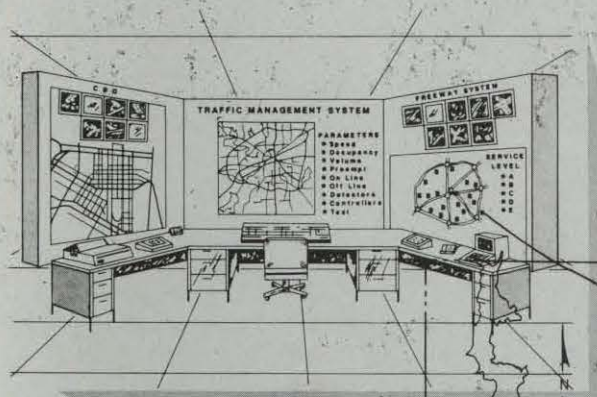
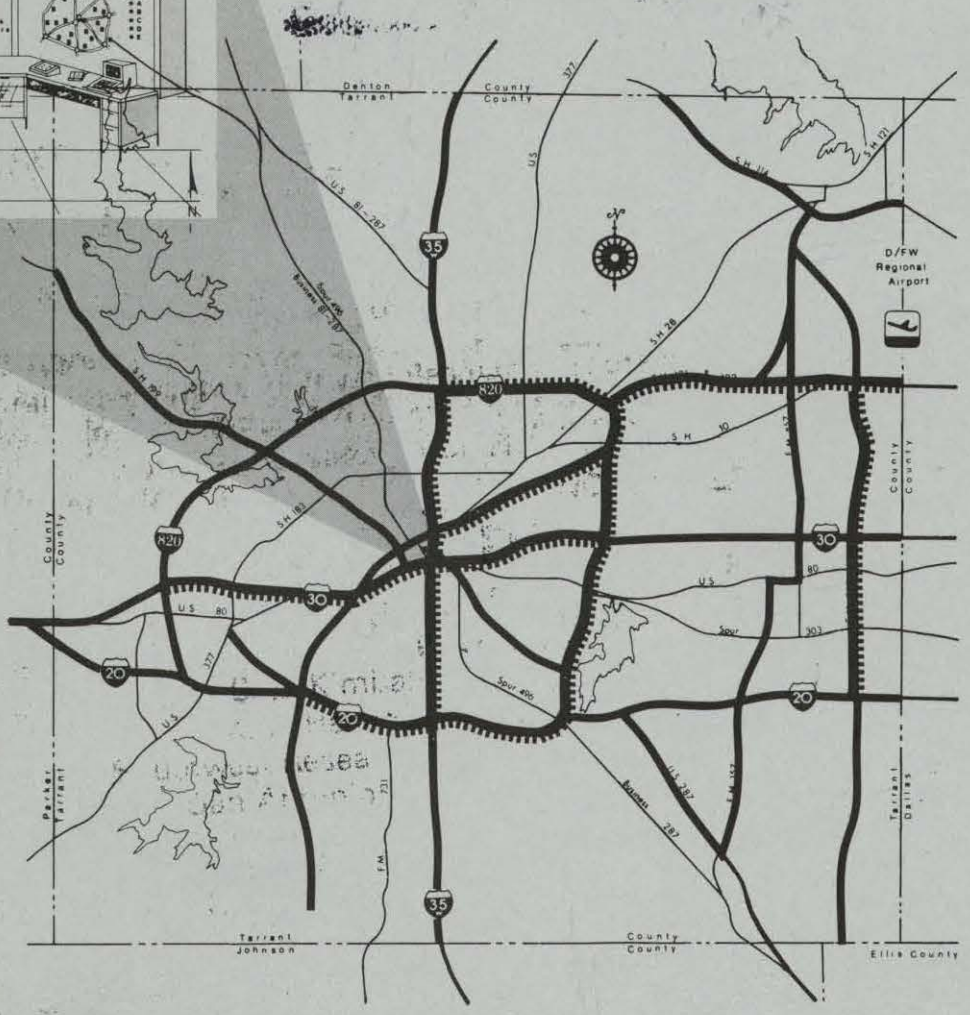
TRAFFIC MANAGEMENT CONCEPT

FOR DISTRICT 2

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION





STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

TRAFFIC MANAGEMENT CONCEPT

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TRAFFIC MANAGEMENT CONCEPT
FOR
DISTRICT 2
STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

EXECUTIVE SUMMARY

The goal of the State Department of Highways and Public Transportation is to provide a safe, functional transportation network. However, traffic demands in Texas urban areas threaten the functional life of our new and old facilites. Our ability to recognize needs and to provide operational solutions will depend upon our capability to monitor traffic operations, evaluate traffic handling alternatives and to implement the optimum solution with appropriate control strategies.

This report provides an overview of the traffic management concept for District 2. It identifies and combines three essential elements: an area-wide surveillance network that provides the means of monitoring traffic conditions; an interconnected communications and traffic control capability; and a management control center to monitor and evaluate traffic situations as they occur and to implement the necessary response.

With the area-wide surveillance network in place, many new capabilities will be available. The ability to monitor the freeways will be possible through electronic surveillance using loop detectors in the pavement and/or closed circuit television monitoring. Information will be available at approximately 1/2 mile intervals on almost every lane on every freeway facility in Tarrant County. This will provide volume, speed, and occupancy information, as well as incident detection capabilities. It will establish a way of knowing what is happening on the freeways on a moment by moment, real-time basis.

Equally important is what is done with this real-time information once it is available. It will then be possible to implement the control strategies, or make adjustments to the system, that are necessary to optimize traffic flow. This will be accomplished by activating ramp metering equipment, changeable message signs, highway advisory radio, lane use signals, and adjusting signal system timing. Courtesy patrol units and/or incident response teams, will provide the flexibility of field response.

The network will be monitored and controlled at a centrally located traffic management center. Representatives from various agencies will work together as a team to operate the system. This will require a close working relationship with the agencies involved.

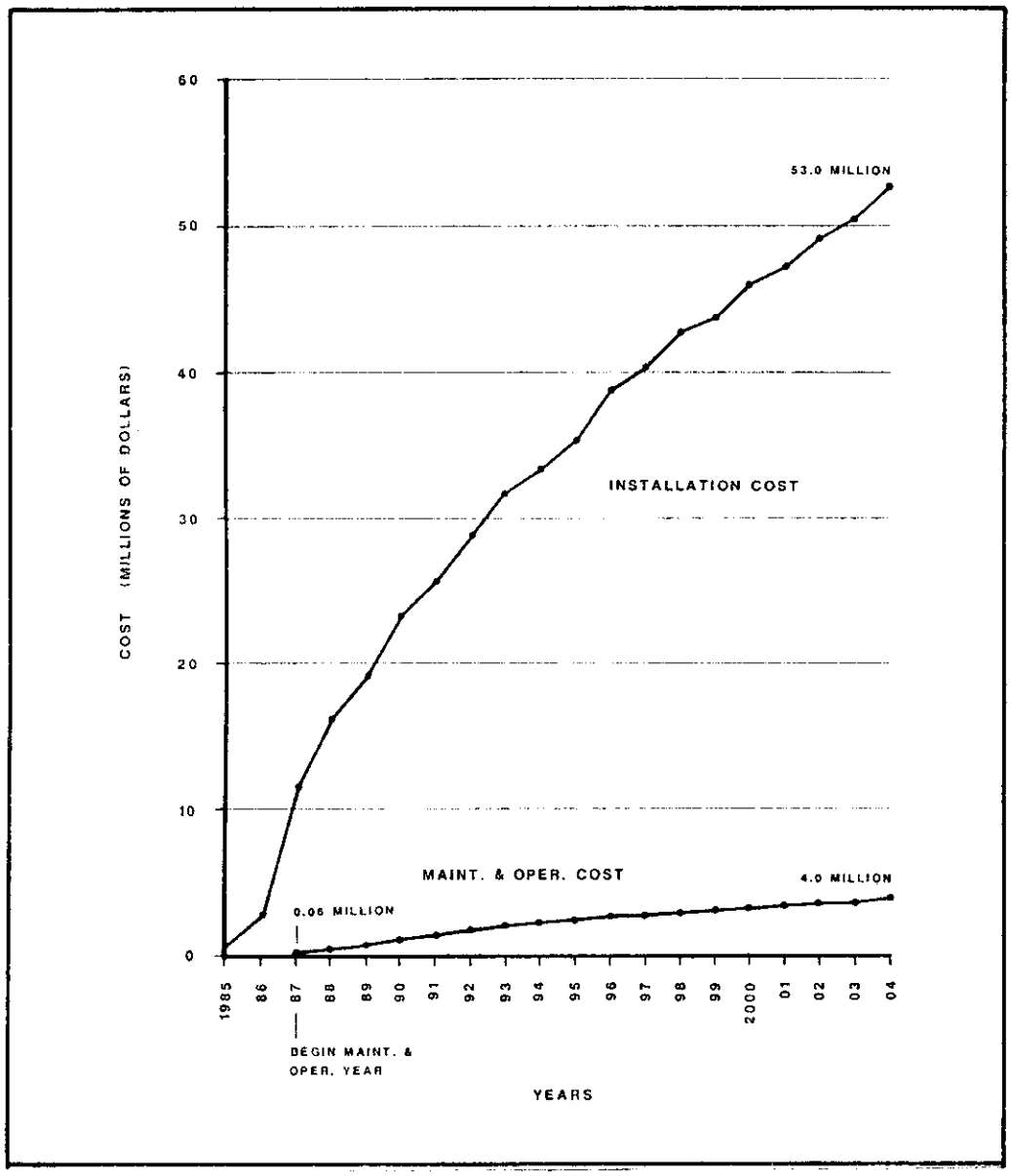
The development of this network will be a part of the District's overall freeway construction/reconstruction plan. When each freeway section is rebuilt, the surveillance network will be incorporated into that project. With the monitoring systems in place, recognition of traffic management needs and implementation of the control aspects of the network will come about as they are needed.

This traffic management concept will also provide the flexibility to accommodate development of public transportation alternatives. As such capabilities as transit and high-occupancy-vehicle facilities are implemented, their operations can be interfaced with the central traffic management center. The added surveillance and control will be compatible with the traffic management system.

The total construction cost of the traffic management projects will be $53 million. It is important to keep this cost in perspective with the corresponding cost of the Department's total roadway construction in Tarrant County. The combined cost for such work in the operational planning document study was $2 billion. The work associated with implementing the proposed traffic management concept will amount to less than 3% of the total expenditure.

In terms of maintenance and operations dollars, it is estimated such costs will be about 8% of the installation cost per year. Over the 20 year period as the system becomes operational incrementally, the maintenance and operations cost per year will increase as shown in the figure below.

Estimates indicate a savings of 156,000 vehicle-hours of delay per day can be achieved with such a traffic management network in place. In addition to delay savings, other benefits such as a 12-20% increase in vehicles per hour, a 10 mph increase travel speeds, and 30% reduction in accidents, can be expected. Effective traffic management also provides a means of extending the functional life of the involved roadway facilities. The system allows recognition and response to safety and operational problems. This precludes or lessens the impact of congestion, reduces pollution, and increases or maintains mobility at acceptable levels of service. Implementation of such a system, built efficiently in stages, will provide the flexibility before the problems far exceed available capabilities and resources.



FREEWAY CORRIDOR SURVEILLANCE AND CONTROL SYSTEM IN FORT WORTH

BY

Wallace E. Ewell

SUPERVISING TRAFFIC ENGINEER
TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
DISTRICT 2 FORT WORTH
January 1988

I. Introduction

District 2 includes nine North Central Texas Counties with a total area of 7,027 miles and an estimated 1986 population of 1,334,000. Tarrant County, the sixth largest county in the District, contains 80% of the total population and approximately 80% of the registered vehicles. The population of Tarrant County has increased from 861,000 in 1980 to an estimated 1,066,000 in 1986, an increase of 24% in just 6 years! In fact, several of the cities in Tarrant County have experienced growth in excess of 80%. If these figures reflect a true indication of what lies ahead, we are in for real trouble on our highways!

We have just about reached the limits of expansion for our existing Tarrant County freeways. Most of our major facilities are in the reconstruction process now and due to restricted right-of-way, a good part of this work is taking place between retaining walls. It is apparent that since we are approaching the limits of our ability to expand existing facilities, we must find some way to optimize operating conditions on the existing system.

II. The solution offered by Traffic Management

Fortunately, some very far-sighted federal, state and city officials came to this realization over 15 years ago and started to plan for the congestion that is now becoming a reality in our District. Working together, Bob Hodge, the former District 2 Traffic Engineer, Herman Haenel, our Freeway Operations Engineer in Austin and Walt Cooper, Chief Transportation Engineer for the City of Fort Worth, and others, prepared a conceptual area wide Traffic Management System Planning document and obtained FHWA approval for the comprehensive plan.

