)	--	--	--	--	9
Northwest Area Express, Tucson, AZ	-3.6/10 mon. (-4/10 mon.)	--	--	--	--	9
Circumferential and Local Bus Service						
Paratransit Programs						
Ventura Freeway Vanpool Support Program, Los Angeles, CA	--	--	--	--	--	48
Los Angeles County Route 14 Vanpool and Buspool Demonstration Project	--	--	--	--	--	60
Space Coast Area Transit, Brevard Co., FL	--	--	--	--	--	48
System/Service Oper. Improvements						
Feeder Bus Service						
Express Bus Service						
Bus Route and Schedule Modifications						
E. Valley Sweeper Service, Tucson, AZ	-1.4/10 mon. (-1.5t/10 mon.)	--	--	--	--	9
Improved Transfers						
Portland, OR	--	--	--	--	--	2
Schedule Coordination						
Bus Traffic Signal Preemption						
Ventura Blvd., Los Angeles, CA	--	--	--	--	--	16
Kent State Univ., Kent, OH	--	--	--	--	--	10
Road Operational Changes						
Lincoln-Broadway Corridor, Denver, CO	--	--	--	--	--	9, 12
Louisville, KY	--	--	--	--	--	4
Operations Monitoring						
Maintenance Improvements						
Park-and-Ride Service						
Subscription Bus Service						
Denver RTD, Denver, CO	--	--	--	--	--	48
(Tidewater Regional Transit), Norfolk, VA	--	--	--	--	--	7

TABLE A-IIIc (CONT'D). IMPROVED PUBLIC TRANSIT

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees	Site (extent): Units	Site (extent): Parking	Site (extent): Fleet	Cost ($)
Demand/Market Strategies											
Employer Offered Incentives											
Marketing and Information Programs											
Peak/Off-Peak Transit Fares											
Simplified Fare Collection											
Reduce Fares											
Monthly Passes											
Unticket Programs											
Passenger Amenities											
Joint Development Activities											
Unclassified											
San Francisco, CA (BART)	1974	--	X	--	--	--	--	34	23,000	--	--
Seattle, WA	--	--	X	--	177 HOV (110 HOV)	--	--	--	12,000	--	--

TABLE A-IIIc (CONT'D). IMPROVED PUBLIC TRANSIT

Action/Example	Travel Impacts: VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift	Rideshare *	Occ.
Demand/Market Strategies											
Employer Offered Incentives											
Marketing and Information Programs											
Peak/Off-Peak Transit Fares											
Simplified Fare Collection											
Reduce Fares											
Monthly Passes											
Unticket Programs											
Passenger Amenities											
Joint Development Activities											
Unclassified											
San Francisco, CA (BART)	--	53 (33)	--	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	+120%	--	--	--	--	--

NOTE
* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIe (CONT'D). IMPROVED PUBLIC TRANSIT

Action/Example	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Demand/Market Strategies						
Employer Offered Incentives						
Marketing and Information Programs						
Peak/Off-Peak Transit Fares						
Simplified Fare Collection						
Reduce Fares						
Monthly Passes						
Unticket Programs						
Passenger Amenities						
Joint Development Activities						
Unclassified						
San Francisco, CA (BART)	--	--	--	--	--	7
Seattle, WA	--	--	--	--	--	7

TABLE A-IIIf. HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Implementation Date	Type: Roadway	Area	Business	Site (extent): Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	Cost $/km ($/mile)
Freeway											
Exclusive (Separate ROW)											
Ottawa-Carleton Transitway, Canada	--	X	--	--	24.1 (15)	--	--	--	--	--	--
Southeast Transitway	1983	X	--	--	2.4 (1.5)	--	--	--	--	--	19.8M (31.6M)
Central Transitway	--	X	--	--	--	--	--	--	--	--	--
West Transitway	1984	X	--	--	4.7 (2.9)	--	--	--	--	--	10.1M (16.4M)
Southwest Transitway	1983	X	--	--	3.1 (1.9)	--	--	--	--	--	10.8M (17.7M)
East PatWay, Pittsburgh, PA	1983	X	--	--	11.3 (7)	--	--	--	--	--	4.779M (7.714M)
South PatWay, Pittsburgh, PA	1977	X	--	--	6.4 (4)	--	--	--	--	--	10.368M (16.588M)
Barrier or Buffer Separated											
I-10 (El Monte), Los Angeles, CA	1973	X	--	--	19.3 (12)	--	--	--	--	--	2.917M (4.692M)
I-15, San Diego, CA	Oct-88	X	--	--	12.9 (8)	--	--	--	--	--	--
I-84, Hartford, CT	Fall 1989	X	--	--	16.1 (10)	--	--	--	--	--	--
Shirley Hwy., I-395, Washington, DC	1969	X	--	--	17.7 (11)	--	--	--	--	--	2.5M (4.0M)
I-66, Washington, DC	1982	X	--	--	15.4 (9.6)	--	--	--	--	--	19.3M (31.0M)
I-93, Boston, MA	1974	X	--	--	2.3 (1.4)	--	--	--	--	--	--
Hwy12/I-394, Minneapolis, MN	1992	X	--	--	4.8 (3)	--	--	--	--	--	--
I-279, Pittsburgh, PA	Aug-89	X	--	--	6.4 (4)	--	--	--	--	--	--
I-10, Houston, TX	Oct-84	X	--	--	20.9 (13)	--	--	--	--	--	1.7M (2.7M)
I-45, Houston, TX	1979	X	--	--	31.7 (19.7)	--	--	--	--	--	3.0M (4.8M)
US 290 Houston, TX	Aug-88	X	--	--	21.7 (13.5)	--	--	--	--	--	4.5M (7.3M)
Concurrent Flow											
I-10, Phoenix, AZ	--	X	--	--	27.4 (17)	--	--	--	--	--	--
Route 91, Los Angeles, CA	1985	X	--	--	12.9 (8)	--	--	--	--	--	21,000 (34,000)
I-405, Los Angeles, CA	1988	X	--	--	--	--	--	--	--	--	--
Route 55, Orange Co., CA	1985	X	--	--	17.7 (11)	--	--	--	--	--	23,000 (37,000)
US 101, San Francisco, CA	1974	X	--	--	11.3 (7)	--	--	--	--	--	--
Oakland Bay Bridge, San Francisco, CA	1970	X	--	--	1.4 (0.9)	--	--	--	--	--	--
I-280, San Francisco, CA	1975	X	--	--	2.6 (1.6)	--	--	--	--	--	--
Route 237, San Jose, CA	1984	X	--	--	6.4 (4)	--	--	--	--	--	--
Montague Expressway, San Jose, CA	--	X	--	--	8.0 (5)	--	--	--	--	--	--
Route 101, San Jose, CA	--	X	--	--	17.7 (11)	--	--	--	--	--	--
San Tomas Expressway, San Jose, CA	--	X	--	--	17.7 (11)	--	--	--	--	--	--
US 36, Denver, CO	--	X	--	--	6.4 (4)	--	--	--	--	--	--
I-95, Washington, DC	--	X	--	--	11.3 (7)	--	--	--	--	--	--
I-95, Miami, FL	1976	X	--	--	22.5 (14)	--	--	--	--	--	1.725M (2.773M)
I-4, Orlando, FL	1979	X	--	--	48.3 (30)	--	--	--	--	--	217,000 (350,000)
Moanalua Fwy., Honolulu, HI	1974	X	--	--	4.0 (2.5)	--	--	--	--	--	4,500 (7,000)

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

	Travel Impacts						
Action/Example	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Freeway							
Exclusive (Separate ROW)							
Ottawa-Carleton Transitway, Canada	--	--	--	--	--	11,000 Pass. (Pk. Hr.)	--
Southeast Transitway	--	--	--	--	--	8,100 Pass. (AM Pk.)	--
Central Transitway	--	--	--	--	--	--	--
West Transitway	--	--	--	--	--	6,900 Pass. (AM Pk.)	--
Southwest Transitway	--	--	--	--	--	4,200 Pass. (AM Pk.)	--
East PatWay, Pittsburgh, PA	--	--	--	--	-15 min.	6,000 Pass. (AM Pk.)	--
South PatWay, Pittsburgh, PA	--	--	--	--	--	2,950 Pass. (AM Pk.)	--
Barrier or Buffer Separated							
I-10 (El Monte), Los Angeles, CA	--	--	--	--	-15 min.	+224%	--
I-15, San Diego, CA	--	--	--	--	--	--	--
I-84, Hartford, CT	--	--	--	--	--	--	--
Shirley Hwy., I-395, Washington, DC	--	--	--	--	-14 min. (1989)	18,400 Pass. (AM Pk.)	7,600/Day-Peak
I-66, Washington, DC	--	--	--	--	--	11,260 Pass. (AM Pk.)	--
I-93, Boston, MA	--	--	--	--	--	--	--
Hwy12/I-394, Minneapolis, MN	--	--	--	--	--	--	--
I-279, Pittsburgh, PA	--	--	--	--	--	--	--
I-10, Houston, TX	--	--	--	--	-8.0 min.	1,860 Pass. (AM Pk.)	--
I-45, Houston, TX	--	--	--	--	-16.0 min.	5,560 Pass. (AM Pk.)	--
US 290 Houston, TX	--	--	--	--	4.6 min.(AM)/5.7 min.(PM)	4,000 Pass. (AM Pk.)	--
Concurrent Flow							
I-10, Phoenix, AZ	--	--	--	--	--	--	--
Route 91, Los Angeles, CA	--	--	--	--	-9.0 min.	3,550 Pass. (PM Pk.)	--
I-405, Los Angeles, CA				--			
Route 55, Orange Co., CA	--	--	--	--	-11.0 min.	3,260 Pass. (PM Pk.)	+30% Veh. Trip
US 101, San Francisco, CA	--	--	--	--	-2.0 min.	3,760 Pass (PM Pk.)	--
Oakland Bay Bridge, San Francisco, CA	--	--	--	--	-11.0 min. (Pk. Hour)	17, 170 Pass. (AM Pk.)	--
I-280, San Francisco, CA	--	--	--	--	--	--	--
Route 237, San Jose, CA	--	--	--	--	--	--	--
Montague Expressway, San Jose, CA	--	--	--	--	--	--	--
Route 101, San Jose, CA	--	--	--	--	--	--	--
San Tomas Expressway, San Jose, CA	--	--	--	--	-6.8 min. (Pk. Hour)	--	--
US 36, Denver, CO	--	--	--	--	--	2,000 Pass. (AM Pk.)	--
I-95, Washington, DC	--	--	--	--	--	--	--
I-95, Miami, FL	--	--	--	--	-27% to -40%	2,810 Pass (AM Pk.)	--
I-4, Orlando, FL	--	--	--	--	--	1,210 Pass (PM Pk.)	--
Moanalua Fwy., Honolulu, HI	--	--	--	--	-20 min.	4,800 Pass. (PM Pk.)	--

