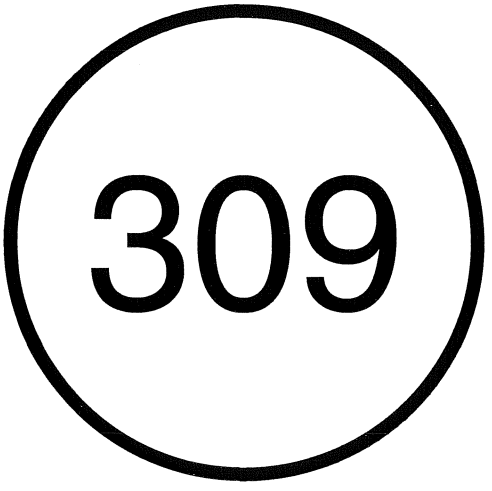
PA 309
INCIDENT MANAGEMENT STUDY



Prepared by:
Delaware Valley Regional Planning Commission
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PA 309

INCIDENT MANAGEMENT STUDY

JANUARY 1994

DELAWARE VALLEY
REGIONAL PLANNING COMMISSION
21 South Fifth Street
Philadelphia, PA 19106

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Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties as well as the City of Philadelphia in Pennsylvania and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. The Commission is an advisory agency which divides its planning and service functions among the Office of the Executive Director, the Office of Public Affairs, and three line Divisions: Transportation Planning, Regional Information Services Center, which includes the Office of Regional Planning, and the Office of Finance. DVRPC's mission for the 1990s is to emphasize technical assistance and services and to conduct high priority studies for member state and local governments, while determining and meeting the needs of the private sector.

The DVRPC logo is adapted from the official seal of the Commission and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River flowing through it. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey. The logo combines these elements to depict the areas served by DVRPC.

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

TITLE	Date Published: January 1994
PA 309 Incident Management Study	Publication No. 94001

Geographic Area Covered:

The freeway section of the PA 309 corridor runs through Lower Gwynedd Township, Upper Dublin Township, Whitemarsh Township, Springfield Township, and Cheltenham Township in Montgomery County.

Key Words:

PA 309, traffic and incident management systems, incident management strategies, changeable message signs, closed circuit television cameras, supplemental signs, standpipes, highway advisory radio, cost estimates

ABSTRACT

Currently, the prospects of widening existing highways for any extended length or constructing new facilities are very limited in this region and many other regions of the country. Many regions of the country are developing traffic and incident management systems to address freeway congestion. The purpose of this study is to identify strategies that, when implemented, manage the traffic operations of the expressway section of PA 309 such that it operates in the most efficient manner.

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Introduction

The purpose of this study is to identify strategies that, when implemented, will manage the traffic operations of the Fort Washington Expressway section of PA 309 such that it operates as efficiently as possible. Currently, the prospects of widening existing highways for any extended length or constructing new facilities are very limited in this region and many other regions of the country due to the Clean Air Act legislation. Because of these limitations, many regions have begun developing traffic and incident management systems to address freeway congestion.

The Pennsylvania Department of Transportation (PennDOT) District 6-0 has recently developed a master plan for implementing a Traffic and Incident Management System (TIMS) for the 115 mile interstate highway system within this region. The PA 309 Expressway intersects this interstate system at the Pennsylvania Turnpike interchange in Fort Washington. Since this section of PA 309 is scheduled to be reconstructed between 1996 and 1998, the inclusion of incident management components into the reconstruction and its integration into the TIMS system is a logical conclusion. This document represents a conceptual effort to identify opportunities and constraints for the implementation of incident management strategies along the PA 309 Expressway and is not intended to serve as an engineering document. Figure 1 displays the geographical relation of PA 309 to the TIMS network.

A description of the physical and operating conditions of this facility is presented in the next section. This description addresses elements such as average annual daily traffic volumes, volume/capacity ratios, interchange configurations and typical roadway cross sections.

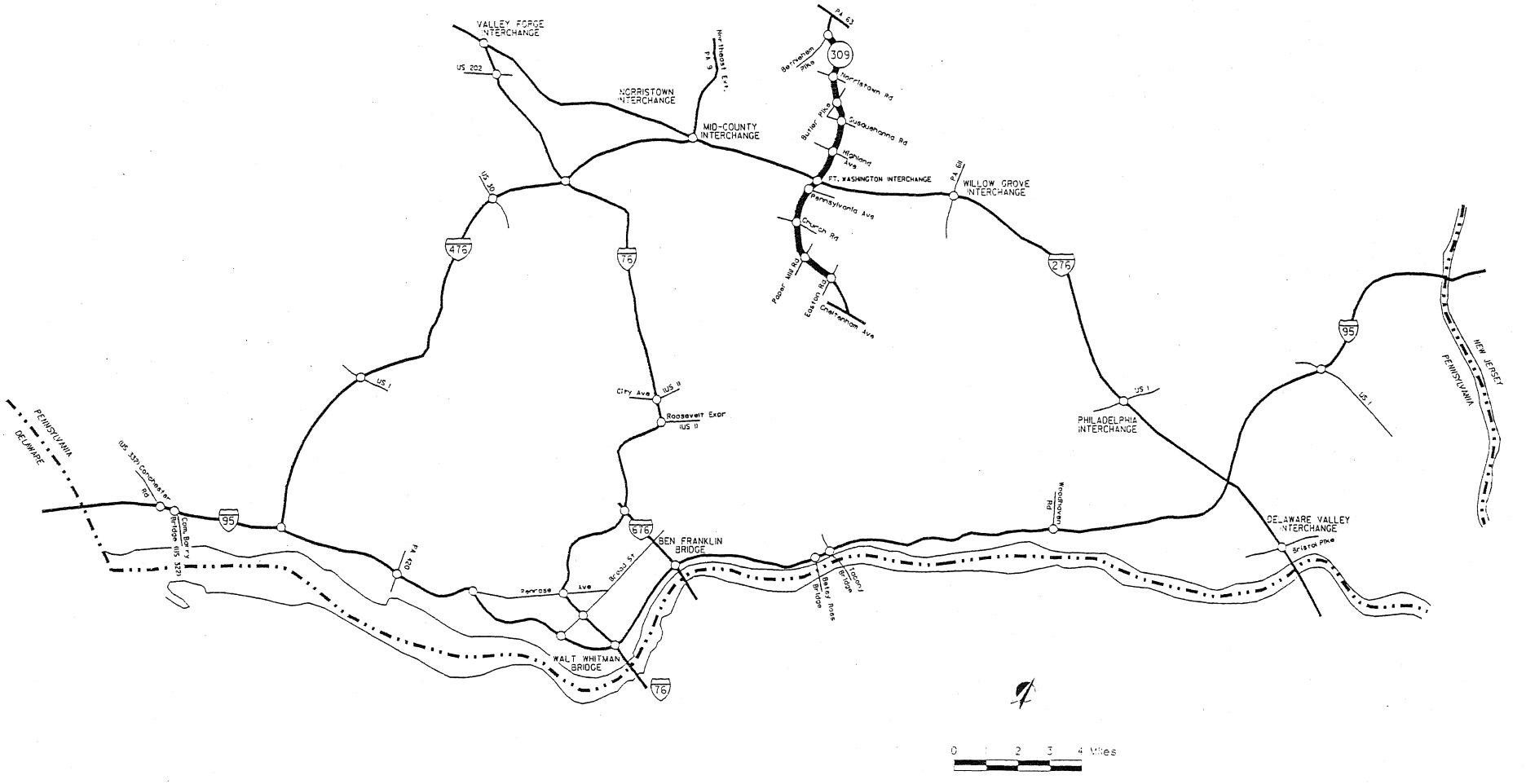
A section identifying incident management strategies follows. This section looks at the criteria and specifications for selected strategies. PennDOT's TIMS report was used as a reference to determine the necessary criteria to be met for the implementation of these selected strategies and field views were conducted to determine if these strategies are appropriate.