This plan involves 191 miles of freeway and when completed will provide:

161	Miles of freeway with surveillance (6876 Loop Detectors).
80	Miles with ramp metering (207 ramps are involved).
80	Miles with frontage road signal control (95 signals).
45	Changeable Message Signs (CMS)
80	Television surveillance cameras (CCTV).
640	Lane control signals (at 160 locations).
6	Highway advisory radio (HAR) locations.
9	Satellite command post locations.
1	Traffic Management Center (command post)-shared with the City.
1	Data collection facility at the District Headquarters.
300	Miles of highway with Courtesy Patrol Services.

The plan was coordinated with the District's twenty-year project development and control plan to allow for the incorporation of two-thirds of the Traffic Management System construction with the ongoing freeway reconstruction program.

It is estimated that the total construction cost of of the Traffic Management Projects will be approximately $53 million. This figure includes the cost of the satellite and Traffic Management Center computer systems, but does not include maintenance and operational expenses. The system is scheduled to be fully operational by the year 2004. It was estimated that when fully operational, the cost of operation and maintaining the system will be $2.3 million a year. This obviously a very expensive undertaking, but the benefit to the highway user is estimated to be a savings of 156,000 vehicle-hours of delay a day. We also expect to see a 12-20% increase in vehicles moved per hour, a 10 mph increase in travel speeds and a 30% reduction in accidents. More efficient freeways mean less timing sitting in traffic and this translates into a huge savings in fuel, pollution reduction and available productive hours.

III. Overview of the District's Traffic Management Concept.

The area-wide traffic management plan includes four interrelated functional systems; a remote sensing or surveillance component to constantly monitor the operational conditions on the freeways, an interactive control network to allow for the implementation of corrective actions as freeway conditions deteriorate, a joint city-state command post to co-ordinate the activities on the freeways and city streets and an area-wide communications network to link the other systems to the Traffic Management Center and to provide a centralized point of contact for other agencies.

System surveillance will be accomplished through the installation of loop detectors on the freeway main-lanes and ramps and strategically located closed-circuit television (CCTV) cameras. The detector loops will be used to monitor traffic volumes and speed and to detect wrong-way ramp usage. The loops can also be used to collect data for operational analysis and planning purposes. The CCTV cameras can be used to visually verify problems identified by the loop detectors, locate accidents and disabled vehicles and to monitor the effectiveness of the corrective measures implemented from the Traffic Management Center.

The interactive control network offers the system operators several options for correcting conditions on the freeways. Among these options are ramp metering to restrict the volume of traffic entering the freeway, Changeable Message Signs (CMS) to warn motorists of upcoming problems and offer alternate routing information, control of frontage road traffic signals to modify timing for changes in volume, lane-use signals to allow for lane closures and highway advisory radio (HAR) to keep motorists advised of changing conditions. The operator will also have the option of dispatching the District's courtesy patrol or the Incident Management Team to problem spots. It may also be possible to provide real-time traffic advisory information to local radio, TV and government agencies via the District's computerized public information network.

IV. Status of the State's portion of the project (as of Jan 88):

We are basically on the schedule established by the planning document, although funding and other local issues have forced us to switch projects around. We have 23 freeway miles designed or under construction at this time. This constitutes 28% of the 80 freeway miles of I-35W, I-20, I-30, SH-121, and SH-360 that will eventually be controlled.

The outside lanes of I-35W (Felix to Hattie St.) were completed in May of 1987. This project included loop detectors and mainline conduit installation on the frontage roads and ramps (5 miles total).

The I-35W (Felix to Hattie) inside lane project is under construction at this time and is due completion in 1990. This project includes 57 lane control signals, 4 CMS and conduit connections to the satellite computer location. The CMS are scheduled for early installation so that they can be used for traffic control for the remainder of the project.

I-30 (from Westridge to Penticost) is under construction now and includes 1.5 miles of mainline conduit, frontage road traffic signals and loop detectors.

I-30 (from Penticost to University Drive) includes 2 miles of conduit, signals and loop detectors. Construction is in progress at this time.

The I-30/I-35W interchange north increment - includes 1 mile of conduit and loop detectors and is under construction now.

I-20 (Campus Drive to US 287) - includes 3.5 miles of conduit, loop detectors and traffic signals - this job is under construction now.

I-20 (Hemphill to McCart) - This job includes 2 CMS, lane control signals, conduit and detectors. This section of roadway will be connected to the same satellite computer building as the I-35 system. We are also planning on including three additional radio-controlled CMS that will be used to provide motorists with alternate routing information during the series of construction projects on I-30 and I-20. Two of these signs will be located outside of the loop 820 connections, providing the opportunity to divert traffic if incidents or construction activities block lanes on any of the freeways.

I-20/I-35 Interchange - 4 miles of conduit, loop detectors and the satellite computer building are included in this project. Work is in progress at this time.

SH-360 (Abrams to I-20) - This job includes 4 miles of conduit and loop detectors, 1 CMS and lane control signals.

We will also look for the opportunity to implement traffic management elsewhere on our system. This may be the construction or relocation of accident investigation sites, experimental HAR & CMS locations or frequent reviews of existing conditions to see if conventional operational improvements, such as signal re-timing and reallocation of lanes, can be made.

V. Status of the City of Ft. Worth's Traffic Management effort.

The City's Traffic Management project has two phases. The basement of the old city jail has been remodeled to provide a location for the Traffic Management Center. The systems installation phase is in progress at this time. This involves the installation of conduit, computers, software design and traffic signal interconnections. It is overall 30% complete. The installation of conduit in the CBD is almost complete. When completed in February 1989, the city system will include the control of 92 traffic signals in the southwest section of town. Also, 138 signals and 11 CCTV cameras in the CBD.

VI. Summary

These traffic surveillance and control systems will supplement the other Traffic Management efforts that the District is now actively engaged in. These present activities include week night and week end courtesy patrols, ramp control at several locations, Incident Management, Special Event Management, a Traffic Management Team, regular planning and operational meetings with the "T", our local bus company, excellent local government relations and an extensive public information program.

The problem of too many cars and not enough roads is not unique to Texas or to this District. We are sure that this plan will help us cope with the traffic woes to come and hopefully provide a better driving environment for the people who travel the highways in this District.

TRAFFIC MANAGEMENT CONCEPT

for

District 2

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

Fort Worth, Texas

December, 1985

Report Prepared by
Traffic Engineering and Safety
SDHPT District 2

Edited and Published
by
Traffic Engineers, Inc.

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List of Figures and Tables

1.0 Introduction and Purpose

The goal of the State Department of Highways and Public Transportation has been to provide a safe, functional transportation network. The reality of keeping up with this basic charge is threatened by the magnitude of the traffic demands in Texas urban areas, and the frequent inability of the existing network to meet these demands. Traditional solutions such as reconstruction of key transportation facilities will continue to be necessary, but there is little reason to assume that adequate roadways can be constructed or reconstructed fast enough to keep up with the demand.

The ultimate functional life of the new facilities will depend upon the ability to recognize needs and to provide operational solutions as problems arise. It will be necessary to monitor the traffic operations, evaluate traffic-handling alternatives, and implement the optimum solution with appropriate control strategies.

The State Department of Highways and Public Transportation (SDPHT) recognizes the need for the establishment and development of traffic management systems. Administrative Order 2-85 (1-28-85) and Minute Order 82421 (11-20-84) define the SDHPT's awareness and role in this regard (Appendix A).

It is the purpose of this report to provide an overview of the traffic management concept for District 2, headquartered in Fort Worth, and to identify the key elements of this management and operations network. This report concentrates on the freeway corridor as a critical element in the urban transportation network within Tarrant County. The implementation of this concept is dependent upon a long-range commitment by the SDHPT and a close working relationship with the cities involved.

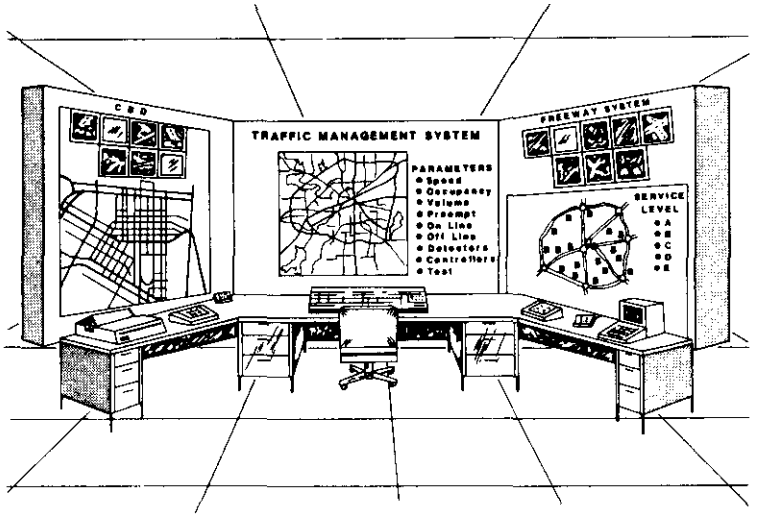
2.0 Overview of Concept

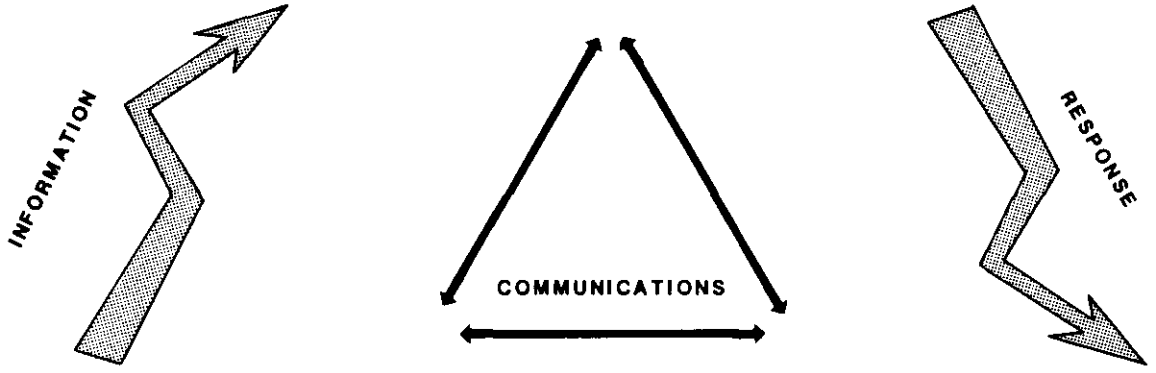
The proposed traffic management concept will combine three essential elements: an area-wide surveillance network that provides the means of monitoring traffic conditions; interconnected communications and traffic control capabilities; and a management control center to monitor and evaluate traffic situations as they occur and to implement the necessary response (Figure 2-1).

With the area-wide network in place, many new capabilities will be available. The ability to monitor the freeways will be possible through electronic surveillance using inductive loop detectors in the pavement and/or closed circuit television monitoring. Information will be available at approximately 1/2 mile spacings on almost every lane of every freeway facility in Tarrant County. This will provide volume, speed, and occupancy information, as well as incident detection capabilities. It will establish a way of knowing what is happening on the freeways on a moment by moment, real time basis.

That is critical information, but equally important is what is done with the information once it is available. It will then be possible to implement the control strategies, or adjustments to the system, that are necessary to optimize vehicle or people moving capabilities. This can be done by activating ramp metering equipment, changeable message signs (CMS), highway advisory radio (HAR), lane use signals, and adjusting signal system timing. Other response efforts can be made by Courtesy Patrol units and Incident Response Teams.

The traffic management network in Fort Worth will be monitored and controlled at a centrally located Traffic Management Center (TMC). At this location representatives from various agencies will work together as a team to operate the system. The City of Fort Worth Transportation and Public Works Department, the State Department of Highways and Public Transportation, and the





SURVEILLANCE

- LOOP DETECTORS - FREEWAY ML & RAMPS
- CLOSED CIRCUIT TV
- WRONG-WAY MOVEMENT DETECTION- CRITICAL SEGMENTS
- SAMPLING LOOP DETECTORS - SIGNAL SYSTEM

CONTROL

- RAMP METERING
- CMS'S
- HAR
- COURTESY PATROL
- INCIDENT RESPONSE TEAMS
- LANE USE SIGNALS
- SIGNAL SYSTEMS TIMING ADJ.