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

	Travel Impacts (Cont'd)				Emission Impacts					
Action/Example	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Freeway										
Exclusive (Separate ROW)										
Ottawa-Carleton Transitway, Canada	--	--	--	--	--	--	--	--	--	52, 54
Southeast Transitway	--	--	--	--	--	--	--	--	--	56
Central Transitway	--	--	--	--	--	--	--	--	--	56
West Transitway	--	--	--	--	--	--	--	--	--	56
Southwest Transitway	--	--	--	--	--	--	--	--	--	56
East PatWay, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	3, 40, 54, 56
South PatWay, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	3, 40, 56
Barrier or Buffer Separated										
I-10 (El Monte), Los Angeles, CA	--	--	--	--	--	--	--	--	--	7, 40, 56
I-15, San Diego, CA	--	--	--	+5.0%	-25%/User km or mile	--	--	--	--	40, 70
I-84, Hartford, CT	--	--	--	--	--	--	--	--	--	40
Shirley Hwy., I-395, Washington, DC	-23%	--	--	--	--	--	--	--	-21%	3, 7, 43, 54, 55
I-66, Washington, DC	--	--	--	--	--	--	--	--	--	3, 56
I-93, Boston, MA	--	--	--	--	--	--	--	--	--	44
Hwy12/I-394, Minneapolis, MN	--	--	--	--	--	--	--	--	--	40, 54, 55
I-279, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	40
I-10, Houston, TX	--	--	--	--	--	--	--	--	--	3, 30, 51, 55, 56, 68
I-45, Houston, TX	--	--	--	--	--	--	--	--	--	3, 51, 54, 55, 56
US 290 Houston, TX	--	--	--	--	--	--	--	--	--	51, 54, 68
Concurrent Flow										
I-10, Phoenix, AZ	--	--	--	--	--	--	--	--	--	40, 59
Route 91, Los Angeles, CA	--	--	--	--	--	--	--	--	--	3, 55, 56
I-405, Los Angeles, CA										40
Route 55, Orange Co., CA	--	--	--	+11%	--	--	--	--	--	3, 55, 56, 70
US 101, San Francisco, CA	--	--	--	--	--	--	--	--	--	3, 40, 55, 56
Oakland Bay Bridge, San Francisco, CA	--	--	--	--	--	--	--	--	--	3, 51, 56
I-280, San Francisco, CA	--	--	--	--	--	--	--	--	--	40, 45
Route 237, San Jose, CA	--	--	--	--	--	--	--	--	--	40, 45
Montague Expressway, San Jose, CA	--	--	--	--	--	--	--	--	--	40
Route 101, San Jose, CA	--	--	--	--	--	--	--	--	--	40
San Tomas Expressway, San Jose, CA	--	--	--	--	--	--	--	--	--	40, 51
US 36, Denver, CO	--	--	--	--	--	--	--	--	--	40, 54
I-95, Washington, DC	--	--	--	--	--	--	--	--	--	40
I-95, Miami, FL	--	--	--	--	--	--	--	--	--	7, 40, 45, 56
I-4, Orlando, FL	--	--	--	--	--	--	--	--	--	3, 55, 56
Moanalua Fwy., Honolulu, HI	--	--	--	--	--	--	--	--	--	7, 40, 45, 55, 56

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	Cost $/km ($/mile)
Concurrent Flow (cont'd.)											
Hwy12/I-394, Minneapolis, MN	1985	X	--	--	17.7 (11)	--	--	--	--	--	--
George Washington Bridge, Ft. Lee, NJ	--	X	--	--	1.6 (1)	--	--	--	--	--	--
I-5, Seattle, WA	1983	X	--	--	6.4 (4.0) & 9.0 (5.6)	--	--	--	--	--	0.8972M (1.442M)
I-5 "South Corridor" Interim HOV Lanes	1991	X	--	--	6.4 (4)	--	--	--	--	--	--
I-90, Seattle, WA	--	X	--	--	8.0 (5)	--	--	--	--	--	--
I-405, Seattle, WA	--	X	--	--	9.7 (6)	--	--	--	--	--	--
SR 520, Seattle, WA	1977	X	--	--	4.8 (3)	--	--	--	--	--	42,000 (67,000)
Contraflow											
US 101, San Francisco, CA	1972	X	--	--	6.8 (4.2)	--	--	--	--	--	30,000 (49,000)
Kalanianole Highway, Honolulu, HI	1975	X	--	--	6.4 (4)	--	--	--	--	--	39,000 (62,000)
Gowanus Expressway, New York City, NY	--	--	--	--	1.4 (0.9)	--	--	--	--	--	--
Long Island Expressway, New York City, NY	--	--	--	--	16.1 (10)	--	--	--	--	--	--
N.J. Rt. 495 (formerly I-495), New York Area, NJ	1970	--	--	--	4.0 (2.5)	--	--	--	--	--	132,500 (212,000)
I-30E, Thornton Freeway, Dallas, TX	1991	X	--	--	5.3 (3.3) & 8.4 (5.2)	--	--	--	--	--	--
Queue bypass											
Unclassified											
I-15, San Diego, CA	--	X	--	--	12.9 (8)	--	--	--	--	--	--
I-10, San Bernardino, CA	--	X	--	--	17.7 (11)	--	--	--	--	--	--
US 101, San Fernando Valley, CA											
Dumbarton Bridge, San Francisco., CA	--	--	--	--	--	--	--	--	--	--	--
Southeast Expressway, Boston, MA	--	X	--	--	--	--	--	--	--	--	--
I-80, NJ	--	X	--	--	19.3 (12)	--	--	--	--	--	--
Banfield Freeway, Portland, OR	1975	X	--	--	5.3 (3.3)	--	--	--	--	--	--
VA Beach-Norfolk Exp.,I-64,I-564	1992	X	--	--	24.1 (15)	--	--	--	--	--	--
Arterial											
Concurrent Flow											
Post, Sutter, Geary, O'Farrel Sts., SF, CA	--	X	--	--	--	--	--	--	--	--	--
Lincoln Ave, Denver, CO	--	X	--	--	3.7 (2.3)	--	--	--	--	--	--
Connecticut Ave, Washington, DC	--	X	--	--	--	--	--	--	--	--	--
South Dixie Hwy., Miami, FL	1974	X	--	--	8.9 (5.5)	--	--	--	--	--	--
Cermak Rd-47th Ave, Chicago, IL	--	X	--	--	0.05 (0.03)	--	--	--	--	--	--
Baltimore, MD	--	X	--	--	--	--	--	--	--	--	--

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Travel Impacts						
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Concurrent Flow (cont'd.)							
Hwy12/I-394, Minneapolis, MN	--	--	--	--	-8.0 min.	1,600 Pass (AM Pk.)	--
George Washington Bridge, Ft. Lee, NJ	--	--	--	--	--	--	--
I-5, Seattle, WA	--	--	--	--	-3.0 min.	3,290 Pass. (PM Pk.)	--
I-5 "South Corridor" Interim HOV Lanes	--	+3.2-4.8 (+2-3)	--	--	-15 to -16 min.	--	--
I-90, Seattle, WA	--	--	--	--	--	--	--
I-405, Seattle, WA	--	--	--	--	--	--	--
SR 520, Seattle, WA	--	--	--	--	-16.0 min.	3,360 Pass. (AM Pk.)	--
Contraflow							
US 101, San Francisco, CA	--	--	--	--	--	6,000 Pass. (PM Pk.)	--
Kalanianole Highway, Honolulu, HI	--	--	--	--	14% to 46%	1,320 Pass. (AM Pk.)	--
Gowanus Expressway, New York City, NY	--	--	--	--	--	--	--
Long Island Expressway, New York City, NY	--	--	--	--	--	--	--
N.J. Rt. 495 (formerly I-495), New York Area, NJ	--	--	--	--	-28 min.	34,685 Pass. (Pk. Hr.)	--
I-30E, Thornton Freeway, Dallas, TX	--	--	--	--	Est. -9 min (AM Pk.)/-7 min (PM Pk.)	7,473 Pass. (AM Pk.)	--
Queue bypass							
Unclassified							
I-15, San Diego, CA	--	+47%	--	--	-6 min.	--	--
I-10, San Bernardino, CA	240,000/day (150,000/day)	--	--	--	-40% to -47%	+1450%	--
US 101, San Fernando Valley, CA							
Dumbarton Bridge, San Francisco., CA	--	--	--	--	-10.0 min. (Pk. Hour)	--	--
Southeast Expressway, Boston, MA	--	--	--	--	--	--	-16%
I-80, NJ	--	--	--	--	--	--	--
Banfield Freeway, Portland, OR	--	--	--	--	62,500 Person-Hour	+111%	--
VA Beach-Norfolk Exp.,I-64,I-564	--	--	--	--	--	--	--
Arterial							
Concurrent Flow							
Post, Sutter, Geary, O'Parrel Sts., SF, CA	--	--	--	--	--	--	--
Lincoln Ave, Denver, CO	--	--	--	--	--	--	--
Connecticut Ave, Washington, DC	--	--	--	--	--	--	--
South Dixie Hwy., Miami, FL	--	--	--	--	-5 to -10 min. (init.)	--	--
Cermak Rd-47th Ave, Chicago, IL	--	--	--	--	--	--	--
Baltimore, MD	--	--	--	--	-17 to -21%	--	--

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

	Travel Impacts (Cont'd)				Emission Impacts					
Action/Example	Fuel Cons. ltr (gal)	Mode Shift	Rideshare*	Occ.	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Concurrent Flow (cont'd.)										
Hwy12/I-394, Minneapolis, MN	--	--	+129% (NA) [NA] {NA}	1.17 to 1.29	--	--	--	--	--	2, 54
George Washington Bridge, Ft. Lee, NJ	--	--	--	--	--	--	--	--	--	40
I-5, Seattle, WA	--	--	--	--	--	--	--	--	--	7, 40, 45, 55, 56
I-5 "South Corridor" Interim HOV Lanes	--	--	--	Overall +1-2%	--	--	--	--	--	63
I-90, Seattle, WA	--	--	--	--	--	--	--	--	--	40
I-405, Seattle, WA	--	--	--	--	--	--	--	--	--	40
SR 520, Seattle, WA	--	--	--	--	--	--	--	--	--	7, 40, 45, 55, 56
Contraflow										
US 101, San Francisco, CA	--	--	--	--	--	--	--	--	--	3
Kalanianole Highway, Honolulu, HI	--	--	--	--	--	--	--	--	--	3, 17, 45, 56
Gowanus Expressway, New York City, NY	--	--	--	--	--	--	--	--	--	40
Long Island Expressway, New York City, NY	--	--	--	--	--	--	--	--	--	40, 53
N.J. Rt. 495 (formerly I-495), New York Area, NJ	--	--	--	--	--	--	--	--	--	3, 40, 56
I-30E, Thornton Freeway, Dallas, TX	--	--	60% (1.3%) [38.7%] {NA}	+4.4%	--	--	--	--	--	54, 75, 76
Queue bypass										
Unclassified										
I-15, San Diego, CA	--	--	--	1.22 to 1.28	-25%/User km or mile	--	--	--	--	4, 10
I-10, San Bernardino, CA	--	--	--	3.3	-5%	--	-15%	--	-10% to -20%	6, 54, 61
US 101, San Fernando Valley, CA										28
Dumbarton Bridge, San Francisco., CA	--	--	--	--	--	--	--	--	--	51
Southeast Expressway, Boston, MA	--	--	--	1.30 to 1.36	--	--	--	--	--	6
I-80, NJ	--	--	--	--	--	--	--	--	--	53
Banfield Freeway, Portland, OR	--	--	--	--	--	--	--	--	+2%	40
VA Beach-Norfolk Exp.,I-64,I-564	--	--	--	--	--	--	--	--	--	54
Arterial										
Concurrent Flow										
Post, Sutter, Geary, O'Parrel Sts., SF, CA	--	--	--	--	--	--	--	--	--	44
Lincoln Ave, Denver, CO	--	--	--	--	--	--	--	--	--	44, 52
Connecticut Ave, Washington, DC	--	--	--	--	--	--	--	--	--	44
South Dixie Hwy., Miami, FL	--	--	--	--	--	--	--	--	--	44
Cermak Rd-47th Ave, Chicago, IL	--	--	--	--	--	--	--	--	--	44
Baltimore, MD	--	--	--	--	--	--	--	--	--	44