Integration of the incident management strategies for PA 309 with the TIMS system is investigated in the next section. This includes tying into the communications network and control center as well as utilizing the same standards and specifications regarding the equipment and operations procedures.

Transit alternatives as a congestion relief measure are identified in the next section of the report. This strategy includes providing directional signs from each interchange to the nearest rail station which could serve trips in the PA 309 Expressway corridor. Descriptions of each rail station and their opportunities and constraints are presented in this section.

The final section of the report presents cost estimates for each of the selected incident management strategies. These cost estimated are consistent with the TIMS report.

FIGURE 1:
RELATION TO PENNDOT TIMS SYSTEM



DELAWARE VALLEY
REGIONAL PLANNING COMMISSION
December, 1993

Corridor Description

PA 309 is a four-lane principal arterial originating as Cheltenham Avenue at PA 611 and running north through Montgomery and Bucks Counties. It has two expressway sections, the Ft. Washington Expressway and the Sellersville Bypass. This report examines incident management strategies for the Ft. Washington Expressway portion of PA 309 and the potential integration into PennDOT's TIMS system at the PA Turnpike. Within this study area, which extends from Cheltenham Avenue to PA 63, PA 309 is 10.9 miles in length and the Fort Washington Expressway portion of this corridor is 9.5 miles long. The remaining 1.4 miles function as a controlled access arterial. The portion of the expressway north of the Pennsylvania Turnpike is served by partial interchanges while the portion south of the Turnpike is served by full interchanges. Following is a list of interchanges:

Bethlehem Pike	Southbound On-Ramp and Northbound Off-Ramp
Norristown Road	Southbound On-Ramp and Northbound Off-Ramp
Butler Pike	Southbound Off-Ramp and Northbound On-Ramp
Susquehanna Road	Southbound On-Ramp and Northbound Off-Ramp
Highland Avenue	Southbound On-Ramp and Northbound Off-Ramp
PA Turnpike/Pennsylvania Ave.	Full Interchange
PA 73 (Church Road)	Full Interchange
Paper Mill Road	Full Interchange
Easton Road	Full Interchange

Substandard acceleration and deceleration lanes are common along the length of the expressway with access to the facility controlled at some on-ramps by stop signs. In addition, shoulders are non-existent or substandard. Reconstruction of the expressway is scheduled for 1998 and is programmed on DVRPC's current Transportation Improvement Program. Planned improvements include roadbed repair and resurfacing and improved acceleration and deceleration lanes.

DVRPC's traffic count files were reviewed to identify average annual daily traffic volumes (AADTs) collected along PA 309 between 1991 and 1993. The traffic volumes were found to vary along the expressway section and were heaviest in the vicinity of the Pennsylvania Turnpike interchange with 57,000 vehicles per day counted for both directions. A level of service (LOS) analysis was conducted for the main line sections of the expressway using the

most recent AADTs available. This analysis dealt only with the free flow operation of the sections between interchanges and did not address ramp impacts in the interchange areas, which in some instances can considerably impede traffic flow . Traffic operations during the PM peak period are represented in this analysis and the results indicate acceptable levels of service. The following table lists the AADTs and levels of service for the expressway sections which were analyzed:

Segment	AADT	LOS
Bethlehem Pike to Norristown Road		
Southbound	18,200	B
Northbound	17,400	B
Highland Avenue to PA Turnpike		
Southbound	28,700	C
Northbound	28,500	C
Church Road to Paper Mill Road		
Southbound	21,200	C
Paper Mill Road to Easton Road		
Southbound	16,700	B

The expressway is located entirely within Montgomery County and traverses parts of Cheltenham, Springfield, Whitemarsh, Upper Dublin and Lower Gwynedd Townships. With the exception of the southern segment, where commercial and institutional land uses dominate, the expressway portion of PA 309 is surrounded mostly by dense residential development. In many areas there appears to be insufficient right-of-way for widening due to adjacent development or steep terrain. In the vicinity of PA 63, several office parks abut the roadway. The Pennsylvania State Police-Belmont Barracks has the responsibility to patrol PA 309 is from Cheltenham Avenue to Bethlehem Pike.

Incident Management Strategies

This section looks at the criteria and specifications for selected strategies. PennDOT's TIMS report was used as a reference to determine the necessary criteria to be met for the implementation of these selected strategies. Several strategies addressed in the TIMS report were not considered appropriate for PA 309 and were not analyzed. These include: ramp metering, emergency crossovers and service patrols.

Detectors

The purpose of detectors is to monitor traffic flow on the facility. This information will be used primarily for incident detection. This is the most critical element of the incident management system. Accurate real-time data must be obtained on the operations of the facility if the system is to have any credibility. The type of traffic flow data which needs to be collected on PA 309 include the following:

- **volume** - the total number of vehicles passing over a certain point during specified time period.
- **occupancy** - a measure of traffic density, the percentage of time that vehicles are present in the detection zone.
- **speed** - the rate of travel of the vehicles passing through the detection zone.
- **classification** - determines the type of vehicle by measuring the length.

Ideally, the measurement of all four types of traffic flow data is preferred, however, cost, accuracy and maintenance requirements prevent this configuration from being practical. Detectors spacing should never be more than two miles. Ideally they should be spaced approximately one-half mile apart and should provide lane specific data. Various detector technologies are currently available on the market, however each has different installation requirements and data collection capabilities. The TIMS report clearly documents how detector technology is rapidly changing. Selecting a specific detector type at this time could result in the equipment being obsolete before implementation of the TIMS system. Because of this, the TIMS report did not recommend a specific detector technology; therefore, this document also recommends no specific type of detector.

Exact locations of the detectors will be identified during the design phase of the PA 309 reconstruction project. This document estimates that approximately 38 detectors would be sufficient to meet the needs of this facility.

Closed Circuit Television Cameras

Once the detectors perceive the occurrence of an incident and the control center is alerted, the incident must be verified so that the proper response can be evoked. Currently, police are dispatched to the scene to assess the situation and request the appropriate response personnel and equipment. Congestion can continue to build during this time consuming process.

Closed circuit television cameras (CCTV) mounted along the highway can transmit pictures instantaneously to the control center and incidents can be verified as soon as they are detected. The TIMS report emphasizes that the principal purpose of CCTV is not to identify the occurrence of an incident; it has been found that simply monitoring the video images does not result in early detection. The primary purposes of CCTV are to rapidly confirm a suspected incident, to verify the nature of the incident and to assist responders in determining an appropriate course of action.