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
TRAFFIC ENGINEERING AND SAFETY

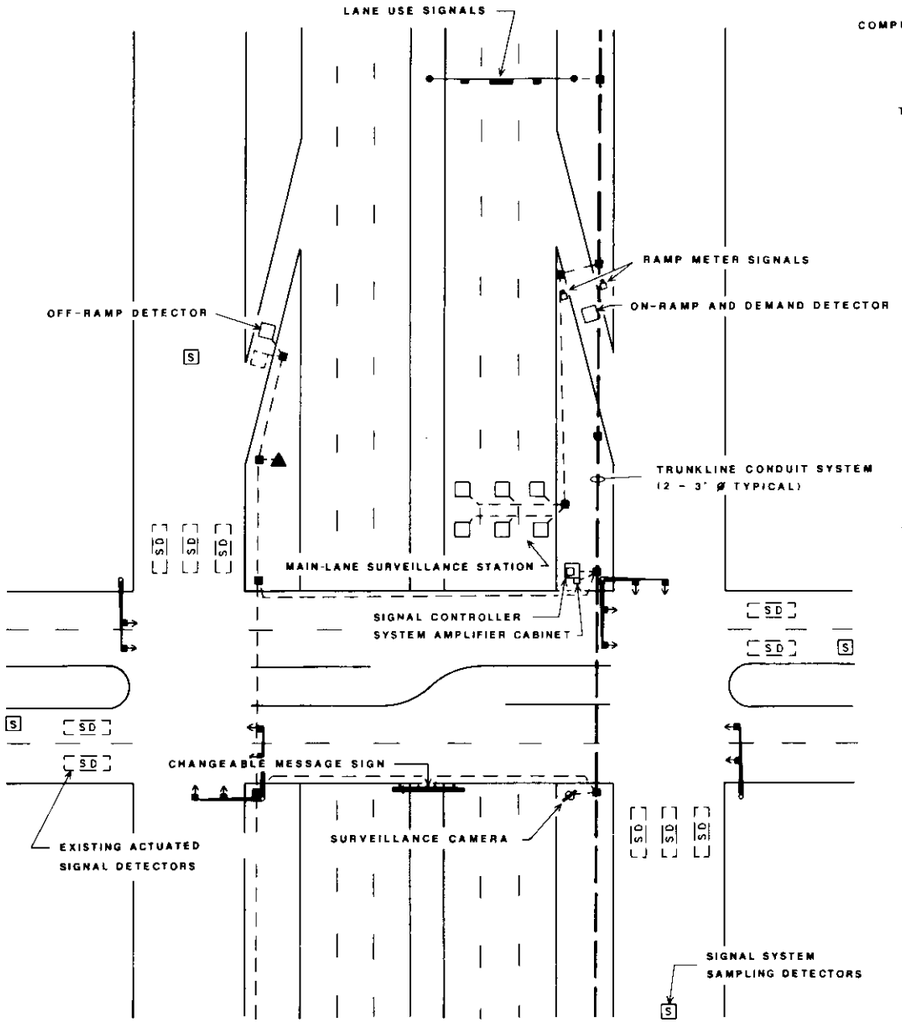
DISTRICT 2 FORT WORTH, TEXAS

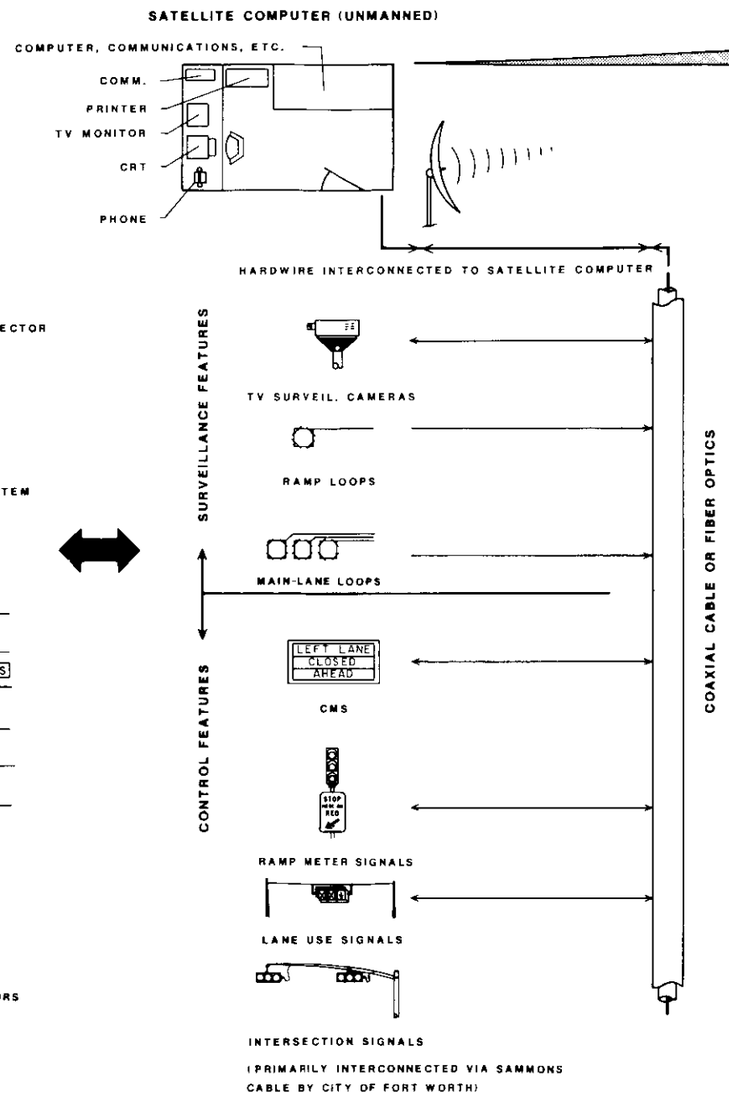
TRAFFIC MANAGEMENT CONCEPT

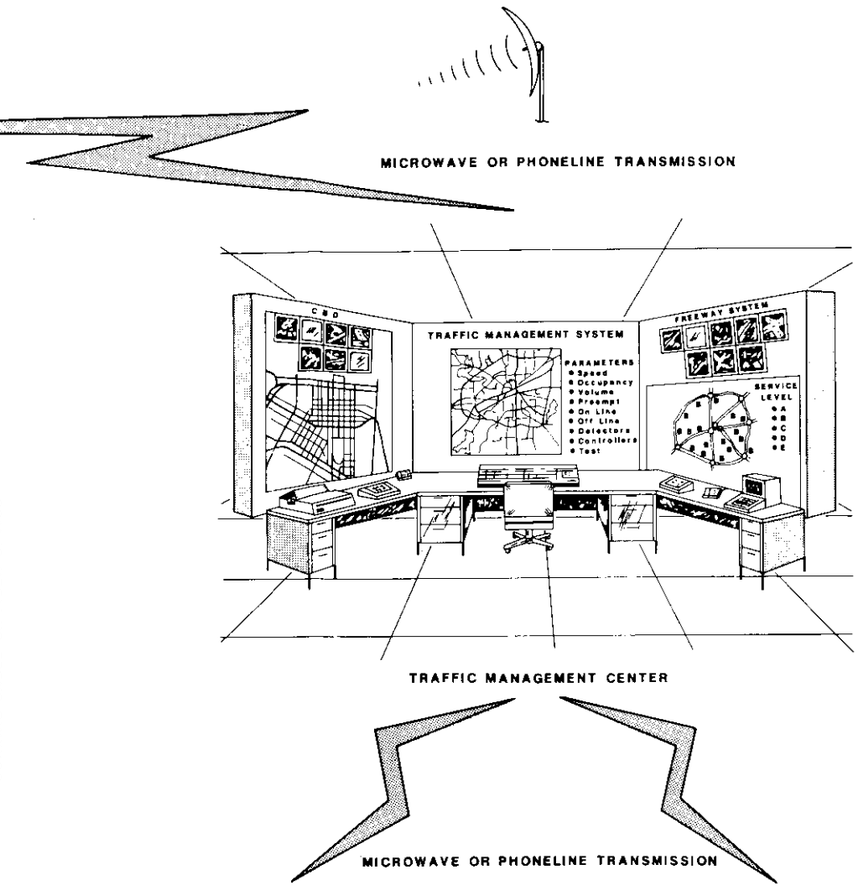
FIGURE 2-1

Fort Worth Police Department will be among those actively involved. Area-wide monitoring capabilities will also be provided at the District Office. Additionally, as surveillance and control systems are provided on freeways within the City of Arlington, such capabilities will be incorporated with their existing Traffic Management Control Center operations (Figure 2-2). Other control centers will be integrated with the network as they develop.

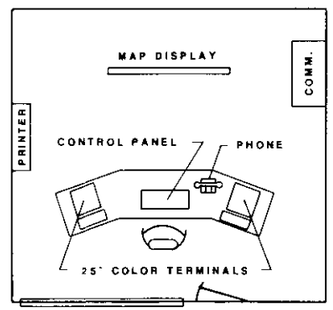
The implementation of this network will be dictated by the District's overall freeway construction/reconstruction plan. As each freeway section is rebuilt, the corresponding link of the surveillance network will be incorporated into the project. Since a great deal of the existing freeways are scheduled for reconstruction within the next 5-10 years, this will allow the surveillance network to evolve basically as traffic demands dictate. With the monitoring systems in place, recognition of traffic management needs and implementation of the control aspects of the network will come about as they are needed. This will mean appropriate and timely control as critical segments of the roadway dictate control strategies (such as ramp metering) or as District or area-wide projects require such measures as CMS or HAR installations.







TRAFFIC MANAGEMENT CENTER



FREEWAY MONITORING CENTER

OTHER CONTROL CENTERS

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

TRAFFIC MANAGEMENT SYSTEM OVERVIEW

FIGURE

2-2

3.0 Surveillance Systems

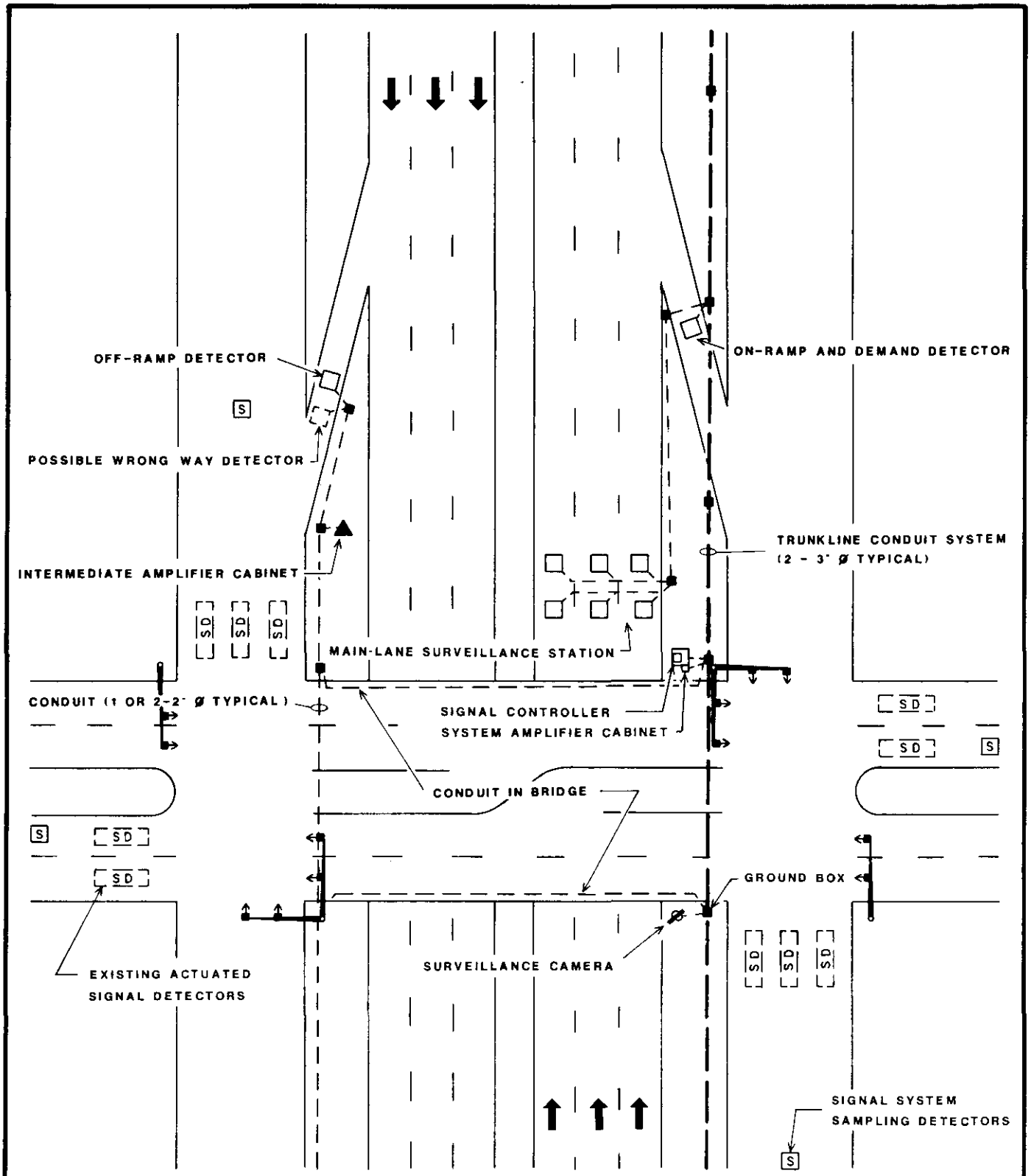
Surveillance involves those aspects of the proposed network that relate to system monitoring. The objective of the surveillance systems is to give the freeway conditions and the status of network traffic operations on a real time basis. Such information has multiple uses as the basis for: design decisions and evaluations; traffic control planning during freeway reconstruction efforts; planning maintenance activities; as well as, the design and timing of signals or ramp control as part of the network control and response function.