NOTE

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Implementation Date	Type			Site (extent)						Cost
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	$/km ($/mile)
Concurrent Flow (cont'd)											
New York City, NY	Jun-82 to Nov-82	X	--	--	17.7 (11)	--	--	--	--	3100	--
Hillside Ave, New York, NY	1969	X	--	--	3.2 (2)	--	--	--	--	--	--
Livingston St., New York, NY	1963	X	--	--	1.1 (0.68)	--	--	--	--	--	--
Victory Blvd., New York, NY	1963	X	--	--	1.6 (1)	--	--	--	--	--	--
Market St., Harrisburg, PA	--	X	--	--	--	--	--	--	--	--	--
Elm/Commerce Sts., Dallas, TX											
Houston, TX	--	X	--	--	1.1 (0.7)	--	--	--	--	--	--
Contraflow											
Spring St., Los Angeles, CA	--	X	--	--	--	--	--	--	--	--	--
South Dixie Highway, Miami, FL	1974	X	--	--	8.9 (5.5)	--	--	--	--	--	--
Chicago, IL	Early 1980s	X	--	--	1.1 (0.7)	--	--	--	--	--	400,000 for Oper./yr.
N. Sheridan Rd, Chicago, IL	1939	X	--	--	2.01 (1.25)	--	--	--	--	--	--
Indianapolis, IN	1965	X	--	--	4.43 (2.75)	--	--	--	--	--	--
3rd St., Louisville, KY	1971	X	--	--	2.4 (1.5)	--	--	--	--	--	--
Pittsburgh, PA	Jun-81	X	--	--	--	--	--	--	--	--	--
Ponce de Leon & Fernandez Sts., San Juan, PR	1971	X	--	--	17.4 (10.8)	--	--	--	--	--	--
Alamo Plaza, San Antonio, TX	--	X	--	--	--	--	--	--	--	--	--
5th Avenue, Seattle, WA	--	X	--	--	--	--	--	--	--	--	--
University Ave, Madison, WI	1966	X	--	--	3.2 (2)	--	--	--	--	--	--
Unclassified											
2nd Avenue, New York, NY	--	X	--	--	--	--	--	--	--	--	--
Reversible Flow											
NW 7th Ave., Miami, FL	--	X	--	--	--	--	--	--	--	--	--
Median Lane											

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Travel Impacts: VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Concurrent Flow (cont'd)							
New York City, NY	--	+15% to +25% : bus +10% to +20%:non-bus	--	--	-2 to -4 min. : bus	+140,000	--
Hillside Ave, New York, NY	--	--	--	--	--	--	--
Livingston St., New York, NY	--	--	--	--	--	--	--
Victory Blvd., New York, NY	--	--	--	--	--	--	--
Market St., Harrisburg, PA	--	--	--	--	--	--	--
Elm/Commerce Sts., Dallas, TX							
Houston, TX	--	--	--	--	-0.4 to -2.0 min. : bus	--	--
Contraflow							
Spring St., Los Angeles, CA	--	--	--	--	--	--	--
South Dixie Highway, Miami, FL	--	--	--	--	-15 to -20 min.	--	--
Chicago, IL	--	+15% to +40%	--	--	-0.87 to -3.5 min./km (-1.4 to -5.7 min./mile)	--	--
N. Sheridan Rd, Chicago, IL	--	--	--	--	--	--	--
Indianapolis, IN	--	--	--	--	--	--	--
3rd St., Louisville, KY	--	--	--	--	-25%	--	--
Pittsburgh, PA	--	--	--	--	--	--	--
Ponce de Leon & Fernandez Sts., San Juan, PR	--	--	--	--	30 min. or -35%	--	--
Alamo Plaza, San Antonio, TX	--	--	--	--	--	--	--
5th Avenue, Seattle, WA	--	--	--	--	--	--	--
University Ave, Madison, WI	--	--	--	--	--	--	--
Unclassified							
2nd Avenue, New York, NY	--	--	--	--	--	--	--
Reversible Flow							
NW 7th Ave., Miami, FL	--	--	--	--	--	--	--
Median Lane							

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Travel Impacts (Cont'd)				Emission Impacts					References
	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Concurrent Flow (cont'd)										
New York City, NY	--	--	--	--	--	--	--	--	--	3
Hillside Ave, New York, NY	--	--	--	--	--	--	--	--	--	44
Livingston St., New York, NY	--	--	--	--	--	--	--	--	--	44
Victory Blvd., New York, NY	--	--	--	--	--	--	--	--	--	44
Market St., Harrisburg, PA	--	--	--	--	--	--	--	--	--	44
Elm/Commerce Sts., Dallas, TX										
Houston, TX	--	--	--	--	--	--	--	--	--	3
Contraflow										
Spring St., Los Angeles, CA	--	--	--	--	--	--	--	--	--	44
South Dixie Highway, Miami, FL	--	--	--	--	--	--	--	--	--	44
Chicago, IL	--	--	--	--	--	--	--	--	--	3
N. Sheridan Rd, Chicago, IL	--	--	--	--	--	--	--	--	--	44
Indianapolis, IN	--	--	--	--	--	--	--	--	--	44
3rd St., Louisville, KY	--	--	--	--	--	--	--	--	--	44
Pittsburgh, PA	--	--	--	--	--	--	--	--	--	3
Ponce de Leon & Fernandez Sts., San Juan, PR	--	--	--	--	--	--	--	--	--	44
Alamo Plaza, San Antonio, TX	--	--	--	--	--	--	--	--	--	44
5th Avenue, Seattle, WA	--	--	--	--	--	--	--	--	--	52
University Ave, Madison, WI	--	--	--	--	--	--	--	--	--	44
Unclassified										
2nd Avenue, New York, NY	--	--	--	--	-90%	--	--	--	--	55
Reversible Flow										
NW 7th Ave., Miami, FL	--	--	--	--	--	--	--	--	--	42
Median Lane										

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees	Site (extent): Units	Site (extent): Parking	Site (extent): Fleet	Cost $/km ($/mile)
Bus Street											
South Dixie Highway, Miami, FL	--	X	--	--	--	--	--	--	--	--	--
Walton St., Atlanta, GA	1958	X	--	--	1.3 (0.8)	--	--	--	--	--	--
Chestnut Street, Chicago, IL	--	X	--	--	--	--	--	--	--	--	--
State Street, Chicago, IL	1958	X	--	--	1.0 (0.6)	--	--	--	--	--	--
Washington St., Chicago, IL	1956	X	--	--	1.0 (0.6)	--	--	--	--	--	--
Canal St., New Orleans, LA	1966	X	--	--	2.01 (1.25)	--	--	--	--	--	--
Barbour Blvd., Portland, OR	--	X	--	--	--	--	--	--	--	--	--
Market St. Philadelphia, PA	1956	X	--	--	1.0 (0.65)	--	--	--	--	--	--
Pittsburgh, PA	--	X	--	--	--	--	--	--	--	--	--
Bus Tunnel											
Entrance Ramp Priority											
Parking Facilities											

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Travel Impacts						
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Bus Street							
South Dixie Highway, Miami, FL	--	--	--	--	-15 to -20 min.	--	--
Walton St., Atlanta, GA	--	--	--	--	--	--	--
Chestnut Street, Chicago, IL	--	--	--	--	--	--	--
State Street, Chicago, IL	--	--	--	--	--	--	--
Washington St., Chicago, IL	--	+14.5 to +20.3% : bus	--	--	--	--	--
Canal St., New Orleans, LA	--	--	--	--	--	--	--
Barbour Blvd., Portland, OR	--	--	--	--	--	--	--
Market St. Philadelphia, PA	--	--	--	--	--	--	--
Pittsburgh, PA	--	--	--	--	--	12,000 (1983) 26,000 (1986)	--
Bus Tunnel							
Entrance Ramp Priority							
Parking Facilities							

TABLE A-IIIf (CONT'D). HIGH-OCCUPANCY VEHICLE LANES

Action/Example	Travel Impacts (Cont'd)				Emission Impacts					References
	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Bus Street										
South Dixie Highway, Miami, FL	--	--	--	--	--	--	--	--	--	44
Walton St., Atlanta, GA	--	--	--	--	--	--	--	--	--	44
Chestnut Street, Chicago, IL	--	--	--	--	--	--	--	--	--	42
State Street, Chicago, IL	--	--	--	--	--	--	--	--	--	42, 44
Washington St., Chicago, IL	--	--	--	--	--	--	--	--	--	44
Canal St., New Orleans, LA	--	--	--	--	--	--	--	--	--	44
Barbour Blvd., Portland, OR	--	--	--	--	--	--	--	--	--	44
Market St. Philadelphia, PA	--	--	--	--	--	--	--	--	--	44
Pittsburgh, PA	--	--	--	--	--	--	--		--	7
Bus Tunnel										
Entrance Ramp Priority										
Parking Facilities										