In addition to incident verification, the following activities are also complimentary applications of the CCTV:

- monitor movement of traffic on the highway and in the interchange area
- verify changeable message sign (CMS) messages and monitor driver response to CMS messages
- monitor adjacent local street operations for potential diversion routes
- detect stranded motorists
- observe weather conditions
- identify damage to other incident management equipment

Full coverage of PA 309 is recommended with special emphasis on the operations of each interchange. Pan, zoom and tilt features are recommended for each camera. Camera viewing of one-half mile in each direction is available, therefore one mile spacing is typically acceptable. Depending on physical features such as horizontal or veritcal curves, overpasses or vegetation,

FIGURE 2:
INCIDENT MANAGEMENT STRATEGIES - CCTV, CMS, HAR, STANDPIPES

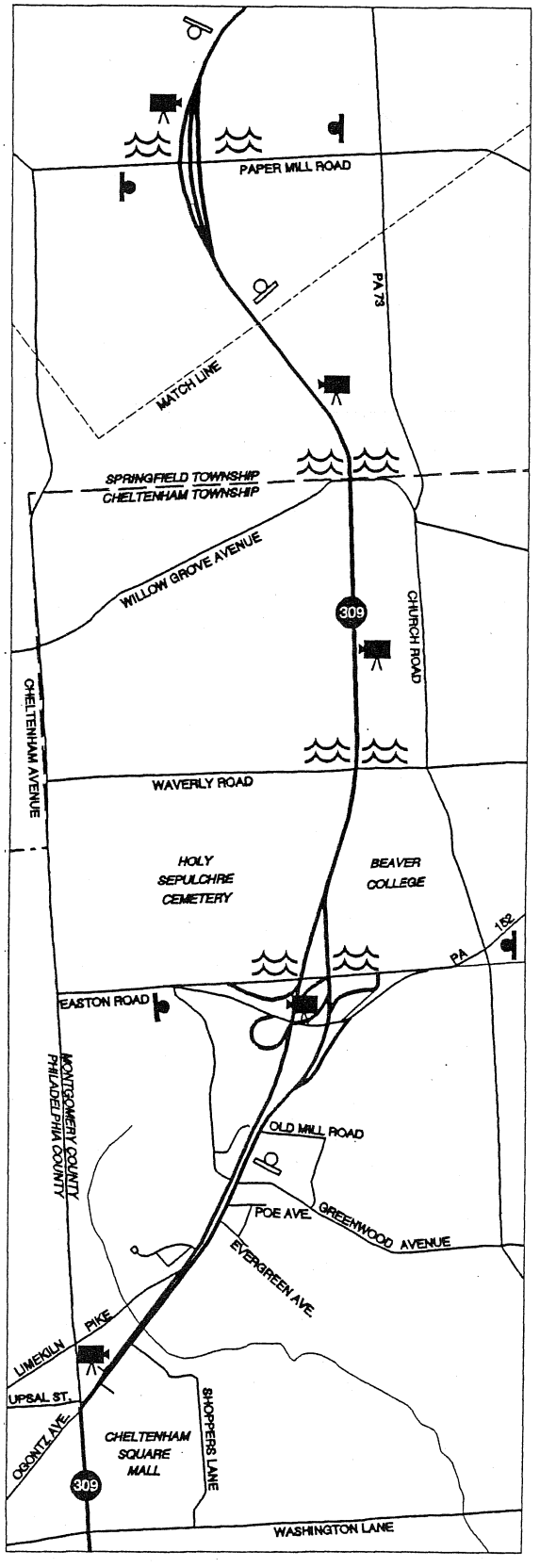


FIGURE 3:
INCIDENT MANAGEMENT STRATEGIES - CCTV, CMS, HAR, STANDPIPES

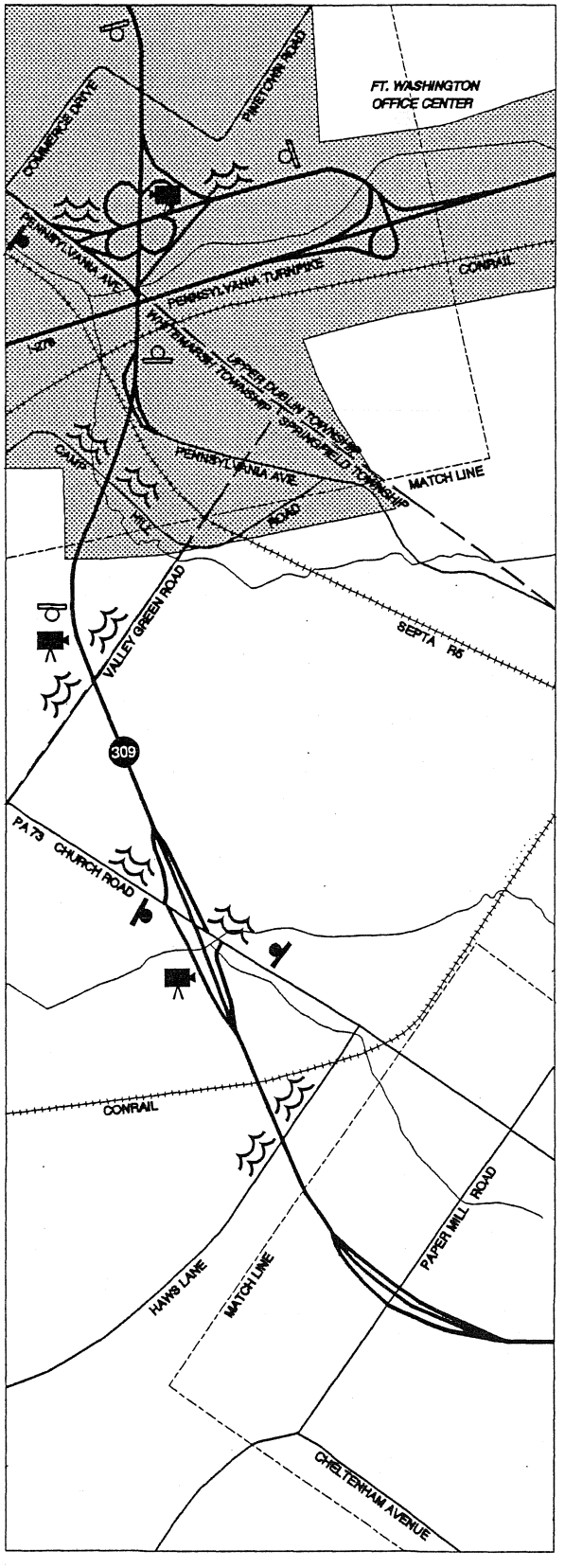
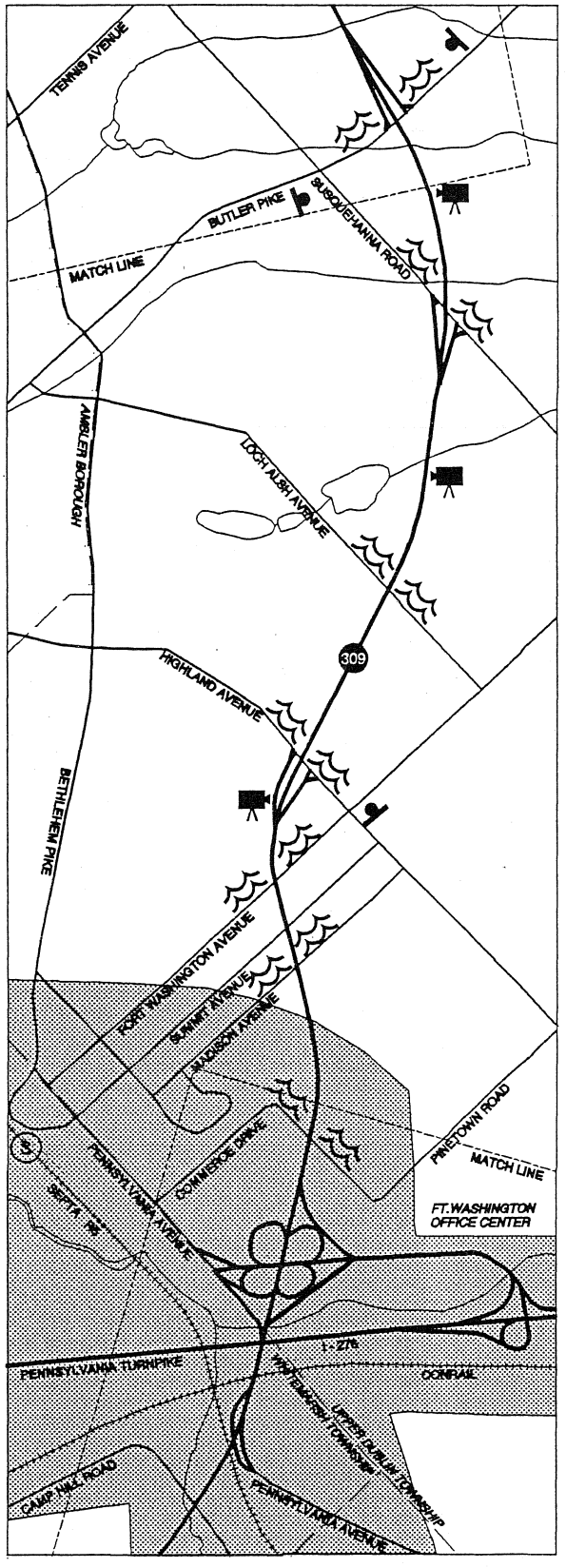