The primary source of surveillance information will be from 6'X6' main-lane and ramp loop detectors. This electronic monitoring will allow rapid collection of traffic volumes on freeway main lanes and ramps. Main-lane detector stations, with detectors in each freeway lane, will be located at approximately 1/2 mile spacings. Alternate main-lane stations will provide double loops for speed sampling. Each entrance and exit ramp will also have a loop detector. It will be possible to determine vehicle speeds and traffic occupancy as well as vehicle counts from this detection subsystem (Figure 3-1).

These surveillance features provide the means of determining and describing freeway operating conditions as they exist in the field at any given time. Thus, areas of congestion and incident locations become identifiable.

An additional use for the entrance-ramp detector will be as a demand detector for the ramp control subsystem. The adjacent main-lane detector station will have one loop furnishing concurrent occupancy data to the ramp meter controllers.

At critical locations, the off-ramp loop detector will consist of a set of loops in tandem which will allow for the detection of wrong way vehicle movements. This feature can be implemented as soon as computer control is established to provide the



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

TYPICAL SURVEILLANCE INSTALLATION

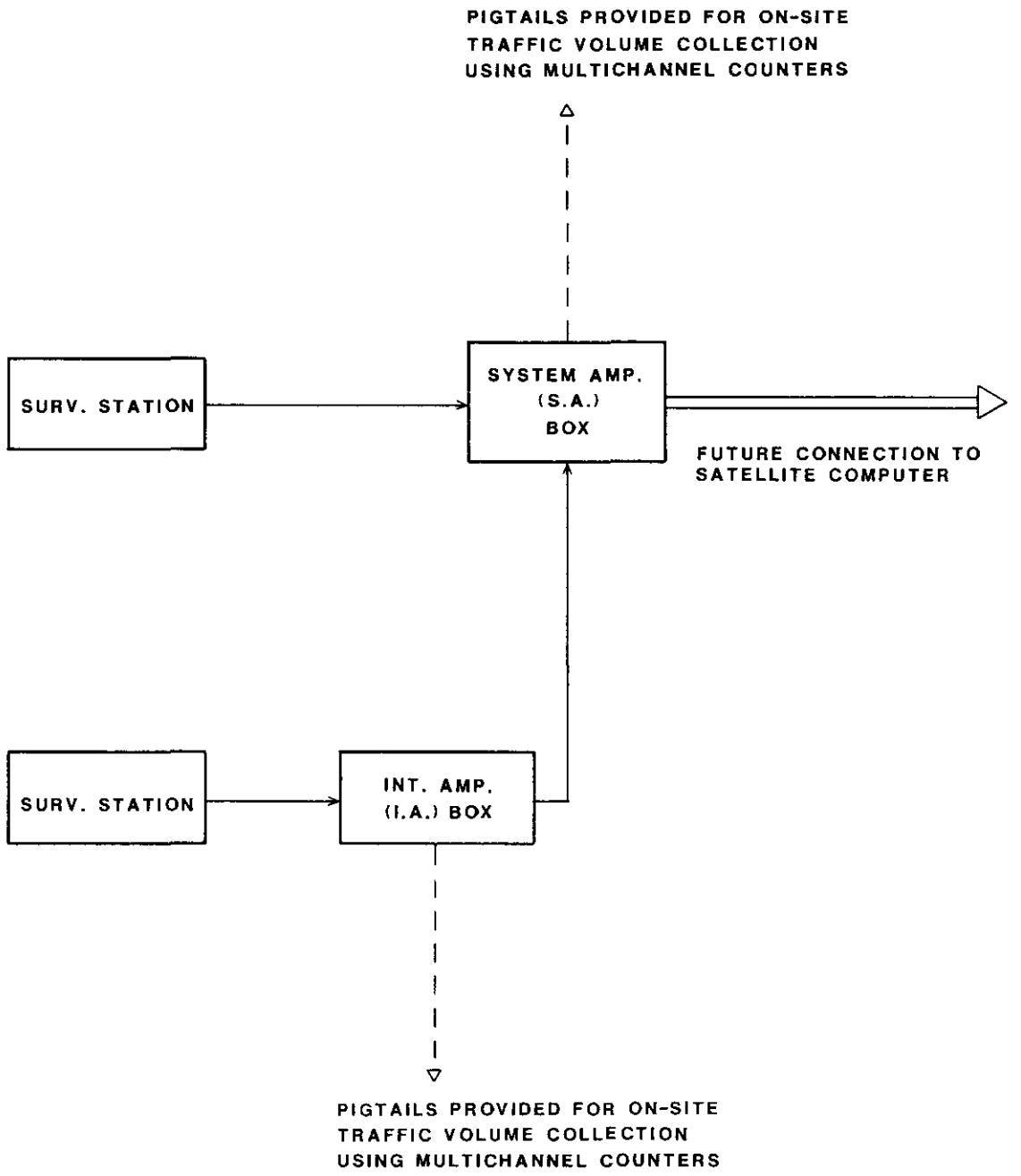
FIGURE

3-1

necessary algorithm to monitor such wrong way movements. Since the cost of the additional detector loop will be minimized by the close proximity of proposed conduit and pullboxes, it will be a desirable feature on much of the freeway network.

There may be an interim period between the time the surveillance loop is installed and the time the loop is hardwired into a satellite computer. During this period, it will be possible to collect data from the surveillance loops with District-owned, multichannel traffic count equipment (Figure 3-2).

A second source of surveillance information will be from closed circuit television monitoring (CCTV). With this subsystem it will be possible to visually confirm information from the loop detectors and identify congestion or accident conditions. A camera spacing of approximately 1 mile should provide adequate information. Cameras will have zoom, focus, pan, tilt, and iris control features. Effective mounting can be achieved at various heights although optimum mounting height will depend upon the type of equipment used. It may also be possible to mount cameras on adjacent buildings or structures in order to provide vantage points to such roadway features as the mixmaster. Other possible uses for CCTV camera monitoring include the ability to provide visual confirmation of CMS messages and to provide security surveillance of unmanned satellite computer buildings.



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

SCHEMATIC OF SURVEILLANCE SUBSYSTEM

FIGURE

3-2

4.0 Control Systems

Control systems involve those aspects of the proposed network that relate to response. The objective of the control systems is to provide effective tools to improve the freeway conditions and traffic operations. Such tools will allow adjustments to the system as problems arise. Control systems thus provide the means of implementing strategies which allow traffic management on a real time basis. The equipment and hardware discussed are what are currently planned; however, they are subject to revision based on technological improvements.

District 2 plans to implement and/or continue the following traffic management tools to allow such system adjustments:

Ramp Metering - This is an attempt to regulate the flow of traffic entering the freeway in order to reduce traffic congestion on the freeway, or to reduce freeway merging conflicts. When traffic conditions warrant ramp metering, interconnected ramp metering signals will be installed.

Signal Systems - The installation of frontage road and corridor street traffic signal control will be coordinated with the City of Fort Worth Traffic Management System wherever possible. The aspect of that system which allows reconfiguration of the interconnected subsystems will allow frontage road and corridor progression priority as needed. In other areas, separate traffic signal systems will be installed which will also be monitored and controlled at the central Traffic Management Center.

Changeable Message Signs (CMS) - These signs advise drivers of freeway conditions ahead and in some cases recommend alternate routes. The CMS network currently planned for District 2 will be of the "dot matrix" type. The signs will be able to accommodate messages up to 4 lines in height and 20 characters per line. Each character will have a 5X7 dot configuration, and be up to 18" high. The CMS message will be retrievable from previously stored message selection, or generated for a specific situation. Strategic placement of these signs is necessary to optimize diversion capabilities.

Highway Advisory Radio (HAR) - These 10 watt AM radio stations are licensed by the FCC on either 530 KHz or 1610 KHz for the broadcast of motorist information such as traffic advisories, directions, road conditions, and highway service information.

Lane Use Signals - On certain sections of freeway, lane use signals may be used to further communicate freeway main lane status. Consisting of a red "X" (lane closed ahead), yellow "X" (prepare to safely vacate that lane) and green downward arrow (lane open ahead), this feature can greatly enhance CMS messages and facilitate routine maintenance operations traffic control. A spacing of 1/4 mile between each set of lane use signals might be typical on those sections of freeway where it is used.

Travel Time Information - When significant congestion is reported, estimated freeway travel times will be provided to the driver by CMS, HAR, and commercial radio broadcasts. The current procedure for communicating with commercial radio stations is primarily through phoning a service such as Metro Traffic Control, which in turn relays the information to subscribing stations. Non-subscribing stations are contacted individually. Once the central Traffic Management Center is established, more options should be available to facilitate the process.

These travel time estimates use the main-lane detector stations, and convert average traffic speed readings to estimated travel times between stations. The incremental travel times are then added between selected points.

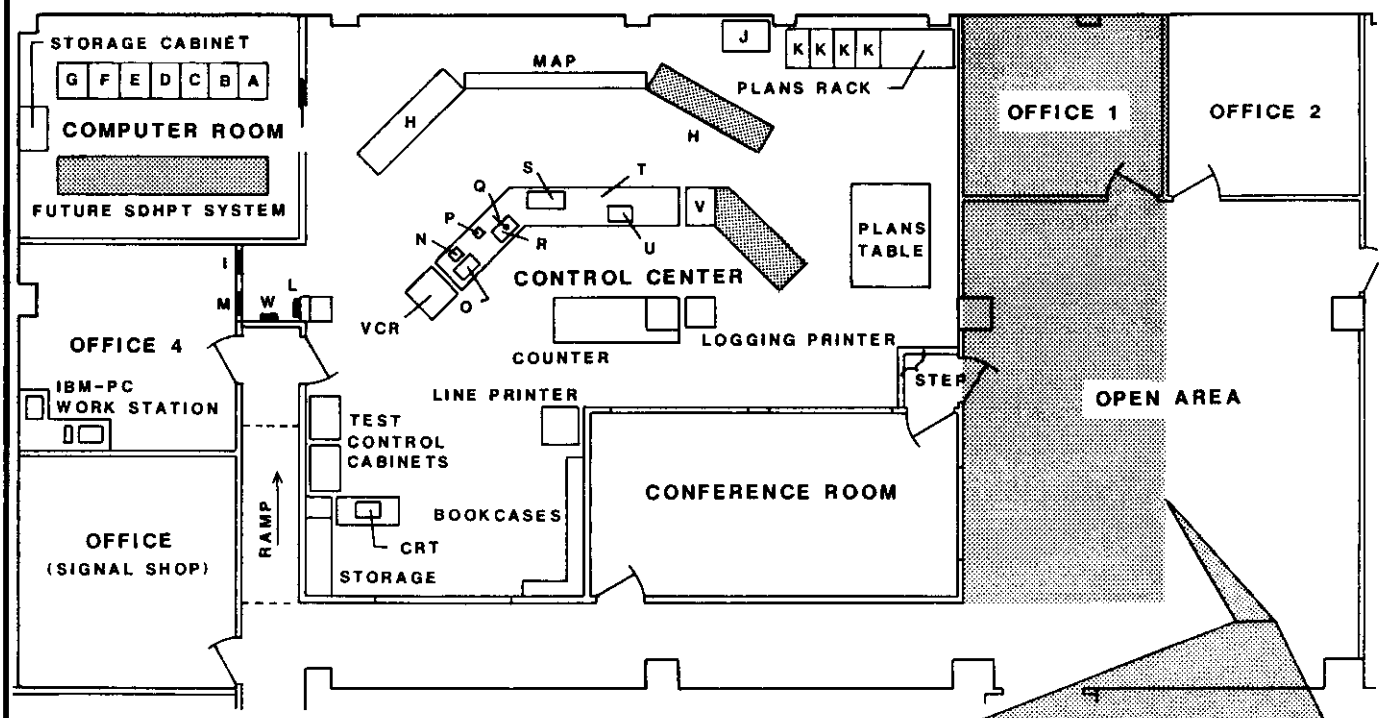
Courtesy Patrol - District 2 currently operates a Courtesy Patrol service which provides motorist assistance between the hours of 4PM to 8AM on weekdays and 24 hours a day on weekends and holidays. The Courtesy Patrol also responds to accident locations and assists with aiding motorists and controlling traffic. This fine effort will continue.

Incident Response Teams - For major incidents a team of personnel specifically trained for the critical nature of these incidents will be dispatched to the scene.

5.0 Communications Network

The realities of how the traffic management network will be physically interconnected and managed relate to the communications aspect of the system. Data must be transmitted from widely spaced field locations back to the traffic management/control centers. The central TMC will be located in the first basement of the Fort Worth Police and Courts Building. A smaller monitoring facility will be located at SDHPT District 2 Headquarters. This will facilitate better utilization of data for planning and design decisions by the District, and will not preclude the TMC from functioning as the primary coordination/management center. The TMC will be staffed 24 hours a day; a joint effort between agencies will be needed to provide trained personnel (Figure 5-1). Communications to other control centers will be provided as needed.