TABLE A-IIIg. TRAFFIC FLOW IMPROVEMENTS

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Traffic Signalization											
Arizona	--	--	X	--	--	--	--	--	--	--	--
FETSIM, California	1987	--	X	--	--	--	--	5,200	--	--	1,400/int.
Garden Grove, CA	--	--	X	--	--	--	--	70	--	--	--
Redwood City, CA	Mid-1960s	--	--	--	--	--	--	--	--	--	--
Sacramento, CA	--	--	X	--	--	--	--	220	--	--	--
San Francisco, CA	1980	--	--	--	--	--	--	--	--	--	--
Sunnyvale, CA	Mid-1960s	--	--	--	--	--	--	--	--	--	--
Denver, CO	1980	--	--	--	--	--	--	--	--	--	--
Gainesville, FL	1980	--	--	--	--	--	--	--	--	--	--
Des Moines, IA	1980	--	--	--	--	--	--	--	--	--	--
Ft. Wayne, IN	1980	--	--	--	--	--	--	--	--	--	--
Missouri	--	--	X	--	--	--	--	161	--	--	B:C = 27:1
Syracuse, NY	1980	--	--	--	--	--	--	--	--	--	--
North Carolina	1985	--	X	--	--	--	--	708	--	--	--
Portland, OR	1980	--	--	--	--	--	--	--	--	--	--
Pawtucket, RI	1980	--	--	--	--	--	--	--	--	--	--
Charleston, SC	1980	--	--	--	--	--	--	--	--	--	--
Sioux Falls, SD	1981	--	X	--	--	--	--	97	--	--	2,000 - 4,000 /int.
Texas Traffic Light Synchronization Phase I	18-Jul-89 to 30-Oct-92	--	X	--	--	--	--	2,243	--	--	7,889,879
Milwaukee, WI	1980	--	--	--	--	--	--	--	--	--	--
Traffic Operations											
Additional Lanes w/o New Construction											
H-1 Freeway, Honolulu, HI	--	--	--	--	3.2 (2)	--	--	--	--	--	--
Intersection and Roadway Widening											
One-Way Streets											
New York, NY	--	--	--	--	--	--	--	--	--	--	--
Turn Lane Installation											
Turning Movement and Lane Use Restrictions											
Reversible Traffic Lanes											
Atlanta, GA	--	X	--	--	5.6 (3.5)	--	--	--	--	--	196,000
Arlington, VA	--	X	--	--	4.5 (2.8)	--	--	--	--	--	150,000
Strengthen Curb Cut Controls											
Improved Traffic Control Devices											
Grade Separation											
Chicago, IL	Late 1950s - Early 1960s	--	--	--	--	--	--	--	--	--	B:C = 2.2 : 1
Austin, TX	1983	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Travel Impacts						
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Traffic Signalization							
Arizona	--	+4 to +16%	--	--	--	--	--
FETSIM, California	--	--	-15%	-15%	-6.5%	--	--
Garden Grove, CA	--	--	-6,015V-H/int./yr.	-489,643 /int./yr.	--	--	--
Redwood City, CA	--	--	--	--	--	--	--
Sacramento, CA	--	+10%	-5%	--	--	--	--
San Francisco, CA	--	--	-36,377 V-H/int./yr.	-1,007,032/int./yr.	--	--	--
Sunnyvale, CA	--	--	--	--	--	--	--
Denver, CO	--	--	-74,311 V-H/int./yr.	+130,439/int./yr.	--	--	--
Gainesville, FL	--	--	-21,627 V-H/int./yr.	+40,091/int./yr.	--	--	--
Des Moines, IA	--	--	-1,915 V-H/int./yr.	-238,542/int./yr.	--	--	--
Ft. Wayne, IN	--	--	-1,499 V-H/int./yr.	-438,716/int./yr.	--	--	--
Missouri	--	--	--	--	--	--	--
Syracuse, NY	--	--	-6,428 V-H/int./yr.	-272,901/int./yr.	--	--	--
North Carolina	--	--	--	--	--	--	--
Portland, OR	--	--	-3,667 V-H/int./yr.	-382,554/int./yr.	--	--	--
Pawtucket, RI	--	--	-26,345 V-H/int./yr.	-468,857/int./yr.	--	--	--
Charleston, SC	--	--	-3,187 V-H/int./yr.	-437,600/int./yr.	--	--	--
Sioux Falls, SD	--	--	437 Hr.-First Year	--	--	--	--
Texas Traffic Light Synchronization Phase I	--	--	-24.6% (43M hr)	-14.2% (1.7B)	--	--	--
Milwaukee, WI	--	--	-4,830 V-H/int./yr.	-413,788/int./yr.	--	--	--
Traffic Operations							
Additional Lanes w/o New Construction							
H-1 Freeway, Honolulu, HI	--	--	--	--	-15 min.	--	--
Intersection and Roadway Widening							
One-Way Streets							
New York, NY	--	--	--	--	-22%	--	--
Turn Lane Installation							
Turning Movement and Lane Use Restrictions							
Reversible Traffic Lanes							
Atlanta, GA	--	--	--	--	-3.5% to -25%	--	--
Arlington, VA	--	--	--	--	-2 to +3 min.	--	--
Strengthen Curb Cut Controls							
Improved Traffic Control Devices							
Grade Separation							
Chicago, IL	--	--	-80,000 V-H/yr.	--	--	--	--
Austin, TX	--	--	22,000 V-H/yr. (1983)	--	--	--	--

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

	Travel Impacts (Cont'd)				Emission Impacts					
Action/Example	Fuel Cons./int./yr. ltr (gal)	Mode Shift	Rideshare	Occ.	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Traffic Signalization										
Arizona	--	--	--	--	-0.54 to -4.9/day (-0.6 to -5.4/day)	--	--	--	--	44
FETSIM, California	-8.6% Overall	--	--	--	-5% to -8%	--	-5% to -8%	--	--	2, 35, 39
Garden Grove, CA	-27,126 (-7,166)	--	--	--	-401/net.-yr. (-442/net.-yr.)	--	-25.69/net.-yr. (-28.32/net.-yr.)	-16.89/net.-yr. (-18.62/net.-yr.)	--	39
Redwood City, CA	--	--	--	--	--	--	--	--	--	4
Sacramento, CA	--	--	--	--	--	--	--	--	--	1
San Francisco, CA	-90,801 (-23,987)	--	--	--	--	--	--	--	--	44
Sunnyvale, CA	--	--	--	--	--	--	--	--	--	4
Denver, CO	-118,919 (-31,415)	--	--	--	--	--	--	--	--	44
Gainesville, FL	-35,719 (-9,436)	--	--	--	--	--	--	--	--	44
Des Moines, IA	-11,076 (-2,926)	--	--	--	--	--	--	--	--	44
Ft. Wayne, IN	-13,934 (-3,681)	--	--	--	--	--	--	--	--	44
Missouri	--	--	--	--	--	--	--	--	--	37
Syracuse, NY	-18,325 (-4,841)	--	--	--	--	--	--	--	--	44
North Carolina	--	--	--	--	--	--	--	--	--	23
Portland, OR	-16,470 (-4,351)	--	--	--	--	--	--	--	--	44
Pawtucket, RI	-55,184 (-14,578)	--	--	--	--	--	--	--	--	44
Charleston, SC	-16,448 (-4,345)	--	--	--	--	--	--	--	--	44
Sioux Falls, SD	--	--	--	--	--	--	--	--	--	37
Texas Traffic Light Synchronization Phase I	-9.1% Overall	--	--	--	--	--	--	--	--	47
Milwaukee, WI	-23,189 (-6,126)	--	--	--	--	--	--	--	--	44
Traffic Operations										
Additional Lanes w/o New Construction										
H-1 Freeway, Honolulu, HI	--	--	--	--	--	--	--	--	--	2
Intersection and Roadway Widening										
One-Way Streets										
New York, NY	--	--	--	--	--	--	--	--	--	4
Turn Lane Installation										
Turning Movement and Lane Use Restrictions										
Reversible Traffic Lanes										
Atlanta, GA	--	--	--	--	--	--	--	--	--	4
Arlington, VA	--	--	--	--	--	--	--	--	--	4
Strengthen Curb Cut Controls										
Improved Traffic Control Devices										
Grade Separation										
Chicago, IL	--	--	--	--	--	--	--	--	--	3
Austin, TX	--	--	--	--	--	--	--	--	--	3

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	Cost ($)
Enforcement and Management											
New Freeway Lanes Using Shoulders or Reduced Lane Widths											
Incident Detection & Management Systems											
Los Angeles, CA	--	--	X	--	67.6 (42)	--	--	--	--	--	B:C = 5:1 to 6:1
Chicago, IDOT, IL	1960	--	X	--	160.9 (100)	--	--	--	--	--	B:C = 17:1
SCANDI, Detroit, MI	1989	--	--	--	48.0 (29.8)	--	--	--	--	--	--
I-80 MAGIC Project, NJ	1980	X	--	--	48.3 (30)	--	--	--	--	--	--
Freeway Diversion and Advisory Signing											
Phoenix Freeway Mgmt. Sys., Phoenix, AZ	--	--	--	--	--	--	--	33	--	--	--
LA Metropolitan Area Mgmt. Sys., Los Angeles, CA	--	--	--	--	--	--	--	48	--	--	--
Sacramento, CA	--	--	--	--	--	--	--	9	--	--	--
San Francisco-Oakland Bay Bridge, S.F., CA	--	--	--	--	--	--	--	15	--	--	--
Eisenhower Memorial/Johnson Memorial Tunnels, Idaho Springs, CO	--	--	--	--	--	--	--	22	--	--	--
Sunshine Skyway Bridge, I-275, FL	--	--	--	--	--	--	--	6	--	--	--
Lake Charles I-H Routes, Lake Charles LA	--	--	--	--	--	--	--	4	--	--	--
N.J. Turnpike Automatic Traffic Surveillance and Control System, NJ	--	--	--	--	--	--	--	108	--	--	--
Variable Speed Limit System, Albuquerque, NM	--	--	--	--	--	--	--	3	--	--	--
Van Wyck Expressway, Queens, NY	--	--	--	--	--	--	--	18	--	--	--
Tappan Zee Bridge, Tarrytown, NY	--	--	--	--	--	--	--	4	--	--	--
I-75 Traffic Diversion System, Cincinnati, OH	--	--	--	--	--	--	--	19	--	--	--
Columbus Metro Fwy. Oper. Sys., Columbus, OH	--	--	--	--	--	--	--	11	--	--	--
Penn-Lincoln Parkway, Pittsburgh, PA	--	--	--	--	--	--	--	3	--	--	--
Lehigh Tunnel, Lehigh, PA	--	--	--	--	--	--	--	4	--	--	--
I-376 @ Squirrel Hill Tunnel, Pittsburgh, PA	--	--	--	--	--	--	--	3	--	--	--
I-297 @ Ft. Pitt Tunnel, Philadelphia, PA	--	--	--	--	--	--	--	7	--	--	--
The Liberty Tunnels, Pittsburgh, PA	--	--	--	--	--	--	--	2	--	--	--
I-279 HOV Lanes, Pittsburgh, PA	--	--	--	--	--	--	--	22	--	--	--
I-35, Austin, TX	--	--	--	--	--	--	--	2	--	--	--
North Central Expressway, Dallas, TX	--	--	--	--	--	--	--	3	--	--	--
Ft. Worth, TX	--	--	--	--	--	--	--	45	--	--	--
I-66/I-395, VA	--	--	--	--	--	--	--	94	--	--	--
Hampton Roads Bridge-Tunnel, Hampton, VA	--	--	--	--	--	--	--	64	--	--	--
Elizabeth River Tunnels, Norfolk/Portsmouth, VA	--	--	--	--	--	--	--	29	--	--	--

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Travel Impacts						
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Enforcement and Management							
New Freeway Lanes Using Shoulders or Reduced Lane Widths							
Incident Detection & Management Systems							
Los Angeles, CA	--	--	-65%	--	--	--	--
Chicago, IDOT, IL	--	--	-9.5 M V-H/yr.	--	--	--	--
SCANDI, Detroit, MI	--	--	--	--	--	--	--
I-80 MAGIC Project, NJ	+1.4M/yr. (+ 0.9M/yr.)	--	--	--	--	--	--
Freeway Diversion and Advisory Signing							
Phoenix Freeway Mgmt. Sys., Phoenix, AZ	--	--	--	--	--	--	--
LA Metropolitan Area Mgmt. Sys., Los Angeles, CA	--	--	--	--	--	--	--
Sacramento, CA	--	--	--	--	--	--	--
San Francisco-Oakland Bay Bridge, S.F., CA	--	--	--	--	--	--	--
Eisenhower Memorial/Johnson Memorial Tunnels, Idaho Springs, CO	--	-- --	--	--	--	--	--
Sunshine Skyway Bridge, I-275, FL	--	--	--	--	--	--	--
Lake Charles I-H Routes, Lake Charles LA	--	--	--	--	--	--	--
N.J. Turnpike Automatic Traffic Surveillance and Control System, NJ	--	--	--	--	--	--	--
Variable Speed Limit System, Albuquerque, NM	--	--	--	--	--	--	--
Van Wyck Expressway, Queens, NY	--	--	--	--	--	--	--
Tappan Zee Bridge, Tarrytown, NY	--	--	--	--	--	--	--
I-75 Traffic Diversion System, Cincinnati, OH	--	--	--	--	--	--	--
Columbus Metro Fwy. Oper. Sys., Columbus, OH	--	--	--	--	--	--	--
Penn-Lincoln Parkway, Pittsburgh, PA	--	--	--	--	--	--	--
Lehigh Tunnel, Lehigh, PA	--	--	--	--	--	--	--
I-376 @ Squirrel Hill Tunnel, Pittsburgh, PA	--	--	--	--	--	--	--
I-297 @ Ft. Pitt Tunnel, Philadelphia, PA	--	--	--	--	--	--	--
The Liberty Tunnels, Pittsburgh, PA	--	--	--	--	--	--	--
I-279 HOV Lanes, Pittsburgh, PA	--	--	--	--	--	--	--
I-35, Austin, TX	--	--	--	--	--	--	--
North Central Expressway, Dallas, TX	--	--	--	--	--	--	--
Ft. Worth, TX	--	--	--	--	--	--	--
I-66/I-395, VA	--	--	--	--	--	--	--
Hampton Roads Bridge-Tunnel, Hampton, VA	--	--	--	--	--	--	--
Elizabeth River Tunnels, Norfolk/Portsmouth, VA	--	--	--	--	--	--	--