FIGURE 4:
INCIDENT MANAGEMENT STRATEGIES - CCTV, CMS, HAR, STANDPIPES



SCALE: 1" = 2000'

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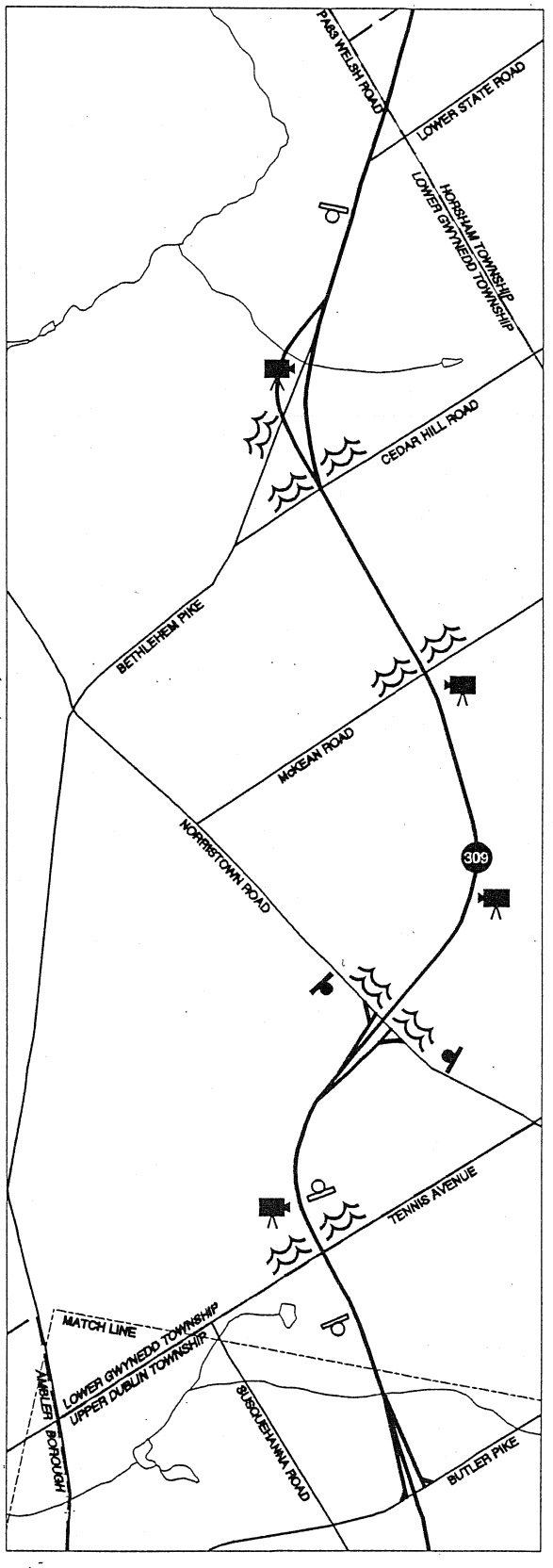
FIGURE 5:
INCIDENT MANAGEMENT STRATEGIES - CCTV, CMS, HAR, STANDPIPES



LEGEND

- CCTV
- CMS (4-Line)
- CMS (2-Line)
- STANDPIPE

SCALE: 1" = 2000'

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closer spacing may be necessary to provide complete coverage.

Initial estimates indicate that complete coverage of PA 309 from PA 63 to Cheltenham Avenue can be accomplished with 15 cameras. Because of the numerous horizontal curves, maximum spacing of one mile can not be utilized in most instances. The recommended locations are presented in Figures 2 through 5. These are approximate locations. Exact locations will be identified during the design phase of the reconstruction project.

Changeable Message Signs

Real-time traffic information must be disseminated to the facility users for the incident management system to be effective. Currently, the most common transmission of traffic information in the Philadelphia region is via commercial radio stations. All to often this does not prove to be an effective method since "up to date, real-time" information is not up to date or is received by the motorists to late to make a route diversion.

Changeable message signs (CMS) are becoming a common medium for conveying this information. Regardless of how the traffic flow information is provided to the traveler, to be effective, the data must be timely, complete and accurate or the information will be ignored. CMS are an effective means of providing dynamic information to motorists concerning the following conditions:

- congestion that lies ahead resulting from an incident, special event or weather conditions.
- diversion to available alternate routes and SEPTA rail stations.
- directional guidance to major trip generators.
- maintenance or construction activities which result in lane closures or shifts.

The recommended CMS locations are displayed in Figures 2 through 5. Signs capable of displaying four lines of text should be installed at key locations along the facility such as; at the PA Turnpike Interchange, in advance of major diversion points, at both ends of the freeway section and access to rail stations. The expressway should be adequately covered with the installation of 10 signs of this type. These CMS should be situated such that the motorists are able to safely continue driving while reading and understanding the messages and still have time

to merge, change lanes or exit the highway safely. Smaller CMS signs capable of displaying two lines of text should be installed on the selected surface streets in strategic areas to inform motorists of the facility's status before they enter the expressway. Twelve of these signs should address the facility's needs.