Typically, it is envisioned that data from field locations will be transmitted via multiconductor cable. A trunkline conduit system (2-3" diameter conduits) is planned for all freeways inside the I-820 Loop, and for all other freeways for which a phone line interconnect would not be preferable. Coaxial cable or fiber optics interconnect will be inside the communications trunkline conduit and will serve as a hardwire interconnect to an adjacent satellite computer. This unmanned satellite computer will perform much of the data evaluation tasks, thereby minimizing the necessary information sent to the Traffic Management Center & SDHPT Freeway Monitoring Center (Figure 5-2). That data transmitted to the management/control centers will be via a dedicated phone line, with the exception of the video signal from the closed circuit television field cameras. This information may require a separate leased cable TV channel to provide video monitoring at the control centers. Microwave transmissions or a physical fiber optics or coaxial cable interconnect are other options for CCTV. If these options are used, then they can serve as data transmission media as well as for the video signals (Figure 5-3).



COMPUTER ROOM EQUIPMENT

- A CENTRAL COMMUNICATIONS EQUIPMENT
- B FRONT-END COMPUTER SYSTEM CRT
- C FRONT-END COMPUTER
- D MAIN COMPUTER
- E AUXILIARY CABINET
- F MAIN COMPUTER SYSTEM CRT
- G DISK DRIVES (3) AND TAPE DRIVE

CONTROL CENTER EQUIPMENT

- H CCTV MONITORS & MAP INSET
- I REGULATED POWER PANEL
- J STORAGE CABINET
- K FILE CABINET
- L TELEPHONE PANEL
- M MAIN POWER PANEL
- N CCTV MONITOR
- O CCTV CONTROL CONSOLE
- P TELEPHONE
- Q RADIO MICROPHONE
- R CRT
- S OPERATOR'S CONSOLE
- T CONSOLE DESK
- U COLOR GRAPHICS TERMINAL
- V COLOR GRAPHICS COMPUTER
- W MULTI-PAIR CABLE TERMINAL PANEL/CENTRAL SITE SURGE PROTECTOR RAISED FLOORING

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

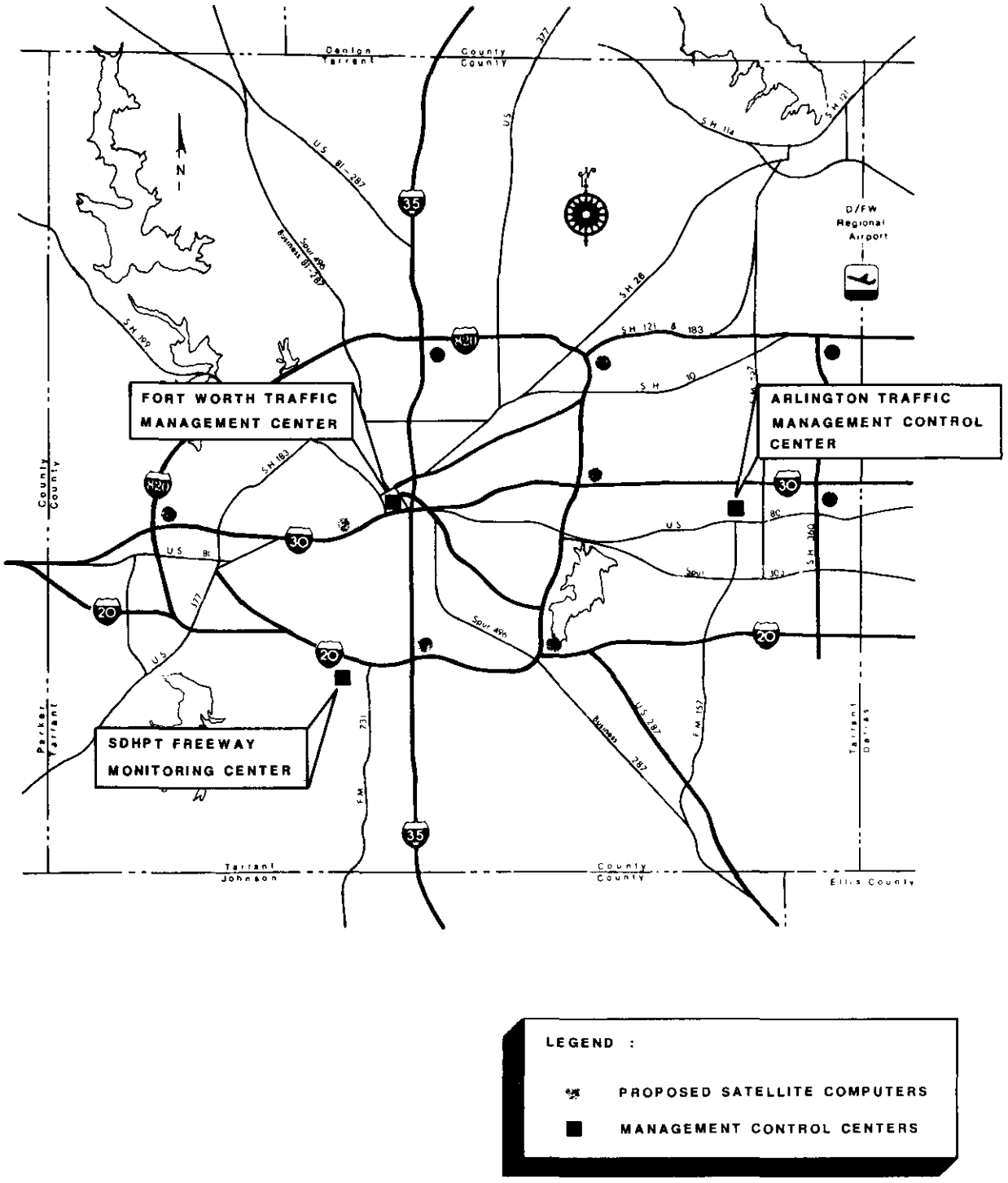
TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

TRAFFIC MANAGEMENT CENTER

FIGURE 5-1



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

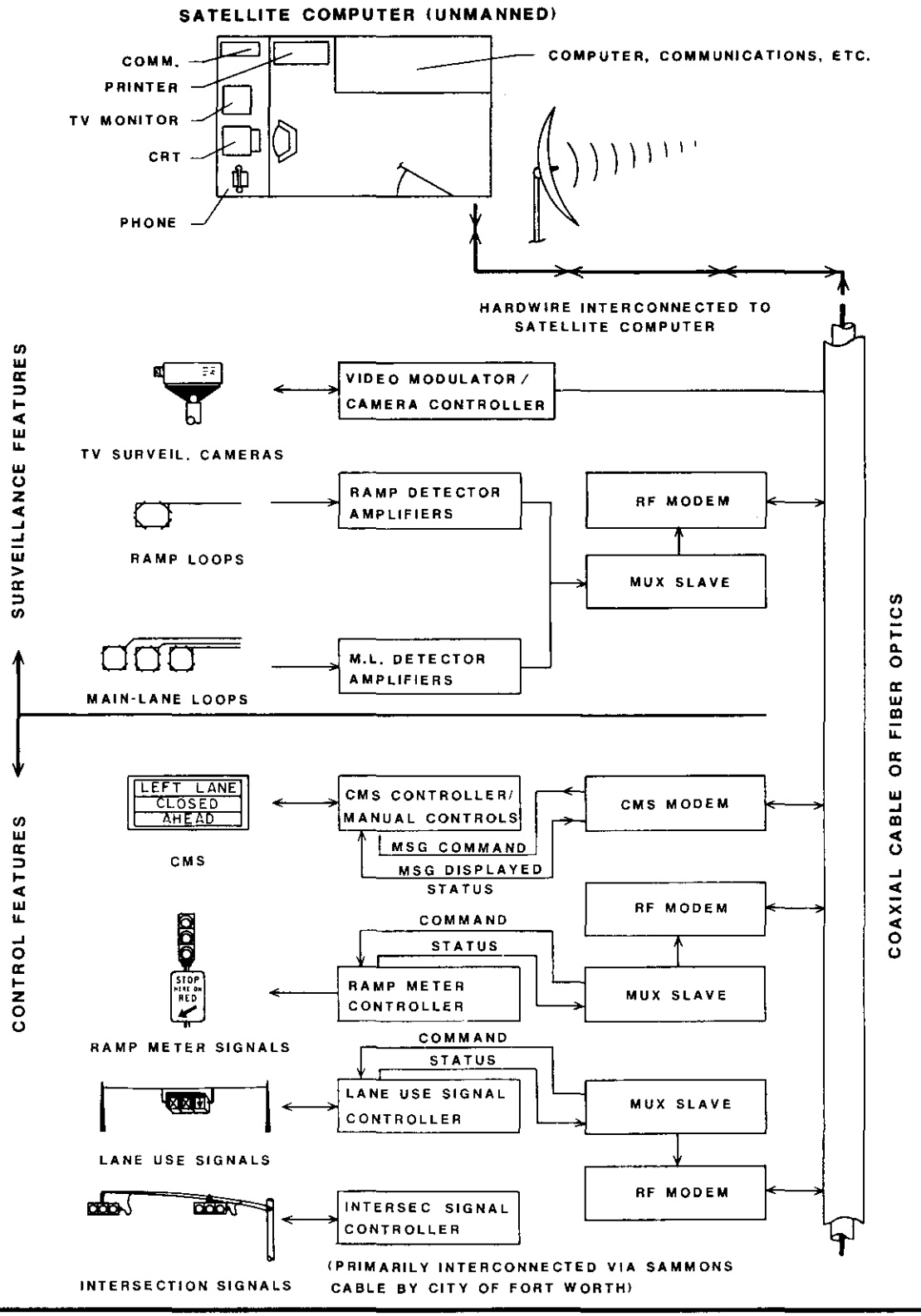
TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2 — **FORT WORTH, TEXAS**

SATELLITE COMPUTER AND CONTROL CENTER LOCATIONS

FIGURE

5-2



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

COMMUNICATIONS SCHEMATIC

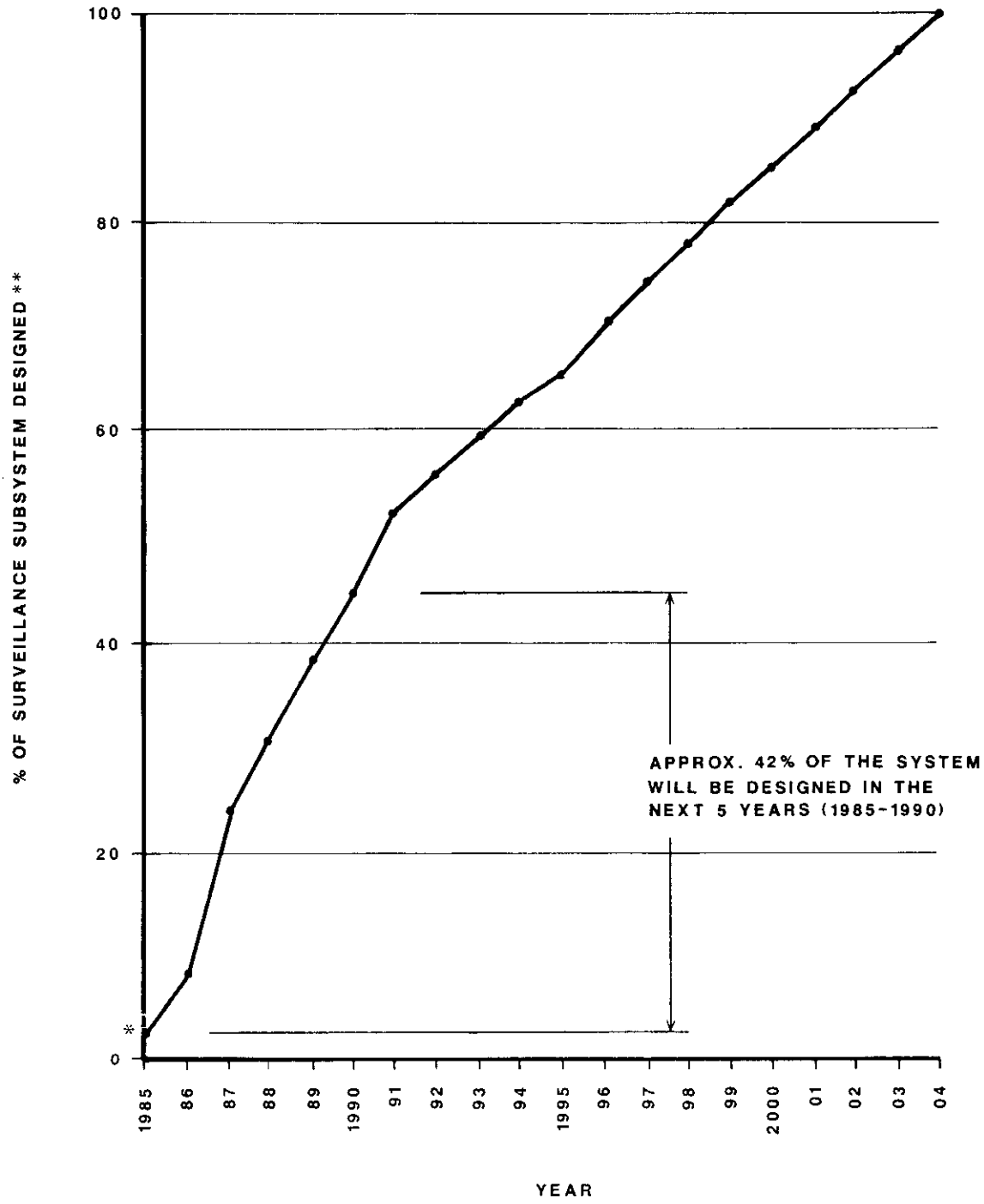
FIGURE

5-3

6.0 Implementation Schedule and Resource Commitment

The evolution of a functional Traffic Management System will be possible only with continued attention to the necessary allocation of resources. The nature of the construction of this management system makes it desirable to include it when freeway reconstruction is underway. Since over two-thirds of the entire surveillance subsystem will be implemented in conjunction with reconstruction, very close coordination with the district's roadway design efforts and letting schedules will be necessary. The State's 20-year Project Development and Control Plan allowed a unified look at the goals for District 2. Working with the Department's Operational Planning Document, a year by year estimate was made regarding the projected workload and implementation sequence of the surveillance subsystem. As shown in Figure 6-1, 42% of the surveillance subsystem will be designed and let to contract in the next 5 years. Figure 6-2 shows the yearly workload, with approximately 3% of the system under design in 1985, 6% in 1986, and 16% in 1987.