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Travel Impacts (Cont'd) Fuel Cons./int./yr. ltr (gal)	Mode Shift	Rideshare	Occ.	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Enforcement and Management										
New Freeway Lanes Using Shoulders or Reduced Lane Widths										
Incident Detection & Management Systems										
Los Angeles, CA	--	--	--	--	--	--	--	--	--	3
Chicago, IDOT, IL	--	--	--	--	--	--	--	--	--	1, 3
SCANDI, Detroit, MI	--	--	--	--	--	--	--	--	--	15
I-80 MAGIC Project, NJ	-94,635 (-25,000) Overall	--	--	--	-45%	--	-40%	6%	--	74
Freeway Diversion and Advisory Signing										
Phoenix Freeway Mgmt. Sys., Phoenix, AZ	--	--	--	--	--	--	--	--	--	45
LA Metropolitan Area Mgmt. Sys., Los Angeles, CA	--	--	--	--	--	--	--	--	--	45
Sacramento, CA	--	--	--	--	--	--	--	--	--	45
San Francisco-Oakland Bay Bridge, S.F., CA	--	--	--	--	--	--	--	--	--	45
Eisenhower Memorial/Johnson Memorial Tunnels, Idaho Springs, CO	--	--	--	--	--	--	--	--	--	45
Sunshine Skyway Bridge, I-275, FL	--	--	--	--	--	--	--	--	--	45
Lake Charles I-H Routes, Lake Charles LA	--	--	--	--	--	--	--	--	--	45
N.J. Turnpike Automatic Traffic Surveillance and Control System, NJ	--	--	--	--	--	--	--	--	--	45
Variable Speed Limit System, Albuquerque, NM	--	--	--	--	--	--	--	--	--	45
Van Wyck Expressway, Queens, NY	--	--	--	--	--	--	--	--	--	45
Tappan Zee Bridge, Tarrytown, NY	--	--	--	--	--	--	--	--	--	45
I-75 Traffic Diversion System, Cincinnati, OH	--	--	--	--	--	--	--	--	--	45
Columbus Metro Fwy. Oper. Sys., Columbus, OH	--	--	--	--	--	--	--	--	--	45
Penn-Lincoln Parkway, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	45
Lehigh Tunnel, Lehigh, PA	--	--	--	--	--	--	--	--	--	45
I-376 @ Squirrel Hill Tunnel, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	45
I-297 @ Ft. Pitt Tunnel, Philadelphia, PA	--	--	--	--	--	--	--	--	--	45
The Liberty Tunnels, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	45
I-279 HOV Lanes, Pittsburgh, PA	--	--	--	--	--	--	--	--	--	45
I-35, Austin, TX	--	--	--	--	--	--	--	--	--	45
North Central Expressway, Dallas, TX	--	--	--	--	--	--	--	--	--	45
Ft. Worth, TX	--	--	--	--	--	--	--	--	--	45
I-66/I-395, VA	--	--	--	--	--	--	--	--	--	45
Hampton Roads Bridge-Tunnel, Hampton, VA	--	--	--	--	--	--	--	--	--	45
Elizabeth River Tunnels, Norfolk/Portsmouth, VA	--	--	--	--	--	--	--	--	--	45

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Ramp Metering											
Phoenix, AZ	1980	--	--	--	--	--	--	18	--	--	--
Phoenix Freeway Mgmt. Sys., Phoenix, AZ								80			
Tucson, AZ								1			
Los Angeles, CA	1968	--	X	--	--	--	--	917	--	--	--
LA Harbor Freeway, Los Angeles, CA	--	X	--	--	--	--	--	--	--	--	--
LA Upgrade and Control Program, Los Angeles, CA	1970	--	X	--	--	--	--	--	--	--	--
Sacramento, CA	1983	--	--	--	--	--	--	14	--	--	--
San Diego, CA	1968	--	X	--	64.4+ (40+)		--	81	--	--	--
SR 94 WB to SR 94 SB	1978	X	--	--	--	--	--	--	--	--	--
SF Bay Area Traffic Oper. Mgmt. Sys., S. F., CA								45			
SF Bay Area Ramp Control System, S. F., CA								11			
San Jose, CA	1974	--	--	--	--	--	--	60	--	--	--
I-25, Denver, CO	3-Mar-81	X	--	--	--	--	--	26	--	--	--
Chicago, IL	1963	--	--	--	--	--	--	91	--	--	--
Chicago Area Fwy. Traffic Mgmt. Prog., Chicago, IL								95			
I-94, Detroit, MI	1982	X	--	--	--	--	--	51	--	--	--
Minneapolis, MN	1970	--	--	--	--	--	--	66	--	--	--
I-94 EB to T.H. 65 SB	--	X	--	--	--	--	--	--	--	--	--
I-494 EB/WB to I-35W SB/NB	--	X	--	--	--	--	--	--	--	--	--
T.H. 13 to I-35W NB	--	X	--	--	--	--	--	--	--	--	--
St. Paul, MN	1970	X	--	--	--	--	--	39	--	--	--
Long Island, NY	Late 1988	--	X	--	64.4 (40)	518 (200)	--	58	--	--	
Columbus, OH	1980	--	--	--	--	--	--	7	--	--	--
Portland, OR	1981	--	--	--	--	--	--	29	--	--	--
I-5, Portland, OR	Jan-81	X	--	--	9.7 (6)	--	--	16	--	--	--
I-35, Austin, TX	--	X	--	--	4.2 (2.6)	--	--	3	--	--	--
US-75, Dallas, TX	1971	X	--	--	16.1 (10)	--	--	39	--	--	--
Ft. Worth, TX	1977	--	--	--	--	--	--	12	--	--	--
Houston, TX	1975	--	--	--	--	--	--	20	--	--	--
San Antonio, TX	1977	--	--	--	--	--	--	9	--	--	--
Virginia	1985	--	--	--	--	--	--	26	--	--	--
I-5, Seattle, WA	Sep-81	X	--	--	--	--	--	25	--	--	--
SR 520, Seattle, WA	1986	X	--	--	--	--	--	2	--	--	--
Milwaukee, WI	1976	--	--	--	--	--	--	21	--	--	--
Mainline Metering											
San Francisco Bay Bridge Approach, CA	--	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

	Travel Impacts						
Action/Example	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Ramp Metering							
Phoenix, AZ	--	--	--	--	--	--	--
Phoenix Freeway Mgmt. Sys., Phoenix, AZ							
Tucson, AZ							
Los Angeles, CA	--	--	--	--	--	--	--
LA Harbor Freeway, Los Angeles, CA	--	+130%	--	--	--	--	--
LA Upgrade and Control Program, Los Angeles, CA	--	+25.7 (+16)	-8,470 V-H/day	--	--	--	--
Sacramento, CA	--	--	--	--	--	--	--
San Diego, CA	--	--	--	--	--	--	--
SR 94 WB to SR 94 SB	--	--	10+ min.	--	Up to -20 min. (on Freeway)	--	--
SF Bay Area Traffic Oper. Mgmt. Sys., S. F., CA							
SF Bay Area Ramp Control System, S. F., CA							
San Jose, CA	--	--	--	--	--	--	--
I-25, Denver, CO	--	+57% init., +16% later	--	--	-37% init.	--	--
Chicago, IL	--	--	--	--	--	--	--
Chicago Area Fwy. Traffic Mgmt. Prog., Chicago, IL							
I-94, Detroit, MI	--	+8%	--	--	--	--	--
Minneapolis, MN	--	--	--	--	--	--	--
I-94 EB to T.H. 65 SB	--	+29% (SB T.H. 65)	1 to 8 min.	--	--	--	--
I-494 EB/WB to I-35W SB/NB	--	--	Less Than 1 min.	--	--	--	--
T.H. 13 to I-35W NB	--	--	3 to 4 min.	--	--	--	--
St. Paul, MN	--	+16%	--	--	-20% to -25%	--	--
Long Island, NY		+16% init.		--	-20% (26 to 21 min.) init.	--	--
Columbus, OH	--	--	--	--	--	--	--
Portland, OR	--	--	--	--	--	--	--
I-5, Portland, OR	--	+7.5% to +156%	--	--	--	--	--
I-35, Austin, TX	--	+60%	--	--	--	--	--
US-75, Dallas, TX	--	+114%	--	--	--	--	--
Ft. Worth, TX	--	--	--	--	--	--	--
Houston, TX	--	--	--	--	-25% (on I-45)	--	--
San Antonio, TX	--	--	--	--	--	--	--
Virginia	--	--	--	--	--	--	--
I-5, Seattle, WA	--		--	--	-47%	--	--
SR 520, Seattle, WA	--	--	--	--	-3 to 4 min. (bus)	--	--
Milwaukee, WI	--	--	--	--	--	--	--
Mainline Metering							
San Francisco Bay Bridge Approach, CA	--	--	Up to 30 min.	--	--	--	--

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Travel Impacts (Cont'd) Fuel Cons./int./yr. ltr (gal)	Mode Shift	Rideshare	Occ.	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Ramp Metering										
Phoenix, AZ	--	--	--	--	--	--	--	--	--	33
Phoenix Freeway Mgmt. Sys., Phoenix, AZ										
Tucson, AZ										
Los Angeles, CA	--	--	--	--	--	--	--	--	--	33
LA Harbor Freeway, Los Angeles, CA	--	--	--	--	--	--	--	--	--	4
LA Upgrade and Control Program, Los Angeles, CA	--	--	--	--	-1%	--	--	--	--	6
Sacramento, CA	--	--	--	--	--	--	--	--	--	33
San Diego, CA	--	--	--	--	--	--	--	--	--	33
SR 94 WB to SR 94 SB	--	--	--	--	--	--	--	--	--	58
SF Bay Area Traffic Oper. Mgmt. Sys., S. F., CA										
SF Bay Area Ramp Control System, S. F., CA										
San Jose, CA	--	--	--	--	--	--	--	--	--	33
I-25, Denver, CO	--	--	--	--	--	--	--	--	-24%	14, 33
Chicago, IL	--	--	--	--	--	--	--	--	--	33
Chicago Area Fwy. Traffic Mgmt. Prog., Chicago, IL										
I-94, Detroit, MI	--	--	--	--	--	--	--	--	--	13, 15, 33
Minneapolis, MN	--	--	--	--	--	--	--	--	--	33
I-94 EB to T.H. 65 SB	--	--	--	--	--	--	--	--	--	58
I-494 EB/WB to I-35W SB/NB	--	--	--	--	--	--	--	--	--	58
T.H. 13 to I-35W NB	--	--	--	--	--	--	--	--	--	58
St. Paul, MN	--	--	--	--	--	--	--	--	--	13, 6, 33
Long Island, NY	-6.7%	--	--	--	-17.4%	--	-13.1%	+2.4%	--	33
Columbus, OH	--	--	--	--	--	--	--	--	--	33
Portland, OR	--	--	--	--	--	--	--	--	--	33
I-5, Portland, OR	-2,044/day (-540/day) Overall	--	--	--	--	--	--	--	--	13, 33
I-35, Austin, TX	--	--	--	--	--	--	--	--	--	13, 33
US-75, Dallas, TX	--	--	--	--	--	--	--	--	--	4, 33
Ft. Worth, TX	--	--	--	--	--	--	--	--	--	33
Houston, TX	--	--	--	--	--	--	--	--	--	33, 62
San Antonio, TX	--	--	--	--	--	--	--	--	--	33
Virginia	--	--	--	--	--	--	--	--	--	33
I-5, Seattle, WA	--	--	--	--	--	--	--	--	--	13
SR 520, Seattle, WA	--	--	--	--	--	--	--	--	--	33
Milwaukee, WI	--	--	--	--	--	--	--	--	--	33
Mainline Metering										
San Francisco Bay Bridge Approach, CA	--	--	--	--	--	--	--	--	--	58