Highway Advisory Radio

Highway Advisory Radio (HAR) provides a way to augment changeable message signs by providing more in-depth, accurate, up-to-date information to motorists regarding congestion, incidents and accidents, and upcoming construction because the information able to be disseminated by HAR is much more comprehensive than on changeable message signs or broadcast traffic updates by commercial radio stations.

Two types of technology currently exist: A 10-watt transmitter and Low-Power Transmission. According to the TIMS report, low-power transmission technology has just received FCC approval and is currently being tested in a California case study. Pending successful completion of testing, it is the technology recommended for the TIMS system.

Low-Power Transmission consists of a series of low-power transmitters which form a number of zones. A message can then be tailored to current traffic conditions in each zone. With a 10-watt transmitter a larger area is covered, thus drivers are inundated with information about all roads in the vicinity, not just the facility they are using. The Low-Power Transmitter also offers less interference and a stronger signal compared to the conventional 10-watt transmitter.

HAR should be properly signed and include a flashing beacon to alert motorists when an important message is being broadcast. TIMS recommends HAR zonal configuration on the Pennsylvania Turnpike (I-276) at the Fort Washington Interchange (PA 309). It is recommended that PA 309 tap into the Pennsylvania Turnpike HAR zone at the Ft. Washington Interchange. This will allow motorists on PA 309 to receive information about conditions on PA 309 in the vicinity of the Turnpike interchange as well as conditions on the turnpike. The coverage area is shown in Figures 2 through 5. No further HAR locations are recommended along PA 309.

Standpipes

During those incidents which require a response by fire equipment, incident related congestion on the highway can cause increased response time for fire vehicles. Fire service standpipes are an incident management strategy which allows fire vehicles to respond to incidents without having to enter the congested facility. By placing dry standpipes at cross street overpasses and underpasses, fire vehicles can save valuable time by hooking up to a dry standpipe on a cross street and running a fire hose to the scene of the accident.

Recommended standpipe locations are shown on Figures 2 through 5. Standpipes should be installed at all cross street overpasses and underpasses. In areas where there are a number of cross streets in close proximity, spacing can be extended to a maximum of ¼ to ½ mile. Standpipes should be provided by direction at each cross street to avoid running hoses across several lanes of traffic, creating further delay. Initial estimates indicate that 41 standpipes are needed on this facility. It is important that all standpipes be numbered and signed for easy identification by fire personnel. In conjunction with this effort, the location of the nearest fire hydrant on all cross streets should be charted. The nearest fire hydrant on cross streets should be no more than ¼ to ½ mile from PA 309.

Supplemental Signs

This strategy refers primarily to the installation of signs which provide locational information to the motorists but also includes signs which impart information on motorist services. The increasing popularity of car phones has led to a new method of detecting freeway incidents. Many incidents are now being reported by the person involved in the incident (disabled vehicle, accident, etc.) or by passing motorists. This method has decreased detection time and has increased the speed for the appropriate response. Cellular call-in signs displaying the number to be dialed to report incidents should be erected in the following locations: north of Easton Road in the northbound direction, north of the PA Turnpike interchange in the northbound direction, south of Bethlehem Pike in the southbound direction and south of SEPTA's R5 Line in the southbound direction.

The most common problem faced by people reporting incidents via car phones is that they have trouble identifying the location of the incident. The installation of supplemental signs

allows motorists to more precisely identify where they or the incidents are on the highway.

There are several features along the highway which should be identified by supplemental signing which would help motorists identify their locations. Listed below are the features that should be identified along PA 309 by a series of supplemental signs and the number of signs needed for each type:

Type of Sign	No. of Signs
• milepost markers in one-tenth mile increments	190
• roadway overpasses/underpasses	42
• railway overpasses/underpasses	6
• standpipe locations	41
• highway trailblazer signs	18
• cellular telephone call-in	4
• highway advisory radio	2

Highway advisory radio is a service which will be available in the vicinity of the PA Turnpike and signs should be erected indicating the radio frequency to tune to for traffic information. These signs should be located south of SEPTA's R5 Line in the northbound direction and south of Highland Avenue in the southbound direction.

Another advantage of the supplemental signs is that they assist motorists comprehend the information being transmitted via the changeable message signs. Figures 6 through 9 display the location of the supplemental signs recommended for PA 309. Although milepost markers are not indicated on the figures they are recommended for PA 309 at one-tenth mile intervals.

In the arterial section of the corridor, the at-grade intersecting streets should be identified by street signs located at the intersections.

Accident Investigation Sites

Accident Investigation Sites (AIS) provide a safe, convenient location to exchange accident and/or insurance information. Optimally, they should be located directly off an interchange, thereby allowing traffic to flow freely on the highway. An accident investigation

site should be well-lighted, provide surveillance and detection equipment, have water and telephone hook-up, and be screened from the highway to avoid "rubber-necking" by other motorists.

It is important that Accident Investigation Sites be frequently and regularly spaced. If they are not, the distance to tow or push a vehicle will be too prohibitive. Motorists will also not be able to recognize or use the AIS if they are not uniformly spaced and familiar. Unfortunately, on PA 309, the right-of-way provides no opportunity for AIS on the side of the roadway and the areas around most interchanges are too heavily developed. Therefore, no accident investigation sites are recommended for PA 309 at this time.