It is estimated that the total construction cost of the Traffic Management projects will be approximately $53 million. It is important to keep this estimate in perspective with the corresponding estimate for Department construction of roadways and bridges in Tarrant County. The combined estimate for such work in the Operational Planning Document Study was $2 billion. The work associated with implementing the proposed Traffic Management Concept will thus amount to less than 3% of the total expenditure. Appendix B relates the specific cost breakdowns and comparisons for three reconstruction projects that include surveillance and control implementation. Figure 6-3 shows the current Traffic Management Implementation Schedule in 5 year intervals. Table 6-1 relates the estimated costs of the specific network segments during these intervals.



*APPROX. 9 FREEWAY MILES DESIGNED PRIOR TO 1985

**BASED ON FREEWAY MILES

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

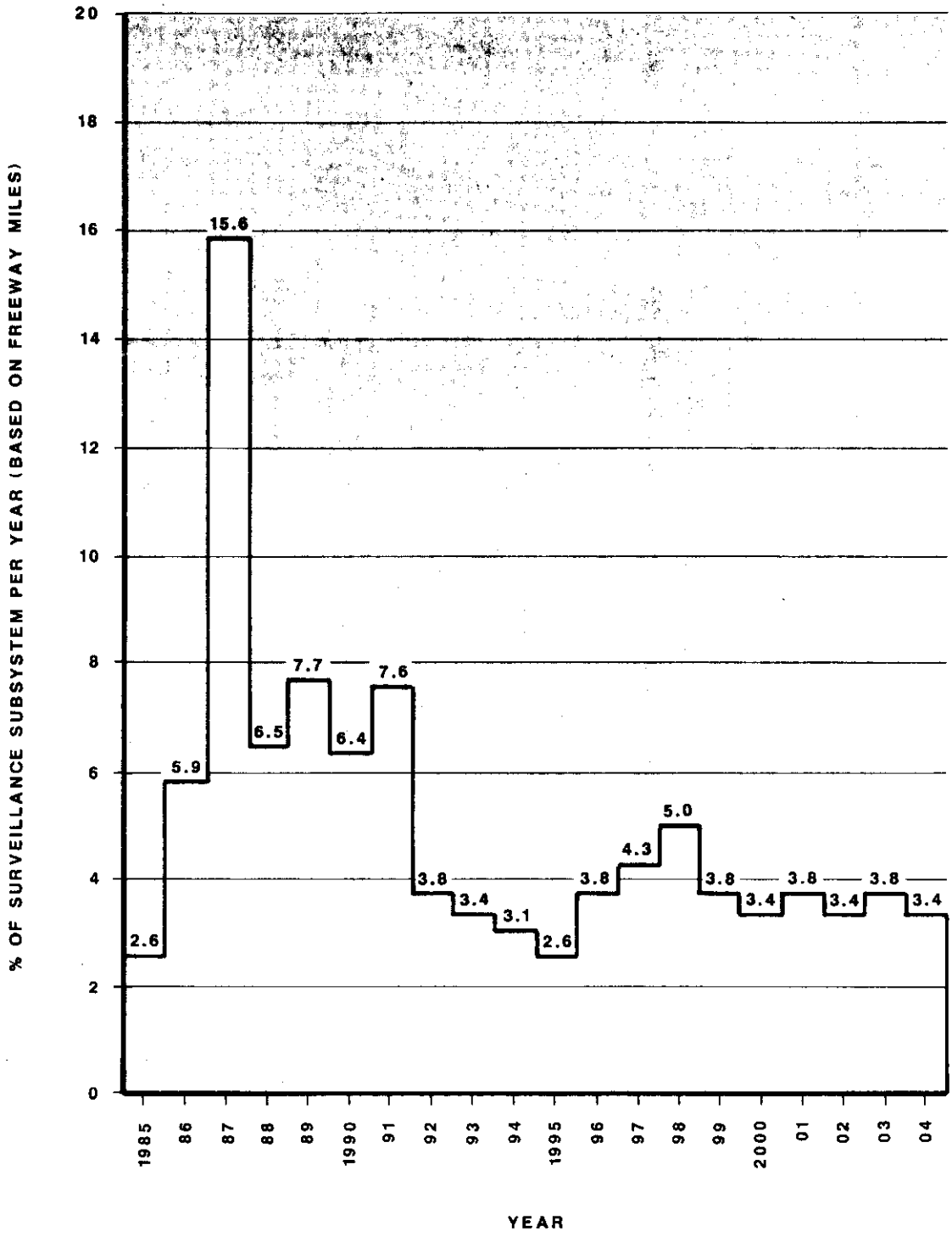
DISTRICT 2

FORT WORTH, TEXAS

SURVEILLANCE DESIGN COMPLETION SCHEDULE

FIGURE

6-1



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

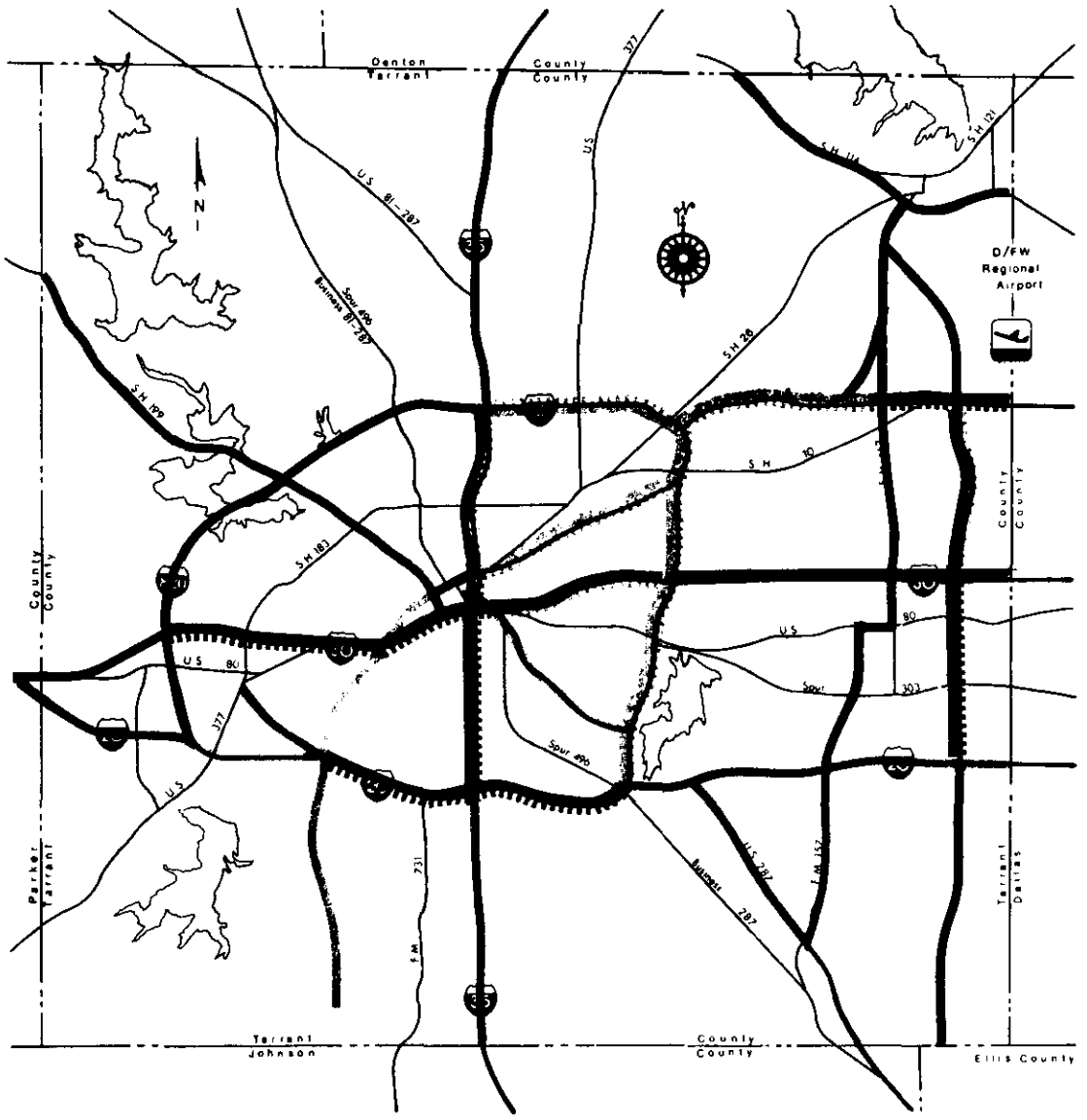
DISTRICT 2

FORT WORTH, TEXAS

YEARLY SURVEILLANCE DESIGN LOAD

FIGURE

6-2



LEGEND :

- SD/C (1985-1989)
- F.T.M.
- SD/C (1990-1994)
- F.T.M.
- SD/C (1995-1999)
- F.T.M.
- SD/C (2000-2004)
- F.T.M.

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2 — **FORT WORTH, TEXAS**

SYSTEM IMPLEMENTATION PLAN

FIGURE

6-3

TABLE 6-1

TRAFFIC MANAGEMENT NETWORK COST ESTIMATE

PROJECT LIMITS (SD/C)		1985 - 1989			1990 - 1994			1995 - 1999			2000 - 2004			Total Summary					
		SD/C	FTM	Total	SD/C	FTM	Total	SD/C	FTM	Total	SD/C	FTM	Total	1985 - 1989	1990 - 1994	1995 - 1999	2000 - 2004	Total All	Miles
I 20	SH 183 to I 820	1.5	3.0	4.5										4.5				4.5	10
I 30	I 820W to Dallas C/L	3.9	3.0	6.9										6.9				6.9	26
I 35W	I 820N to I 820S	1.8	2.1	3.9										3.9				3.9	19
SH 199	FM 1886 to I 30	1.5	-	1.5										1.5				1.5	10
SH 360	SH 183 to I 20	1.7	1.8	3.5										3.5				3.5	11
														20.30					
I 20	I 820 to SH 183				.75	-	.75								.75			.75	5
I 30	Beach to I 820				-	1.2	1.2								1.2			1.2	4
I 35W	I 820N to SH 121				-	1.5	1.5								1.5			1.5	5
I 820	I 35W to I 20E				2.7	5.4	8.1								8.1			8.1	18
US 287	I 30 to I 820				.9	-	.9								.9			.9	6
SH 121	I 35W to SH 183				1.8	3.6	5.4								5.4			5.4	12
SH 121	Bluff to I 20				1.05	-	1.05								1.05			1.05	7
SH 183	SH 121 to FM 157				.3	.6	.9								.9			.9	2
															19.80				
I 30	I 20 to I 820							.9	-	.9						.9		.9	6
I 30	I 820W to SH 183							-	.6	.6						.6		.6	2
I 820	I 35W to I 20W							2.25	-	2.25						2.25		2.25	15
SH 114	Denton C/L to Dallas C/L							.1	-	.1						.1		.1	10
SH 121	SH 114 to SH 183							.1	-	.1						.1		.1	7
SH 121	I 35W to Bluff							.15	-	.15						.15		.15	1
SH 183	FM 157 to Dallas C/L							.6	1.2	1.8						1.8		1.8	4
SH 360	I 20 to Ellis C/L							.1	-	.1						.1		.1	9
SH 360	SH 121 to SH 183							.1	-	.1						.1		.1	5
FM 157	SH 121 to I 20							1.8	-	1.8						1.8		1.8	12
																7.90			
I 20	I 30 to I 820										.1	-	.1				.1	.1	6
I 20	I 820 to Dallas C/L										.1	-	.1				.1	.1	12
I 35W	Denton C/L to I 820										.1	-	.1				.1	.1	10
I 35W	I 20 to Johnson C/L										1.2	-	1.2				1.2	1.2	8
US 287	I 20 to FM 157										.1	-	.1				.1	.1	6
SH 121	I 20 to FM 1187										1.05	-	1.05				1.05	1.05	7
SH 183	US 377 to I 20										.6	-	.6				.6	.6	4
SH 199	Azle to FM 1886										.1	-	.1				.1	.1	6
FM 157	I 20 to US 287										.1	-	.1				.1	.1	6
																	3.45		
Traffic Management Center and Other Control Centers			.6						.5									1.1	
																	Total	52.55	