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Integrated Surveillance and Control											
ATSAC, Los Angeles, CA	Jun-84	--	X	--	--	10.4 (4)	--	118 sig.	--	--	--
Santa Monica Fwy., Los Angeles, CA	--	--	X	--	19.3 (12)	155.4 (60)	--	--	--	--	--
Traffic Relief Program, Boston, MA	Aug-86	--	--	--	--	--	--	--	--	--	--
INFORM, New York	--	--	X	--	56.3 (35)	453.2 (175)	--	--	--	--	--
PEGASUS, TX	--	--	--	--	--	--	--	--	--	--	--
Enforcement											
Intelligent-Vehicle Highway Systems											

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Travel Impacts						
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed
Integrated Surveillance and Control							
ATSAC, Los Angeles, CA	--	+14.8%	--	-35.2%	-13.2%	--	--
Santa Monica Fwy., Los Angeles, CA	--	--	--	--	--	--	--
Traffic Relief Program, Boston, MA	--	+6% to +28% 9.7 to 19.3 (6 to 12)	--	--	-18%, -28% to -30%	--	--
INFORM, New York	--	--	--	--	--	--	--
PEGASUS, TX	--	--	--	--	--	--	--
Enforcement							
Intelligent-Vehicle Highway Systems							

TABLE A-IIIg (CONT'D). TRAFFIC FLOW IMPROVEMENTS

Action/Example	Travel Impacts (Cont'd)				Emission Impacts					References
	Fuel Cons./int./yr. ltr (gal)	Mode Shift	Rideshare	Occ.	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Integrated Surveillance and Control										
ATSAC, Los Angeles, CA	--	--	--	--	-10%	--	-10%	--	--	3, 62
Santa Monica Fwy., Los Angeles, CA	--	--	--	--	--	--	--	--	--	3
Traffic Relief Program, Boston, MA	--	--	--	--	--	-15% to -18% 8-Hr +13% to -33% 1-Hr	--	--	--	3
INFORM, New York	--	--	--	--	--	--	--	--	--	3
PEGASUS, TX	--	--	--	--	--	--	--	--	--	3
Enforcement										
Intelligent-Vehicle Highway Systems										

TABLE A-IIIh. PARKING MANAGEMENT

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
ARCO, Los Angeles, CA	--	--	--	X	--	--	--	--	--	--	--
Commuter Computer, Los Angeles, CA	May-83	--	--	X	--	--	--	--	--	--	--
Sacramento, CA	--	--	--	--	--	--	--	--	--	--	--
San Francisco, CA	--	--	--	--	--	--	--	--	--	--	--
Bank of America, San Francisco, CA	--	--	--	--	--	--	--	--	--	--	--
Childrens Hospital, San Francisco, CA	1978 - 1980	--	--	X	--	--	--	--	1,040	--	--
University of California, San Francisco, CA	--	--	--	--	--	--	--	--	2,000	--	--
Santa Cruz, CA	--	--	--	--	--	--	--	--	--	--	--
Hartford, CT	--	--	--	--	--	--	--	--	--	--	--
Orlando, FL (MeterEater)	Feb-82	--	--	--	--	--	--	--	--	--	--
Honolulu, HI	--	--	--	--	--	--	--	--	--	--	--
Chicago, IL	--	--	--	--	--	--	--	--	--	--	--
Boston, MA	--	--	--	--	--	--	--	--	--	--	--
Baltimore, MD	--	--	--	--	--	--	--	--	--	--	--
Montgomery County, MD	--	--	--	--	--	--	--	--	--	--	--
Minneapolis, MN	--	--	--	--	--	--	--	--	--	--	--
SMART Program, New York, NY	--	--	X	--	--	--	--	--	--	--	--
Eugene, OR	1980	--	--	--	--	--	--	--	--	--	--
Portland, OR	--	--	--	--	--	--	--	--	--	--	--
Knoxville, TN	--	--	--	--	--	--	--	--	--	--	--
San Antonio, TX	--	--	--	--	--	--	--	--	200	--	--
Bellevue, WA	1979	--	--	--	--	--	--	--	--	--	--
Seattle, WA	1974	--	--	--	--	--	--	--	--	--	--
Madison, WI	1981	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIh (CONT'D). PARKING MANAGEMENT

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare *	Occ.
Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
ARCO, Los Angeles, CA	--	--	--	--	--	--	--	--	--	56% (NA) [NA] {NA}	--
Commuter Computer, Los Angeles, CA	--	--	--	--	--	--	--	--	NA (+33%)	--	--
Sacramento, CA	--	--	--	--	--	--	--	--	--	--	--
San Francisco, CA	--	--	--	--	--	--	--	--	NA (60%)	+10-15% (NA) [NA] {NA}	--
Bank of America, San Francisco, CA	--	--	--	--	--	--	--	--	--	--	--
Childrens Hospital, San Francisco, CA	--	--	--	--	--	--	--	--	--	+55 (NA) [NA] {NA}	--
University of California, San Francisco, CA	--	--	--	--	--	--	--	--	--	10% (NA) [NA] {NA}	--
Santa Cruz, CA	--	--	--	--	--	--	--	--	--	--	--
Hartford, CT	--	--	--	--	--	--	--	--	--	--	--
Orlando, FL (MeterEater)	--	--	--	--	--	--	--	--	--	--	--
Honolulu, HI	--	--	--	--	--	--	--	--	--	--	--
Chicago, IL	--	--	--	--	--	--	--	--	--	--	--
Boston, MA	--	--	--	--	--	--	--	--	--	--	--
Baltimore, MD	--	--	--	--	--	--	--	--	--	--	--
Montgomery County, MD	--	--	--	--	--	--	--	--	--	48 (NA) [NA] {NA}	--
Minneapolis, MN	--	--	--	--	--	--	--	--	--	--	--
SMART Program, New York, NY	--	--	--	--	--	--	--	--	--	--	--
Eugene, OR	--	--	--	--	--	--	--	--	--	NA (NA) [NA] {40-50}	--
Portland, OR	--	--	--	--	--	--	--	--	NA (+58%)	288 (NA) [NA] {NA}	3.3
Knoxville, TN	--	--	--	--	--	--	--	--	--	--	--
San Antonio, TX	--	--	--	--	--	--	--	--	--	--	--
Bellevue, WA	--	--	--	--	--	--	-17.8% trips	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--	--	+62% (NA) [NA] {NA}	--
Madison, WI	--	--	--	--	--	--	--	--	NA (5% to 8%)	--	--

<u>NOTE</u>

† SOV (Other)

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIh (CONT'D). PARKING MANAGEMENT

Action/Example	Emission Impacts: CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Los Angeles, CA	--	--	--	--	--	44
ARCO, Los Angeles, CA	--	--	--	--	--	3
Commuter Computer, Los Angeles, CA	--	--	--	--	--	3
Sacramento, CA	--	--	--	--	--	3, 44
San Francisco, CA	--	--	--	--	--	44
Bank of America, San Francisco, CA	--	--	--	--	--	2
Childrens Hospital, San Francisco, CA	--	--	--	--	--	3, 41
University of California, San Francisco, CA	--	--	--	--	--	41
Santa Cruz, CA	--	--	--	--	--	1
Hartford, CT	--	--	--	--	--	1
Orlando, FL (MeterEater)	--	--	--	--	--	2, 44
Honolulu, HI	--	--	--	--	--	1
Chicago, IL	--	--	--	--	--	3, 44
Boston, MA	-12.2/day (-13.4/day) or 0.5% reg	--	-1.0/day (-1.1/day) or 0.3% reg	--	--	44
Baltimore, MD	--	--	--	--	--	1
Montgomery County, MD	--	--	--	--	--	44
Minneapolis, MN	--	--	--	--	--	1
SMART Program, New York, NY	--	--	--	--	--	2
Eugene, OR	--	--	--	--	--	44
Portland, OR	-12%	--	--	--	--	1, 44
Knoxville, TN	--	--	--	--	--	2
San Antonio, TX	--	--	--	--	--	1
Bellevue, WA	--	--	--	--	--	44, 48
Seattle, WA	--	--	--	--	--	44
Madison, WI	--	--	--	--	--	1, 44

TABLE A-IIIi. PARK-AND-RIDE/FRINGE PARKING

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
Calgary, Canada	--	--	X	--	--	--	--	--	7,200	--	--
Hartford, CT	--	--	--	--	--	--	--	--	--	--	--
Chicago, IL	--	--	--	--	--	--	--	--	10,200	--	--
Atlanta, GA	1975	--	--	--	--	--	--	--	907	--	--
Boston, MA	--	--	--	--	--	--	--	--	17,000	--	--
St. Paul, MN	--	--	--	--	--	--	--	--	3,000	5 buses	--
St. Louis, MO	--	--	--	--	--	--	--	--	--	--	--
Trenton, NJ	--	--	--	--	--	--	--	--	--	--	--
New York, NY	--	--	--	--	--	--	--	--	--	--	--
Cleveland, OH	--	--	--	--	--	--	--	--	--	--	--
Toledo, OH	--	--	--	--	--	--	--	--	1,245	--	--
Philadelphia, PA	--	--	--	--	--	--	--	--	--	--	--
San Antonio, TX	--	--	--	--	--	--	--	--	--	--	--
Houston, TX	--	--	--	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--	1,500	--	30,000/yr.
Milwaukee, WI	--	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIi (CONT'D). PARK-AND-RIDE/FRINGE PARKING

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership*	Veh. Removed	Fuel Cons./wkday ltr (gal)	Mode Shift	Rideshare	Occ.
Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
Calgary, Canada	-2% to 3% (AM Pk.)	--	--	--	--	--	5,400 (Pk. Pd.)	-11,460 (-3,027)	--	--	--
Hartford, CT	--	--	--	--	--	--	--	--	--	--	--
Chicago, IL	--	--	--	--	--	--	--	--	--	--	--
Atlanta, GA	--	--	--	--	--	--	-1200	--	--	--	--
Boston, MA	--	--	--	--	--	--	--	--	--	--	--
St. Paul, MN	--	--	--	--	--	1600/day (NA) [NA] {NA}	--	--	--	--	--
St. Louis, MO	--	--	--	--	--	--	--	--	--	--	--
Trenton, NJ	--	--	--	--	--	--	--	--	--	--	--
New York, NY	--	--	--	--	--	--	--	--	--	--	--
Cleveland, OH	--	--	--	--	--	--	--	--	--	--	--
Toledo, OH	--	--	--	--	--	--	--	--	--	--	--
Philadelphia, PA	--	--	--	--	--	--	--	--	--	--	--
San Antonio, TX	--	--	--	--	--	--	--	--	--	--	--
Houston, TX	--	--	--	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--
Milwaukee, WI	--	--	--	--	--	--	--	--	--	--	--