FIGURE 6:
INCIDENT MANAGEMENT STRATEGIES - SUPPLEMENTAL SIGNS

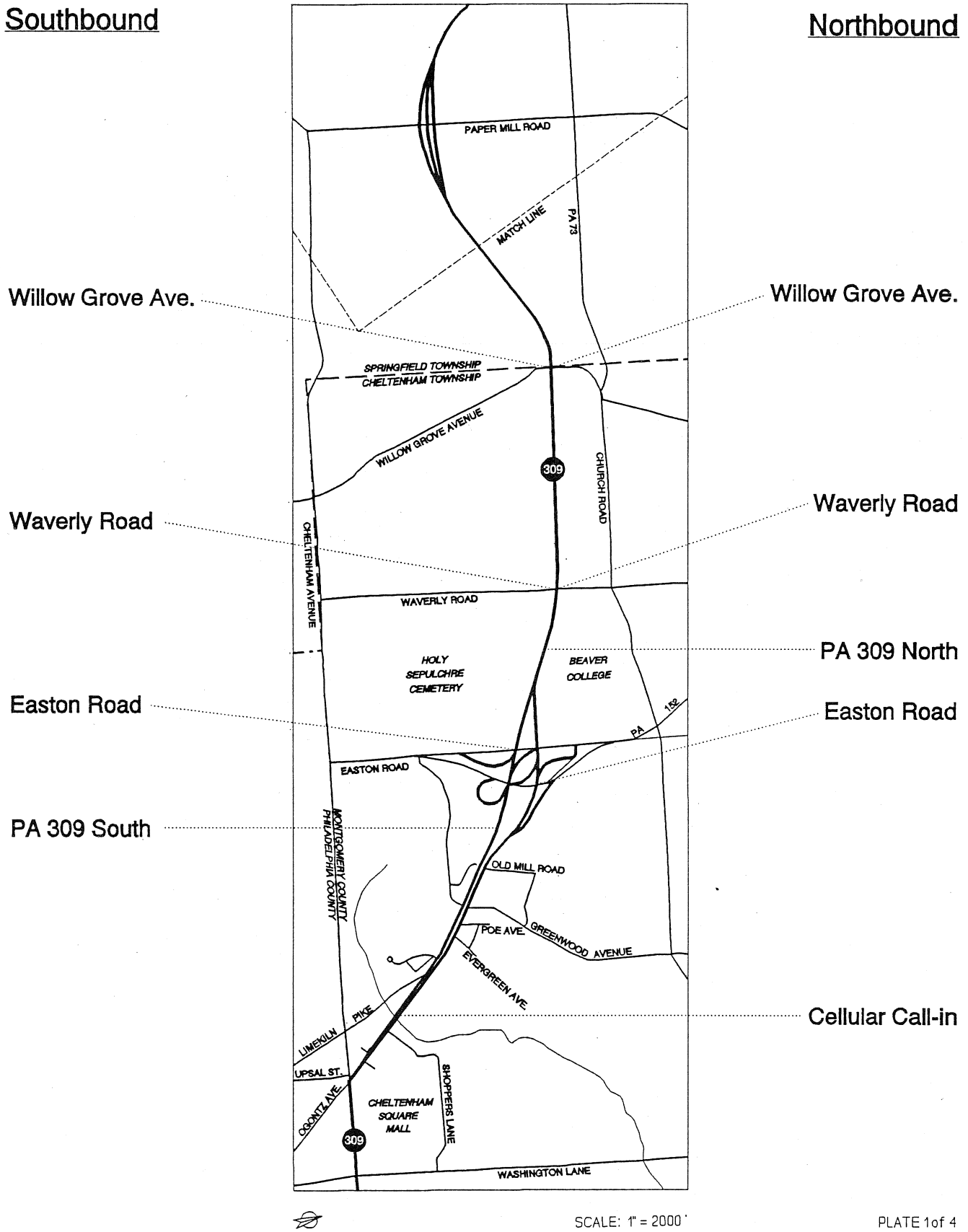


FIGURE 7:
INCIDENT MANAGEMENT STRATEGIES - SUPPLEMENTAL SIGNS

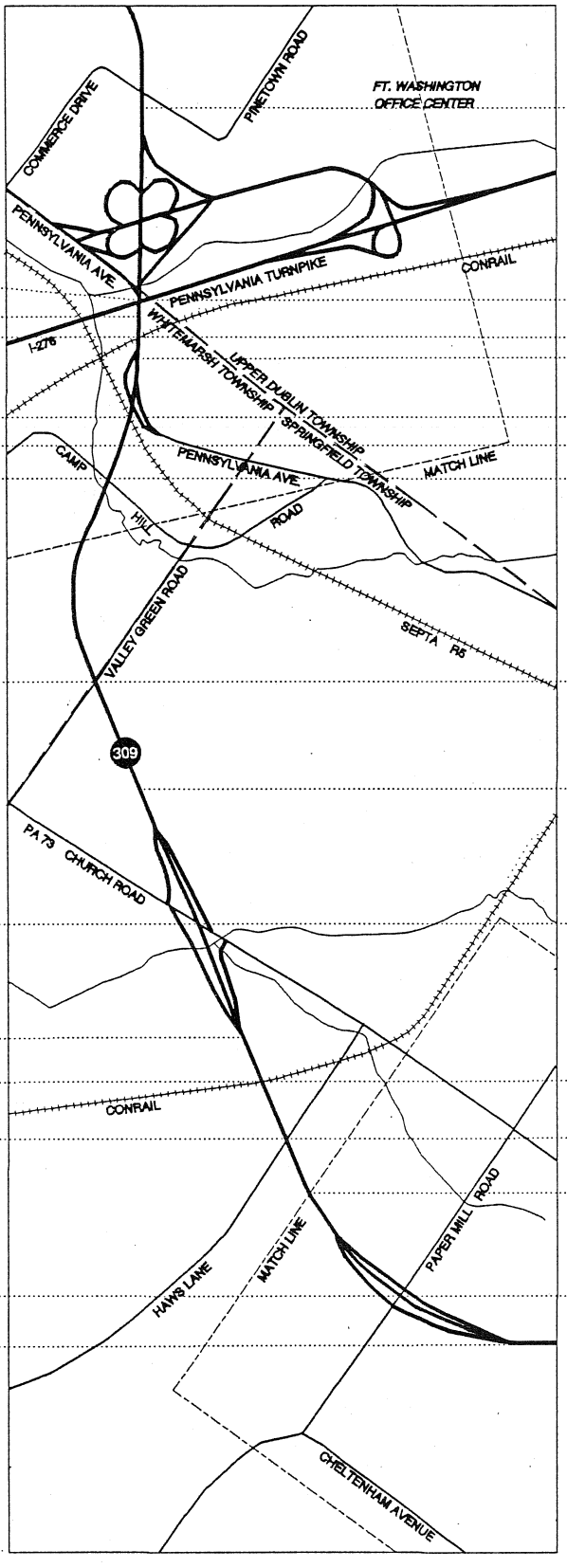
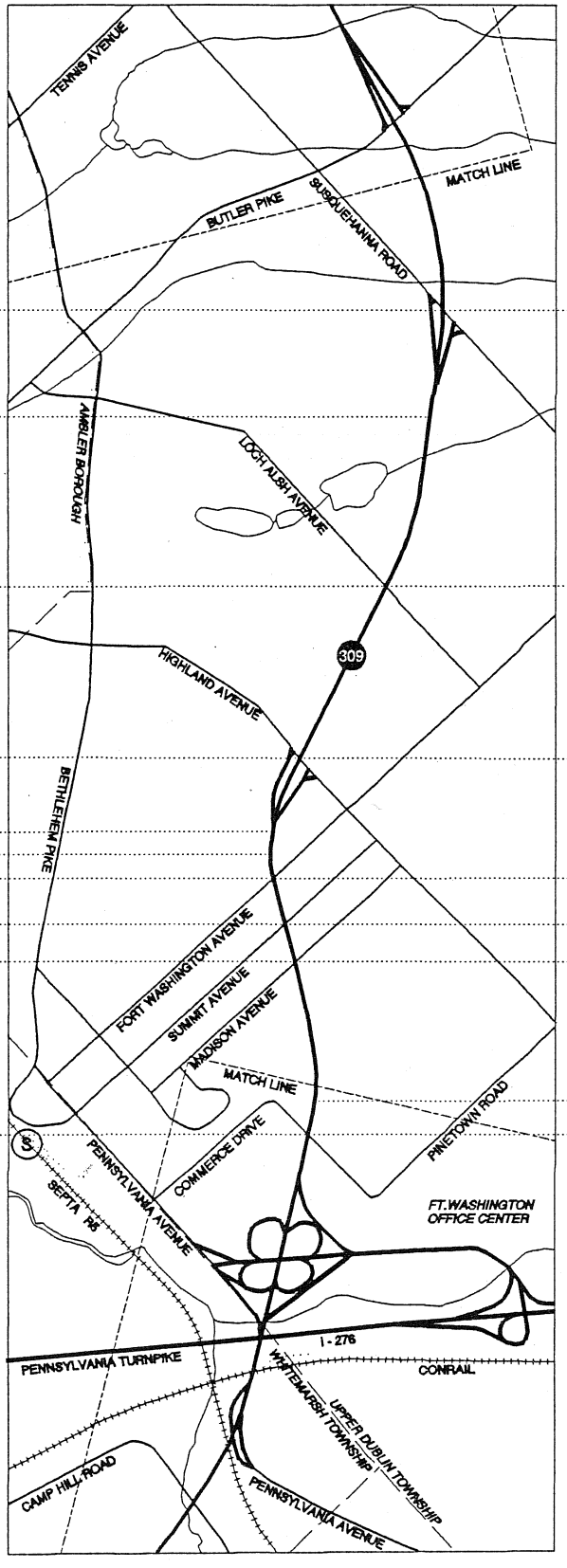