Surveillance Detection/Conduit (SD/C)
(Approx. 260 Freeway Miles)

Includes: 2-3 Ø PVC Trunkline
Phone Line Installation
Loop Detectors

Freeway Traffic Management (FTM)
(Approx. 80 Freeway Miles)

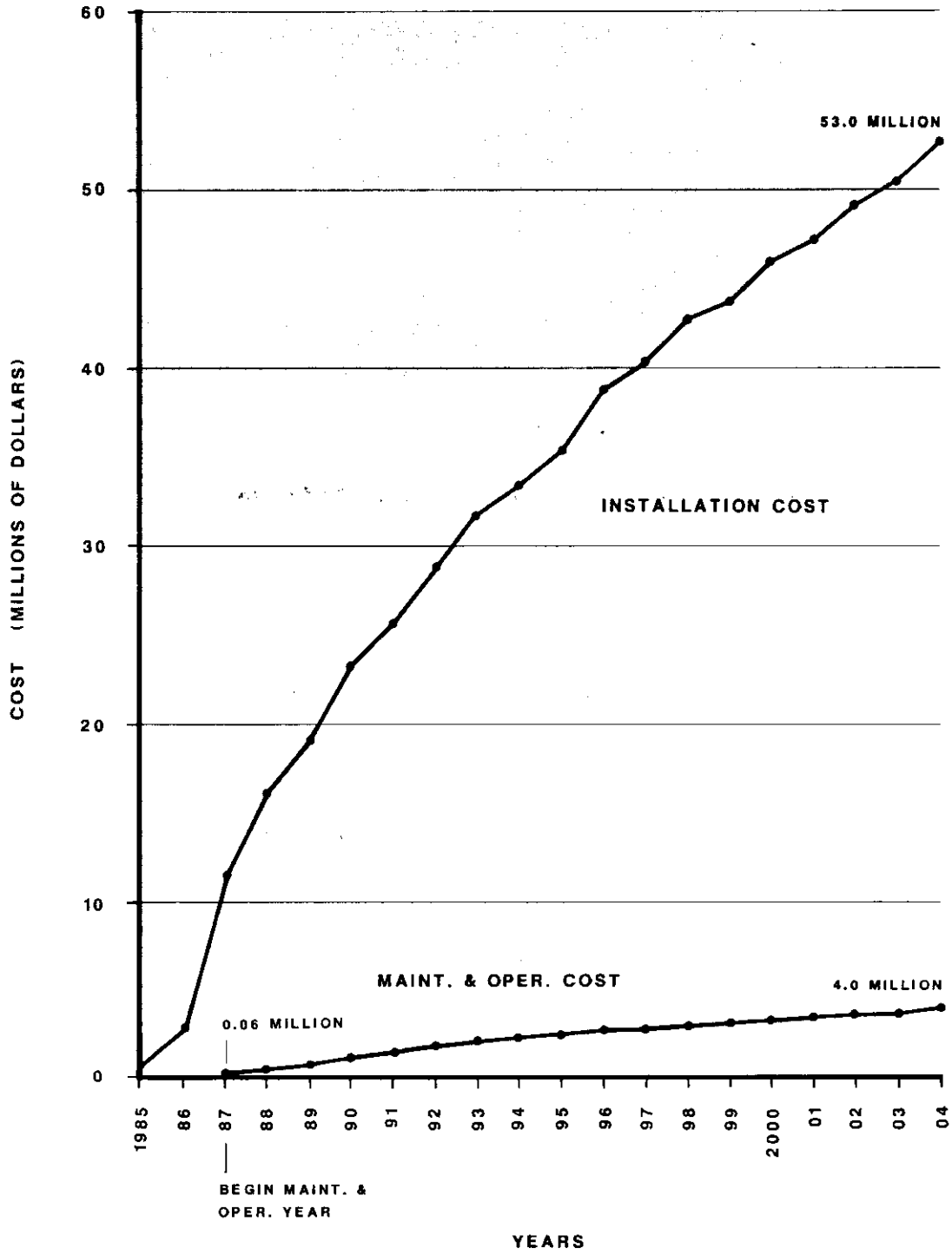
Includes: Ramp Metering
Signal System
Changeable Message Signs
Highway Advisory Radio
Lane Use Signals
Television Surveillance
Communications
Satellite Computers

Average Estimate Cost/Mile

SD/C $150,000
FTM $300,000

Note: All of the table figures indicate millions of dollars.

Implementing the components of this management concept allows it to function as intended only if the means to operate and maintain it are also allocated. In terms of dollars, it is estimated that such costs will be about 8% of the installation cost per year. Over the next 20 years, as the system becomes operational incrementally, the maintenance and operations costs per year will increase. Figure 6-4 shows the installation and maintenance/operation costs on a year by year basis.



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRAFFIC ENGINEERING AND SAFETY

DISTRICT 2

FORT WORTH, TEXAS

INSTALLATION AND MAINTENANCE - OPERATIONS COST

FIGURE 6-4

7.0 Conclusion

With area-wide traffic management in place, it will be possible to monitor the operational status of the freeway network, evaluate alternatives, and respond with control features which will enable adjustments to the network.

This traffic management concept will also provide the flexibility to accommodate development of public transportation alternatives. As such capabilities as transit and high-occupancy-vehicle (HOV) facilities are implemented, their operations can be interfaced with the central Traffic Management Center. The added surveillance and control will be compatible with the traffic management systems. Appendix C presents proposed area public transportation routes that will receive such consideration.

In preparing the 20-year Operational Planning Document in 1982, it was estimated that over 127,000 vehicle-hours of delay could be saved per day with such a traffic management network in place. Recent estimates for the proposed network indicate a savings of 156,000 vehicle-hours per day could be achieved. Delay savings are only one of many measurements of benefit to the future's roadway system user (Appendix D). Implementation of an effective traffic management concept also provides a means of extending the functional life of the involved roadway facilities. As capacities are exceeded or safety and operational problems occur, it provides the capability to recognize and respond in an appropriate and timely manner. This precludes or lessens the impact of congestion by reducing pollution, decreasing accidents, and increasing or maintaining mobility and acceptable levels of service. These benefits demonstrate the importance of the transportation system as a key element in a viable urban economy. Implementation of such a system, built efficiently in stages, will provide the flexibility before the problems far exceed available capabilities and resources.

APPENDICES

APPENDIX A

STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
AUSTIN, TEXAS 78701

January 28, 1985

ADMINISTRATIVE ORDER NO. 2-85

IN REPLY REFER TO
FILE NO. D-18T

SUBJECT: Traffic Management

TO: ALL DISTRICT ENGINEERS, AND DIVISION HEADS

Gentlemen:

It is apparent that there is a need to manage traffic operation to obtain maximum movement of persons, services, and goods within urban areas. Attached is a copy of Minute Order 84241 passed by the Highway Commission on November 20, 1984, establishing policy for development of traffic management systems. Existing Departmental policy regarding traffic signals on frontage roads and highways is supplemented by this action. Administrative Order No. 15-74 Freeway Corridor Management, dated May 21, 1974 is hereby cancelled.

In addition to expanding the scope of Department involvement in Urban Traffic Management, Districts will be supplied with account numbers for Traffic Engineering and Traffic Management activities for budget allocation purposes for FY 1986.

The Commission has expressed an interest in how the increased involvement in Urban Traffic Management is to be approached and how it will impact Urban Traffic Operations. Accordingly certain Districts will be requested to carry out the following for their larger urban area:

1. Develop annual goals for traffic operations improvements through traffic management activities.

2. Develop procedures for measuring and reporting progress on these goals.

3. Prepare annual reports on the goals established and progress experienced.

The annual reports will be transmitted to D-18 for compilation and presentation to the Commission. Details on the account numbers and goals for traffic operations improvements will be provided in a subsequent Administrative Circular.

State and other agency responsibilities for Urban Traffic Management Systems will be as follows:

Improvement	State Responsibility	City Responsibility	Public Transportation Agency Responsibility
1. Freeway Control and Surveillance including required interconnection, housing and special facilities for public transportation.			
a. Within SDHPT R.O.W.			
(1) Not Interconnected with City operated and maintained frontage road traffic signals.	Install, Operate & Maintain Ramps & Main Lanes		By Agreement Where Applicable to Public Transportation Facilities
(2) Interconnected with City maintained frontage road traffic signals.	Install, Operate & Maintain Ramps & Main Lanes if Mutually Agreed by City and State	Operate and Maintain Ramps & Main Lanes if Mutually Agreed by City & State	By Agreement Where Applicable to Public Transportation Facilities
b. Outside SDHPT R.O.W.			
(1) Traffic Control and Surveillance	By Agreement Participate in Engineering Support utilizing Federal Funds Where Applicable	By Agreement Install, Operate & Maintain	By Agreement Where Applicable to Public Transportation Facilities
2. Freeway Accident Investigation Sites			
a. Within SDHPT R.O.W.	Install & Maintain		
b. Outside SDHPT R.O.W.		Normally Install & Maintain	
3. Freeway Corridor Motorist Aid			
a. Within SDHPT R.O.W.			
(1) Motorist Communications such as Changeable Message Signs, Lane Control Signals, and Highway Advisory Radio	Install, Operate and Maintain in Cooperation with Other Agencies	By Agreement Where Applicable	By Agreement Where Applicable

MORE

Improvement	State Responsibility	City Responsibility	Public Transportation Agency Responsibility
(2) Courtesy Patrol	Operate		
(3) Major Incident Response Teams	Operate in Cooperation with Other Agencies	Operate in Cooperation with Other Agencies	Operate in Cooperation with Other Agencies
b. Outside SDHPT R.O.W.			
Motorist Communications such as Changeable Message Signs, Lane Control Signals, and Highway Advisory Radio	By Agreement Participate in Engineering Support utilizing Federal Funds Where Applicable	By Agreement Install, Operate & Maintain	By Agreement Where Applicable to Public Transportation Facilities
4. Arterial Street Traffic Management on Numbered Highway System or Federal Aid Urban System.			
a. Inside Cities where city Installs, operates and maintains signals	By Agreement Participate in Engineering Support	By Agreement Participate in Installation, Operation & Maintenance	By Agreement Where Applicable to Public Transportation Facilities
b. Inside and Outside cities where State Installs, operates and maintains signals	Install, Operate and Maintain	By Agreement Where Applicable	By Agreement Where Applicable to Public Transportation Facilities

This assignment of responsibility and the attached Minute Order will be guidance for development of traffic management system improvements. After a proposed traffic management system improvement has been determined necessary and feasible by the Department, the Department will enter into agreement with any affected agency for the installation, operation and maintenance of the project. If questions should arise, they should be addressed to the Division of Safety and Maintenance Operations.

Sincerely yours,

M. G. Goode

M. G. Goode
Engineer-Director

Attachment

DISTRIBUTION:
District Engineers
Division Heads
Resident Engineers

Form 330-B Rev. 8-80

STATE DEPARTMENT OF HIGHWA
AND PUBLIC TRANSPORTATION

Various County

District No. Various

MINUTE ORDER

WHEREAS, there exists a need to improve the operation and safety, to reduce congestion, and to maximize capacity for movement of persons and goods along urban arteries; and

WHEREAS, the need for this improvement extends to and includes arterial streets and freeways; and

WHEREAS, the results of research and traffic operations projects have shown that traffic management, which includes all or part of the items of control, surveillance, communications, motorist aid and enforcement, improves operation and safety, and increases the capacity for the movement of persons and goods; and

WHEREAS, the present state of development of equipment and management techniques makes it practical to implement traffic management within urban areas where warranted; and

WHEREAS, the Texas State Department of Highways & Public Transportation desires to assist in the development of traffic management systems in order to improve operation within urban areas by increasing the capacity and improving safety and comfort in the movement of persons and goods; and

WHEREAS, the Texas State Department of Highways & Public Transportation desires to cooperate with cities and other agencies in urban areas in improving operations and safety through traffic management where the City and/or other agency expresses a desire to cooperate.

Form 336-B Rev. 8-80

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

Various County

District No. Various

MINUTE ORDER

NOW, THEREFORE, IT IS ORDERED that the following policy be and is hereby established for development of traffic management systems.

1. The responsibilities of the parties in Departmental projects involving another agency will be set out by contract or agreement.

2. Participation in improvements by the Department may be along an urban arterial including freeway and streets, provided such arterials are on the numbered highway system or part of the Federal Aid Urban System.

3. Participation by the Department will generally be limited to improvements as follows:

   a. Freeway traffic management systems.

   b. Accident investigation sites.

   c. Motorist aid.

   d. Arterial street traffic management systems.

4. Participation by the City will include adopting and enforcing ordinances and regulations necessary for the proper operation of the improvement.