NOTE

* Carpools (Vanpools) [Buspools] {Persons}

TABLE A-IIIi (CONT'D). PARK-AND-RIDE/FRINGE PARKING

Action/Example	Emission Impacts					References
	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Los Angeles, CA	--	--	--	--	--	4
Calgary, Canada	-1.786/wkdy (-1.620/wkdy)	--	--	-0.154/wkdy (-0.140/wkdy)	-7.265/wkdy (-6.591/wkdy)	73
Hartford, CT	--	--	--	--	--	4
Chicago, IL	--	--	--	--	--	4
Atlanta, GA	--	--	--	--	--	4
Boston, MA	--	--	--	--	--	4
St. Paul, MN	--	--	--	--	--	21
St. Louis, MO	--	--	--	--	--	4
Trenton, NJ	--	--	--	--	--	4
New York, NY	--	--	--	--	--	2
Cleveland, OH	--	--	--	--	--	4
Toledo, OH	--	--	--	--	--	4
Philadelphia, PA	--	--	--	--	--	4
San Antonio, TX	--	--	--	--	--	29
Houston, TX	--	--	--	--	--	29
Seattle, WA	--	--	--	--	--	4, 21
Milwaukee, WI	--	--	--	--	--	4

TABLE A-IIIj. BICYCLE AND PEDESTRIAN MEASURES

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees†	Site (extent): Units*	Site (extent): Parking	Site (extent): Fleet	Cost ($)
Bicycle Facilities											
Routes, Lanes, and Paths											
Tucson, AZ	1971	--	X	--	482.8 (300)	--	--	--	--	--	300,000/yr.
Davis, CA	--	--	X	--	--	--	--	--	--	--	--
Palo Alto, CA	--	--	X	--	--	--	--	--	--	--	--
Eugene, OR	--	--	X	--	--	--	--	--	--	--	--
Seattle, WA	--	--	X	--	233.4 (145)	--	--	--	--	--	6,000,000/yr.
Madison, WI	1972	--	X	--	160.9 (100)	--	--	--	--	--	65-85,000/yr.
Bicycle Plans and Maps											
Tucson, AZ	1971	--	X	--	482.8 (300)	--	--	--	--	--	300,000/yr.
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	X	--	--	600 (NA)	--	--	--	--
Bicycle Coordinators											
Tucson, AZ	1971	--	X	--	482.8 (300)	--	--	--	--	--	300,000/yr.
Lockers, Racks, and Other Storage Facilities											
Tucson, AZ	1971	--	X	--	482.8 (300)	--	--	--	--	--	300,000/yr.
Xerox Corporation, Palo Alto, CA	--	--	--	X	--	--	500 (NA)	--	--	--	--
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	X	--	--	600 (NA)	--	--	--	--
Empire State Office Plaza, Albany, NY	Jun-88	--	--	X	--	--	--	--	--	--	--
Seattle, WA	--	--	X	--	233.4 (145)	--	--	--	--	--	6,000,000/yr.
Showers and Clothing Lockers											
Xerox Corporation, Palo Alto, CA	--	--	--	X	--	--	500 (NA)	--	--	--	--
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	X	--	--	600 (NA)	--	--	--	--
Empire State Office Plaza, Albany, NY	Jun-88	--	--	--	--	--	--	--	--	--	--
Integration with Transit											
Seattle, WA	--	--	X	--	233.4 (145)	--	--	--	--	--	6,000,000/yr.
Ordinances											
Seattle, WA	--	--	X	--	233.4 (145)	--	--	--	--	--	6,000,000/yr.
Madison, WI	1972	--	X	--	160.9 (100)	--	--	--	--	--	65-85,000/yr.
Education											
Tucson, AZ	1971	--	X	--	482.8 (300)	--	--	--	--	--	300,000/yr.
Seattle, WA	--	--	X	--	233.4 (145)	--	--	--	--	--	6,000,000/yr.
Madison, WI	1972	--	X	--	160.9 (100)	--	--	--	--	--	65-85,000/yr.
Media and Promotion											
Tucson, AZ	1971	--	X	--	482.8 (300)	--	--	--	--	--	300,000/yr.

NOTE

† Participating (Total Number)

* Bicycles

TABLE A-IIIj (CONT'D). BICYCLE AND PEDESTRIAN MEASURES

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare	Occ.
Bicycle Facilities											
Routes, Lanes, and Paths											
Tucson, AZ	--	--	--	--	--	--	--	--	3.5%	--	--
Davis, CA	--	--	--	--	--	--	--	--	--	--	--
Palo Alto, CA	--	--	--	--	--	--	--	--	--	--	--
Eugene, OR	--	--	--	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--
Madison, WI	--	--	--	--	--	--	--	--	--	--	--
Bicycle Plans and Maps											
Tucson, AZ	--	--	--	--	--	--	--	--	3.5%	--	--
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	--	--	--	--	--	12%	--	--
Bicycle Coordinators											
Tucson, AZ	--	--	--	--	--	--	--	--	3.5%	--	--
Lockers, Racks, and Other Storage Facilities											
Tucson, AZ	--	--	--	--	--	--	--	--	3.5%	--	--
Xerox Corporation, Palo Alto, CA	--	--	--	--	--	--	--	--	18%	--	--
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	--	--	--	--	--	12%	--	--
Empire State Office Plaza, Albany, NY	--	--	--	--	--	--	--	--	--	--	--
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--
Showers and Clothing Lockers											
Xerox Corporation, Palo Alto, CA	--	--	--	--	--	--	--	--	18%	--	--
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	--	--	--	--	--	12%	--	--
Empire State Office Plaza, Albany, NY	--	--	--	--	--	--	--	--	--	--	--
Integration with Transit											
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--
Ordinances											
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--
Madison, WI	--	--	--	--	--	--	--	--	--	--	--
Education											
Tucson, AZ	--	--	--	--	--	--	--	--	3.5%	--	--
Seattle, WA	--	--	--	--	--	--	--	--	--	--	--
Madison, WI	--	--	--	--	--	--	--	--	--	--	--
Media and Promotion											
Tucson, AZ	--	--	--	--	--	--	--	--	3.5%	--	--

NOTE
† To Bicycles

TABLE A-IIIj (CONT'D). BICYCLE AND PEDESTRIAN MEASURES

Action/Example	Emission Impacts					References
	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall	
Bicycle Facilities						
Routes, Lanes, and Paths						
Tucson, AZ	--	--	--	--	--	1
Davis, CA	--	--	--	--	--	49
Palo Alto, CA	--	--	--	--	--	2
Eugene, OR	--	--	--	--	--	49
Seattle, WA	--	--	--	--	--	1
Madison, WI	--	--	--	--	--	1
Bicycle Plans and Maps						
Tucson, AZ	--	--	--	--	--	1
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	--	--	1
Bicycle Coordinators						
Tucson, AZ	--	--	--	--	--	1
Lockers, Racks, and Other Storage Facilities						
Tucson, AZ	--	--	--	--	--	1
Xerox Corporation, Palo Alto, CA	--	--	--	--	--	2
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	--	--	1
Empire State Office Plaza, Albany, NY	--	--	--	--	--	2
Seattle, WA	--	--	--	--	--	1
Showers and Clothing Lockers						
Xerox Corporation, Palo Alto, CA	--	--	--	--	--	2
Fleetwood Enterprises, Inc., Riverside, CA	--	--	--	--	--	1
Empire State Office Plaza, Albany, NY	--	--	--	--	--	2
Integration with Transit						
Seattle, WA	--	--	--	--	--	1
Ordinances						
Seattle, WA	--	--	--	--	--	1
Madison, WI	--	--	--	--	--	1
Education						
Tucson, AZ	--	--	--	--	--	1
Seattle, WA	--	--	--	--	--	1
Madison, WI	--	--	--	--	--	1
Media and Promotion						
Tucson, AZ	--	--	--	--	--	1

TABLE A-IIIj (CONT'D). BICYCLE AND PEDESTRIAN MEASURES

Action/Example	Implementation Date	Type: Roadway	Type: Area	Type: Business	Site (extent): Kilometers (Miles)	Site (extent): Sq. Kilometers (Sq. Miles)	Site (extent): No. of Employees †	Site (extent): Units*	Site (extent): Parking	Site (extent): Fleet	Cost ($)
Unclassified											
Lawrence Livermore National Laboratories	--	--	--	X	--	--	600 (7,200)	--	--	--	--
Hewlett-Packard, Palo Alto, CA	--	--	--	X	--	--	--	--	--	--	--
Syntex and Syva, Palo Alto, CA	--	--	--	X	--	--	NA (2,000)	--	--	--	--
Lockheed Missles and Space Co., Sunnyvale, CA	--	--	--	X	--	--	--	1,100	--	--	--
Pedestrian Facilities and Programs											
Sidewalks and Walkways											
Safe Facilities											
Sidewalk Environment/Furniture											
Connections with Transit											
Education											

NOTE

† Participating (Total Number)

* Bicycles

TABLE A-IIIj (CONT'D). BICYCLE AND PEDESTRIAN MEASURES

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare	Occ.
Unclassified											
Lawrence Livermore National Laboratories	--	--	--	--	--	--	--	--	--	--	--
Hewlett-Packard, Palo Alto, CA	--	--	--	--	--	--	--	--	9%	--	--
Syntex and Syva, Palo Alto, CA	--	--	--	--	--	--	--	--	5.30%	--	--
Lockheed Missles and Space Co., Sunnyvale, CA	--	--	--	--	--	--	--	--	--	--	--
Pedestrian Facilities and Programs											
Sidewalks and Walkways											
Safe Facilities											
Sidewalk Environment/Furniture											
Connections with Transit											
Education											

NOTE

† To Bicycles

TABLE A-IIIj (CONT'D). BICYCLE AND PEDESTRIAN MEASURES

Action/Example	Emission Impacts: CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall	References
Unclassified						
Lawrence Livermore National Laboratories	--	--	--	--	--	41
Hewlett-Packard, Palo Alto, CA	--	--	--	--	--	41
Syntex and Syva, Palo Alto, CA	--	--	--	--	--	41
Lockheed Missles and Space Co., Sunnyvale, CA	--	--	--	--	--	41
Pedestrian Facilities and Programs						
Sidewalks and Walkways						
Safe Facilities						
Sidewalk Environment/Furniture						
Connections with Transit						
Education						

TABLE A-IIIk. SPECIAL EVENTS

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
1984 Olympics, Los Angeles, CA	1984	--	X	--	--	--	--	--	--	--	--
Orlando Centroplex, Orlando, FL	--	--	X	--	--	0.0028 (0.0011)	--	--	--	--	--
Southeast Expressway, Boston, MA	1984 - 1985	X	--	--	13.4 (8.3)	--	--	--	--	--	--
1982 World's Fair, Knoxville, TN	May-82	--	X	--	--	--	--	--	12,300	--	--
Husky Stadium, Seattle, WA	--	--	X	--	--	--	--	--	--	--	--

TABLE A-IIIk (CONT'D). SPECIAL EVENTS

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare	Occ.
1984 Olympics, Los Angeles, CA	--	--	--	--	--	--	--	--	--	--	--
Orlando Centroplex, Orlando, FL	--	--	--	--	--	--	--	--	--	--	--
Southeast Expressway, Boston, MA	--	--	--	--	--	--	--	--	--	--	--
1982 World's Fair, Knoxville, TN	--	--	--	--	--	--	--	--	NA (5%)	--	--
Husky Stadium, Seattle, WA	--	--	--	--	--	--	--	--	--	--	--

NOTE
† SOV (Other)

TABLE A-IIIk (CONT'D). SPECIAL EVENTS

Action/Example	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
1984 Olympics, Los Angeles, CA	--	--	--	--	--	1
Orlando Centroplex, Orlando, FL	--	--	--	--	--	8
Southeast Expressway, Boston, MA	--	--	--	--	--	1
1982 World's Fair, Knoxville, TN	--	--	--	--	--	1
Husky Stadium, Seattle, WA	--	--	--	--	--	36