FIGURE 8:
INCIDENT MANAGEMENT STRATEGIES - SUPPLEMENTAL SIGNS

Southbound		Northbound
Susquehanna Rd.		Susquehanna Rd.
PA 309 South		
Loch Alsh Avenue		Loch Alsh Avenue
Highland Avenue		Highland Avenue
PA 309 South		
HAR		
Ft. Washington Ave.		Ft. Washington Ave.
Summit Avenue		Summit Avenue
Madison Avenue		Madison Avenue
		Cellular Call-in
Commerce Drive		Commerce Drive



SCALE: 1" = 2000'

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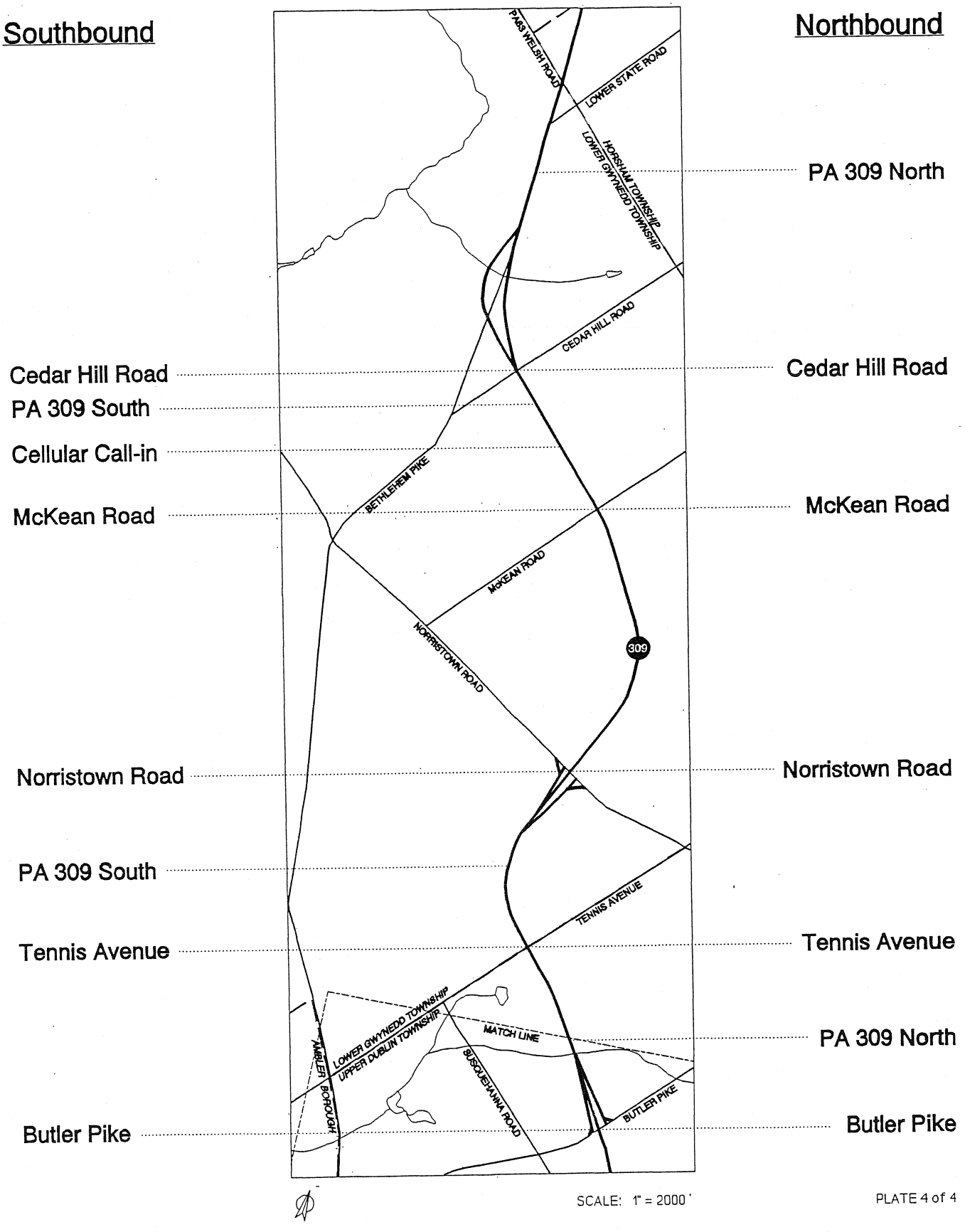
FIGURE 9:
INCIDENT MANAGEMENT STRATEGIES - SUPPLEMENTAL SIGNS



Integration With TIMS

The strategies developed for PA 309 must be integrated into the TIMS system if they are to be effective. These strategies should utilize some of the TIMS communication infrastructure and should be tied into the control center. Several elements of the PA 309 incident management plan need to be physically tied into the TIMS system while others such as supplemental signs and standpipes can implemented as a stand-alone feature. The detectors, CCTV cameras and the changeable message signs should be hardwired to the TIMS control center. To account for this interconnection, the following measures should be carried out:

- the capacity of the fiber optic network along the PA Turnpike used to provide two-way transmission of data, video and voice information between the TIMS control center and the various field elements should be increased to take into account the connection with the PA 309 system.
- the needs of the control center should be re-examined to account for the added input and output of information. The following elements should be re-evaluated to determine if additional units are required: CCTV monitors, workstations/computer terminals, telephone lines or personnel.
- during the design of the PA 309 reconstruction project, determine whether a separate communication hub is needed along PA 309 or if a joint use of the hub planned for the PA Turnpike under the TIMS system is possible.
- coordinate the operations of both systems in the vicinity of the PA Turnpike Fort Washington Interchange; this includes detectors, CMS and HAR.
- provide access to the cellular call-in system recommended for the TIMS system for reporting of incidents by motorists.
- the wording of the CMS in the PA 309 system should be consistent with that of the TIMS system.

Transit Alternatives in the PA 309 Corridor

Passenger rail service is provided in the PA 309 corridor by SEPTA's R5 Doylestown Line, R7 Chestnut Hill East Line and R8 Chestnut Hill West Line. The R5 connects Doylestown, Bucks County with Center City Philadelphia and provides a transit alternative throughout the entire expressway portion of the corridor. Both the R7 and R8 connect the Chestnut Hill section of Philadelphia to Center City and provide a transit alternative in the southern section of the PA 309 Expressway corridor. This passenger rail service provides an excellent opportunity to serve trips to Center City from this corridor during the expressway reconstruction project and as a congestion mitigation strategy resulting from an incident management plan for the corridor.