The State Engineer Director is directed to proceed in the most feasible and economical manner in the development of arterial traffic management improvements and is authorized to enter into any necessary agreements with cities and other agencies to secure local participation.

This Minute Order cancels and supersedes Commission Minute Order Number 68807, dated May 7, 1974.

Submitted by: _____

(Title) Chief Engineer of Safety and Maintenance Operations

Examined and recommended by: _____

Deputy/Assistant Engineer-Director

Approved: _____

Engineer-Director

Approved:

_____ Commissioner

_____ Commissioner

_____ Commissioner

Minute Number 82421

Date Passed NOV 20 84

MINUTE ORDER DOCKET SHEET

Minute Order Number: 82421

Subject: VARIOUS - Traffic Management Systems

Presented to and considered by the State Highway and Public Transportation Commission at its duly scheduled meeting on the 20th day of NOVEMBER, 1984.

Members present: ✓ ROBERT C. LANIER, Chairman

: ✓ ROBERT H. DEDMAN, Member

: ✓ JOHN R. BUTLER, JR., Member

Action Taken : ✓ Approved Without Change

: _____ Rejected

: _____ Other

Vote Recorded : 3 For (By Number)

: 0 Against (By Number)

Certified as true and correct: _____ Recording Secretary

APPENDIX B

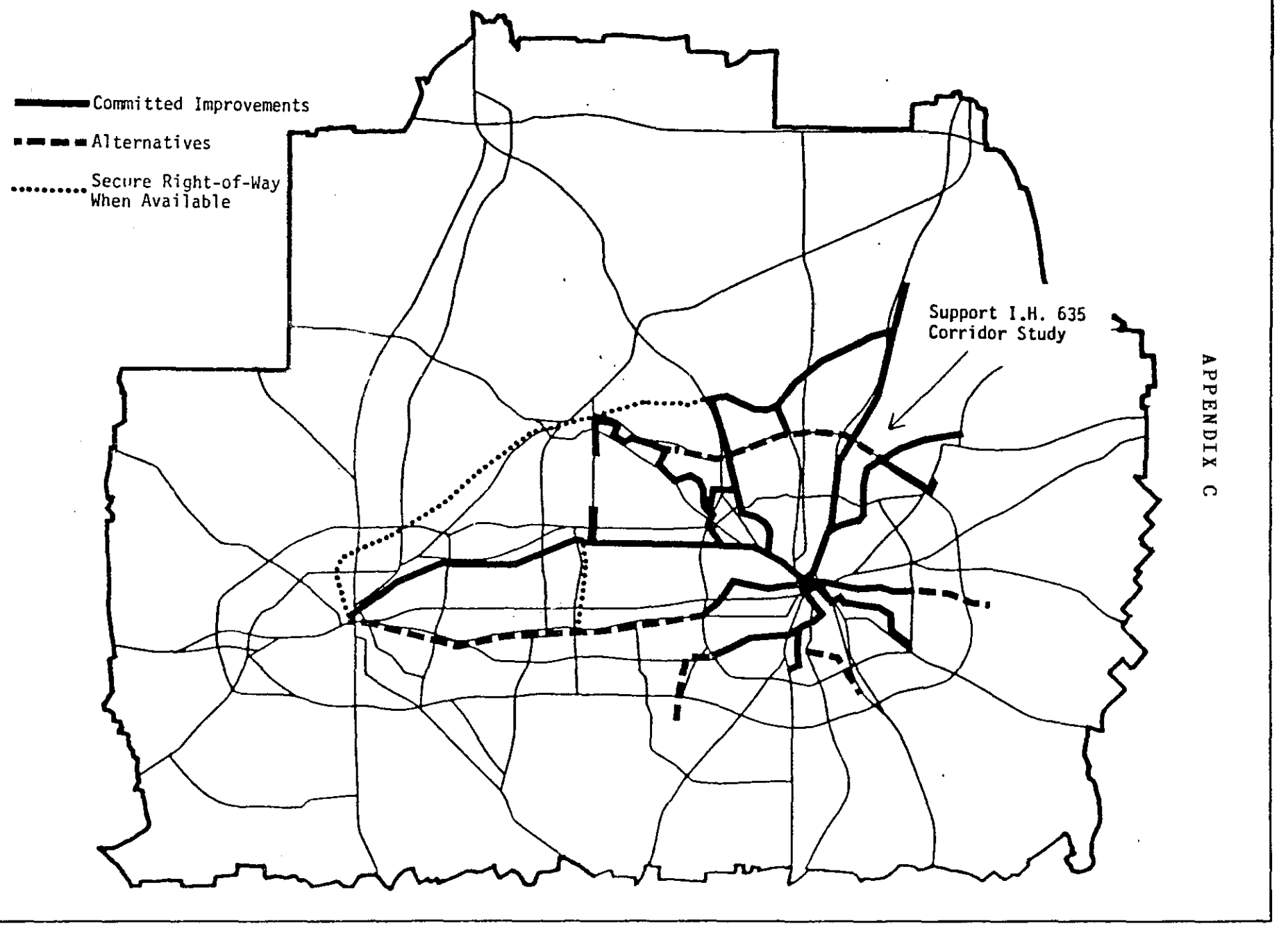
Typical Project Cost Breakdown and Comparison

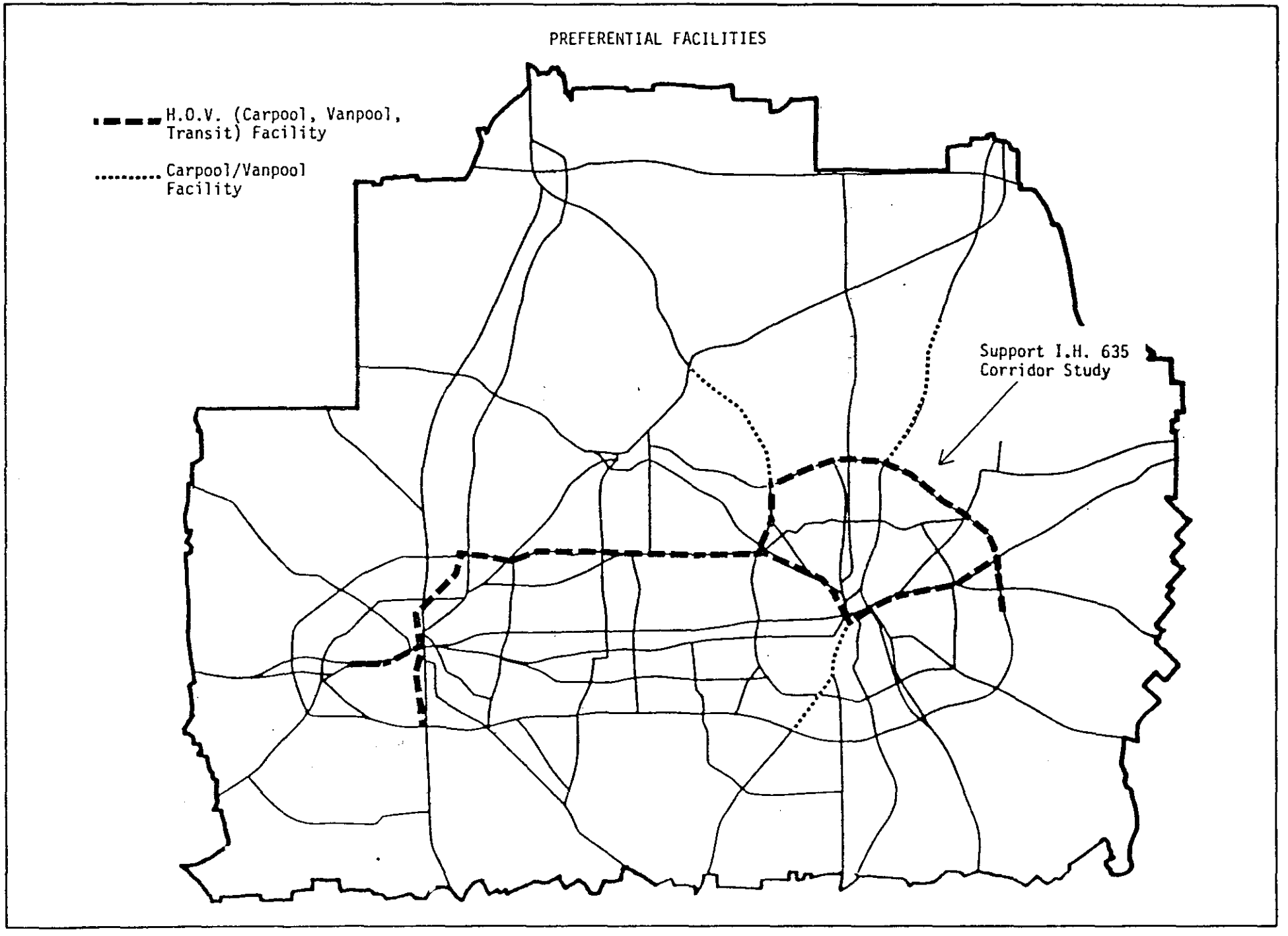
Surveillance Detection/Conduit (SD/C) and Freeway Traffic Management (FTM)* represent a small percentage of the overall cost of constructing or reconstructing a freeway. Estimates based on systems designed to date indicate that less than 3% of the project cost relates to these surveillance and management features. Some examples of project cost breakdowns are shown below (dollar amounts indicate millions):

Hwy/Limits	Estimated Project Cost ($)	Estimated Cost, SD/C ($)	Estimated Cost, SD/C & FTM ($)	% SD/C Proj Cost	% SD/C & FTM Proj Cost
I 30 Westridge to Penticost	37.8	.225	.675	0.6	1.8
I 30 Penticost to University	32.4	.3	.9	0.9	2.8
I 20 Campus Dr to US 287	45.0	.525	1.58	1.2	3.5
			Approx Avg	1%	3%

*The components of SD/C and FTM are described on the Traffic Management Network Cost Estimate Table, page 20.

RAIL FACILITIES




PREFERENTIAL FACILITIES
H.O.V. (Carpool, Vanpool, Transit) Facility
Carpool/Vanpool Facility
Support I.H. 635 Corridor Study

APPENDIX D

The Need For and Benefits Obtained From Traffic Management Along Urban Highways and Freeway Corridors in Texas

There is a need today for freeway corridor management in our principal urban cities. This need will increase during the next 20 years as the Texas population increases by an anticipated 50 percent with as much as an 80 to 100 percent increase in some cities. A study by the Houston Chamber of Commerce concluded that traffic congestion cost Houstonians $1.9 billion during 1981. A study by TTI has shown that Dallas, San Antonio, Fort Worth and El Paso could reach the same level of congestion along freeways and principal city streets as Houston within the next 10 years (by 1995). Although Austin was not studied by TTI, it could well be that Austin will also reach the same level of congestion as Houston by 1995. Congestion will also continue to be a problem to a lesser degree in other major cities.

Because of the higher traffic volumes, congestion will be a problem not only during the peak periods but also during the off peak periods since business appointments are met, goods are delivered, and services carried out during the off peak periods between 8:00 a.m. and 5:00 p.m.

The results of studies have shown that the following benefits can be obtained from traffic management along freeway corridors and major highway failities:

A. Freeway Corridor

1. Increase in total Main Lane and Frontage Road Flow (Vehicles per Hour)	12% to 20% (Improvements of 15% to 25% could be achieved if additional lanes are added to signalized frontage road intersections).

2.	Increase in Main Lane Speed	Average of 10 mph
3.	Accident Reduction Along Main Lanes	Average of 30%
4.	Benefit to Cost Ratio	Average of 12 to 1
5.	Net Reduction of Delay	District 2 estimated from its city-wide study of freeway corridor needs that 127,000 vehicle hours per day could be saved when the total freeway corridor management system is in operation in Fort Worth.

B. Major Highway Facility

1.	Increase in Speed	Average of 22%
2.	Reduction in Stops	Average of 43%
3.	Reduction in Overall System Delay	Average of 27%
4.	Benefit to Cost Ratio	Average of 11 to 1

Transportation is this nation's lifeline and the urban freeway corridor and highway system is a vital part of this lifeline. Increased mobility is needed throughout the day in order to move people, services, and goods. Traffic management is needed to improve mobility along freeway corridors and arterial systems.

Source: SDHPT, D-18T, August, 1984.

REFERENCES

REFERENCES

1. Jenkins, Robert W. "Freeway Operations Management Concept for SDHPT District 2." Paper Presented to Urban Traffic Operations and Management Seminar, San Antonio, Texas, September 28-29, 1982.

2. "Traffic Control System Management Plan for the City of Fort Worth, Texas." PRC Engineering, February, 1984.

3. "Conceptual Design Report for I-45 North Freeway Corridor Surveillance Communication & Control System." Preliminary Report for Review. SDHPT D-18T and D-19, Houston, Texas, February 12, 1985.

4. "Proposal for Design and Implementation of a Traffic Control Management System for the City of Fort Worth, Texas." PRC Engineering, July, 1984.

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8. "Mobility 2000: The Regional Transportation Plan for North Central Texas. Preliminary Findings." North Central Texas Council of Governments, Transportation and Energy Department, November, 1985.

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