TABLE A-IIII. VEHICLE USE LIMITATIONS/RESTRICTIONS

		Type			Site (extent)						
Action/Example	Implementation Date	Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	Cost ($)
Route Diversion											
Automobile Free (Restricted) Zones											
Burbank, CA	1968	--	X	--	--	--	--	--	--	--	973,000
Oakland, CA	1961	--	X	--	--	--	--	--	--	--	--
Pomona, CA	1962	--	X	--	--	--	--	--	--	--	640,000
Riverside, CA	1966	--	X	--	--	--	--	--	--	--	720,000
Denver, CO (16th Street Mall)	--	--	X	--	--	--	--	11 blk.	--	--	--
Washington, DC (F Street Mall)	1966	--	X	--	--	--	--	2 blk.	--	--	--
Miami Beach, FL	1960	--	X	--	--	--	--	--	--	--	600,000
Honolulu, HI	1969	--	X	--	--	--	--	--	--	--	1,336,000
Danville, IL	1967	--	X	--	--	--	--	--	--	--	112,000
Atchison, KS	1963	--	X	--	--	--	--	--	--	--	300,000
Louisville, KY	1973	--	X	--	--	--	--	--	--	--	1,500,000
Boston, MA (Downtown Crossing)	1978	--	X	--	--	1.8 (0.7)	--	--	--	--	--
Salisbury, MD	1968	--	X	--	--	--	--	--	--	--	150,000
Kalamazoo, MI	1959	--	X	--	--	--	--	--	--	--	120,000
Minneapolis, MN (Nicollet Mall)	1968	--	X	--	--	--	--	--	--	--	3,875,000
Brooklyn, NY (Fulton Street Mall)	1979	--	X	--	--	--	--	--	--	--	--
Portland, OR (Portland Mall)	1978	--	X	--	--	--	--	12 blk.	--	--	--
Allentown, PA (Hamilton Mall)	1973	--	X	--	--	--	--	--	--	--	--
Philadelphia, PA (Chestnut Street Mall)	1976	--	X	--	--	--	--	12 blk.	--	--	--
Providence, RI (Westminster Mall)	1965	--	X	--	--	--	--	4 blk.	--	--	530,000
Memphis, TN (Mid-American Mall)	1974	--	X	--	--	--	--	10 blk.	--	--	--
Madison, WI (State Street Mall)	1975-1979	--	X	--	--	--	--	--	--	--	--
Pedestrian Malls											
Traffic Controls											
No-Drive Days											
Voluntary											
Phoenix, AZ	1989	--	--	--	--	--	--	--	--	--	325,000/yr.
Denver, CO	1986	--	--	--	--	--	--	--	--	--	500,000/yr.
Required											

TABLE A-IIII (CONT'D). VEHICLE USE LIMITATIONS/RESTRICTIONS

	Travel Impacts										
Action/Example	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare	Occ.
Route Diversion											
Automobile Free (Restricted) Zones											
Burbank, CA	--	--	--	--	--	--	--	--	--	--	--
Oakland, CA	--	--	--	--	--	--	--	--	--	--	--
Pomona, CA	--	--	--	--	--	--	--	--	NA (+73%)	--	--
Riverside, CA	--	--	--	--	--	--	--	--	--	--	--
Denver, CO (16th Street Mall)	--	--	--	--	--	--	--	--	--	--	--
Washington, DC (F Street Mall)	--	--	--	--	--	--	--	--	NA (+23%)	--	--
Miami Beach, FL	--	--	--	--	--	--	--	--	NA (+50%)	--	--
Honolulu, HI	--	--	--	--	--	--	--	--	--	--	--
Danville, IL	--	--	--	--	--	--	--	--	--	--	--
Atchison, KS	--	--	--	--	--	--	--	--	--	--	--
Louisville, KY	--	--	--	--	--	--	--	--	--	--	--
Boston, MA (Downtown Crossing)	--	--	--	--	--	--	--	--	--	--	--
Salisbury, MD	--	--	--	--	--	--	--	--	--	--	--
Kalamazoo, MI	--	--	--	--	--	--	--	--	NA (+40%)	--	--
Minneapolis, MN (Nicollet Mall)	--	--	--	--	--	--	--	--	--	--	--
Brooklyn, NY (Fulton Street Mall)	--	--	--	--	--	--	--	--	--	--	--
Portland, OR (Portland Mall)	--	--	--	--	--	--	--	--	--	--	--
Allentown, PA (Hamilton Mall)	--	--	--	--	--	--	--	--	--	--	--
Philadelphia, PA (Chestnut Street Mall)	--	--	--	--	--	--	--	--	--	--	--
Providence, RI (Westminster Mall)	--	--	--	--	--	--	--	--	--	--	--
Memphis, TN (Mid-American Mall)	--	--	--	--	--	--	--	--	--	--	--
Madison, WI (State Street Mall)	--	--	--	--	--	--	--	--	--	--	--
Pedestrian Malls											
Traffic Controls											
No-Drive Days											
Voluntary											
Phoenix, AZ	-2.8% in 1989	--	--	--	--	--	--	--	--	--	--
Denver, CO	--	--	--	--	--	--	--	--	--	--	--
Required											

NOTE

† SOV (Other)

TABLE A-IIII (CONT'D). VEHICLE USE LIMITATIONS/RESTRICTIONS

Action/Example	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References
Route Diversion						
Automobile Free (Restricted) Zones						
Burbank, CA	--	--	--	--	--	38
Oakland, CA	--	--	--	--	--	38
Pomona, CA	--	--	--	--	--	38
Riverside, CA	--	--	--	--	--	38
Denver, CO (16th Street Mall)	--	--	--	--	--	44
Washington, DC (F Street Mall)	--	--	--	--	--	38, 44
Miami Beach, FL	--	--	--	--	--	38
Honolulu, HI	--	--	--	--	--	38
Danville, IL	--	--	--	--	--	38
Atchison, KS	--	--	--	--	--	38
Louisville, KY	--	--	--	--	--	38
Boston, MA (Downtown Crossing)	--	--	--	--	--	6, 44
Salisbury, MD	--	--	--	--	--	38
Kalamazoo, MI	--	--	--	--	--	38
Minneapolis, MN (Nicollet Mall)	--	--	--	--	--	38
Brooklyn, NY (Fulton Street Mall)	--	--	--	--	--	44
Portland, OR (Portland Mall)	--	--	--	--	--	44
Allentown, PA (Hamilton Mall)	--	--	--	--	--	38
Philadelphia, PA (Chestnut Street Mall)	--	--	--	--	--	44
Providence, RI (Westminster Mall)	--	--	--	--	--	38
Memphis, TN (Mid-American Mall)	--	--	--	--	--	44
Madison, WI (State Street Mall)	--	--	--	--	--	44
Pedestrian Malls						
Traffic Controls						
No-Drive Days						
Voluntary						
Phoenix, AZ	-24.5 (-27) in 1989	--	-3.2 (-3.5) in 1989 -1.3 (-1.4) in 1990	-3.9 (-4.3) in 1989 -1.6 (-1.8) in 1990	--	1
Denver, CO	--	--	--	--	-2%	1
Required						

TABLE A-IIII (CONT'D). VEHICLE USE LIMITATIONS/RESTRICTIONS

		Type			Site (extent)						
Action/Example	Implementation Date	Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	Cost ($)
Control of Truck Movement											
Designated Truck Routes											
Truck Management Strategies											
Scheduling of Shipping/Receiving											
Peak Period Truck Bans on Arterials											
Freight and Delivery Consolidation											
Unclassified											
San Diego, CA	--	--	--	--	--	--	--	--	--	--	--

TABLE A-IIII (CONT'D). VEHICLE USE LIMITATIONS/RESTRICTIONS

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift †	Rideshare	Occ.
Control of Truck Movement											
Designated Truck Routes											
Truck Management Strategies											
Scheduling of Shipping/Receiving											
Peak Period Truck Bans on Arterials											
Freight and Delivery Consolidation											
Unclassified											
San Diego, CA	--	--	--	--	--	--	--	--	--	--	--

NOTE
† SOV (Other)

TABLE A-IIII (CONT'D). VEHICLE USE LIMITATIONS/RESTRICTIONS

Action/Example	Emission Impacts					References
	CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Control of Truck Movement						
Designated Truck Routes						
Truck Management Strategies						
Scheduling of Shipping/Receiving						
Peak Period Truck Bans on Arterials						
Freight and Delivery Consolidation						
Unclassified						
San Diego, CA	--	--	--	--	--	1

TABLE A-IIIm. ACCELERATED RETIREMENT OF VEHICLES

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Unocal Corp., SCRAP, Los Angeles, CA	1990	--	X	--	--	--	--	--	--	--	--

TABLE A-IIIm (CONT'D). ACCELERATED RETIREMENT OF VEHICLES

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.
Unocal Corp., SCRAP, Los Angeles, CA	--	--	--	--	--	--	8376 (Scrapped)	--	--	--	--

TABLE A-IIIm (CONT'D). ACCELERATED RETIREMENT OF VEHICLES

Action/Example	Emission Impacts					References
	CO Mg (tons)	PM Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Unocal Corp., SCRAP, Los Angeles, CA	-3,333/yr. (-3,674/yr.)	-57/yr. (-63/yr.)	-680/yr. (-750/yr.)	-84/yr. (-93/yr.)	--	1, 50

TABLE A-IIIn. ACTIVITY CENTERS

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	

TABLE A-IIIn (CONT'D). ACTIVITY CENTERS

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.

TABLE A-IIIn (CONT'D). ACTIVITY CENTERS

Action/Example	Emission Impacts CO Mg (tons)	O3 Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	References

TABLE A-IIIo. EXTENDED VEHICLE IDLING

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Placer County, CA	1982	--	--	--	--	--	--	--	--	--	--
Sacramento County, CA	--	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIo (CONT'D). EXTENDED VEHICLE IDLING

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.
Placer County, CA	--	--	--	--	--	--	--	--	--	--	--
Sacramento County, CA	--	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIo (CONT'D). EXTENDED VEHICLE IDLING

Action/Example	Emission Impacts					References
	CO Mg (tons)	PM Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Placer County, CA	--	--	--	--	--	1
Sacramento County, CA	--	--	--	--	--	1

TABLE A-IIIp. EXTREME LOW-TEMPERATURE COLD STARTS

Action/Example	Implementation Date	Type			Site (extent)						Cost ($)
		Roadway	Area	Business	Kilometers (Miles)	Sq. Kilometers (Sq. Miles)	No. of Employees	Units	Parking	Fleet	
Fairbanks North Star Borough, AK	1984	--	X	--	--	--	--	--	--	--	--

TABLE A-IIIp (CONT'D). EXTREME LOW-TEMPERATURE COLD STARTS

Action/Example	Travel Impacts										
	VKT (VMT)	Speed kph (mph)	Delay	Stops	Travel Time	Ridership	Veh. Removed	Fuel Cons. ltr (gal)	Mode Shift	Rideshare	Occ.
Fairbanks North Star Borough, AK	--	--	--	--	--	--	--	--	--	--	--

TABLE A-IIIp (CONT'D). EXTREME LOW-TEMPERATURE COLD STARTS

Action/Example	Emission Impacts					References
	CO Mg (tons)	PM Mg (tons)	HC Mg (tons)	NOx Mg (tons)	Overall Mg (tons)	
Fairbanks North Star Borough, AK	--	--	--	--	--	1

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