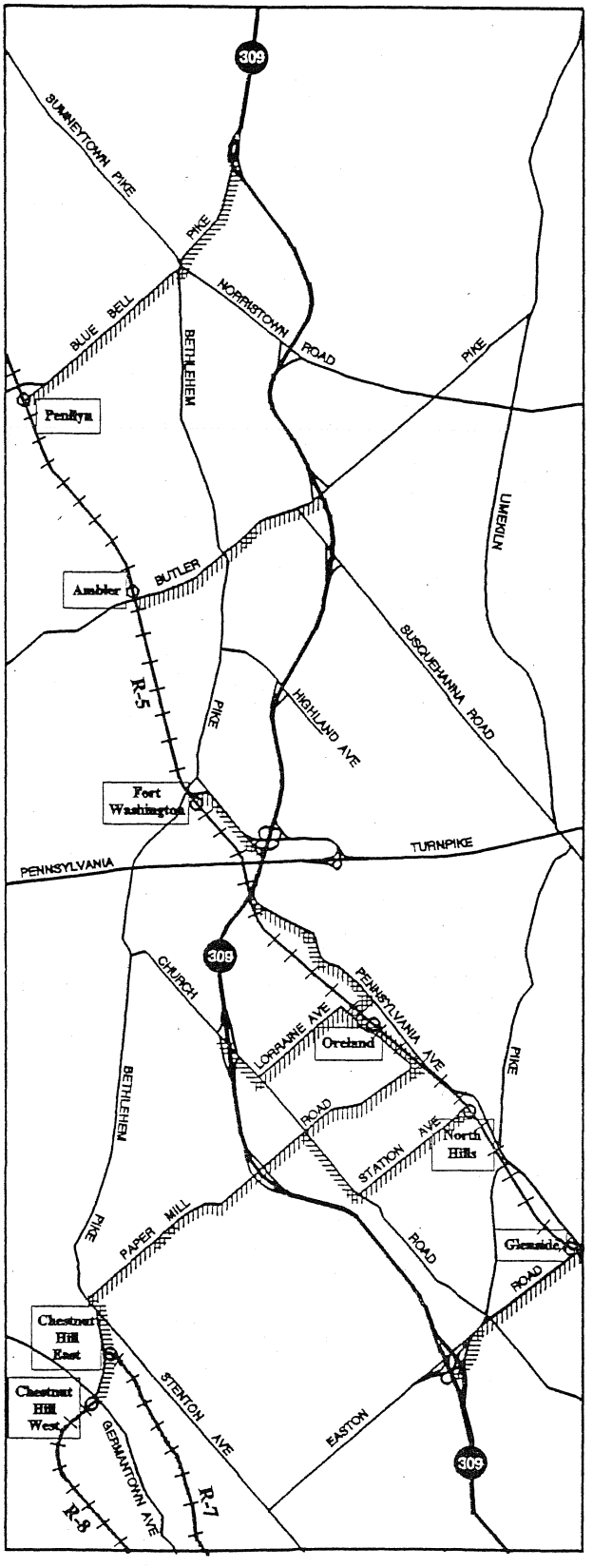
Six stations along the R5 and the terminal stations on the R7 and R8 are easily accessed from the PA 309 Expressway and can be used as relief valves when congestion causing incidents occur on the expressway.

As part of the incident management plan for the expressway, changeable message signs (CMS) installed on the expressway would be invoked to alert motorists of downstream congestion. Alternate travel plans suggesting use of SEPTA rail service could be imparted. The message could inform drivers of the availability of rail service and the time of the next departing train. Each CMS could be individually programmed to offer transit information on only the station or stations closest to the upcoming interchange. Once the motorists have departed the expressway, station directional signs which would be erected, would provide the most direct route to the appropriate station. Figure 10 displays the most direct routes from the PA 309 interchanges to the appropriate station.

A potential problem with this strategy involves the available parking supply at the stations. In some cases, the existing parking is fully utilized on a typical weekday by the regular transit patrons. Because of this condition, potential parking lot expansions or temporary accommodations for overflow parking should be evaluated further.

Descriptive information for the eight stations in the corridor is presented below:

FIGURE 10:
ACCESS TO REGIONAL RAIL STATIONS IN THE CORRIDOR



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R5 - Doylestown Line

Pennlyn Station

- *Access from southbound PA 309* - at the entrance to the PA 309 Expressway, stay on Bethlehem Pike. Turn right onto Pennlyn Blue Bell Pike and follow this road to Pennlyn Station. This station is 2.3 miles from the beginning of the PA 309 Expressway
- *Parking* - currently, limited parking is available (39 spaces). All parking at the station is free.
- *Travel time to Center City* - seven peak period trains provide local service which takes 40 minutes to get to Market East Station. Average peak period headways from this station are 30 minutes.
- *Fare* - This station is located in Zone 4 where peak one-way fare is $4.25.

Ambler Station

- *Access from southbound PA 309* - exit PA 309 at Butler Pike and turn right onto Butler Pike. Follow Butler Pike 2.4 miles to Ambler Station.
- *Parking* - recent expansion at this station brought the lot up to 585 spaces. This is now the largest lot in the SEPTA system. Parking charges are $.50 a day.
- *Travel time to Center City* - seven peak period trains provide local service which takes 37 minutes to get to Market East Station. The three express trains cut travel time to approximately 29 minutes. This station has average peak period headways of approximately 20 minutes.
- *Fare* - This station is located in Zone 3 where peak one-way fare is $3.75.

Ft. Washington Station

- *Access from southbound PA 309* - exit PA 309 onto westbound Pennsylvania Avenue. Follow Pennsylvania Avenue .5 miles to Summit Avenue and turn left into the station.
- *Parking* - there are 189 parking spaces at the station. Parking charges are $.50 a day. SEPTA is currently investigating the potential for future expansion at this station.
- *Travel time to Center City* - seven peak period trains provide local service which takes 34 minutes to get to Market East Station and the three express trains take 26 minutes. This station has average peak period headways of approximately 20 minutes.
- *Fare* - This station is located in Zone 3 where peak one-way fare is $3.75.

Oreland Station

- *Access from southbound PA 309* - The station can be easily accessed from the following three interchanges: exit PA 309 onto eastbound Pennsylvania Avenue and follow to Bridge Street. Turn right onto Bridge Street and follow to the station. The distance is 1.5 miles from the Pennsylvania Avenue interchange. From the interchange with PA 73, exit PA 309 and turn left. Follow PA 73 to Lorraine Avenue and turn left. Follow Lorraine Avenue to Ehrenpfort Avenue and turn right to the station. This route covers a distance of 1.3 miles. From the Paper Mill Road interchange, exit PA 309 and turn left. Follow Paper Mill Road to Bruce Road and turn left to the station. This route is 1.6 miles.
- *Parking* - there are 143 parking spaces available at this station and the daily parking fee is $.50.
- *Travel time to Center City* - seven peak period trains provide local service which takes 30 minutes to get to Market East Station. This station has average peak period headways of approximately 30 minutes.
- *Fare* - This station is located in Zone 3 where peak one-way fare is $3.75.

North Hills Station

- *Access from southbound PA 309* - exit PA 309 at Paper Mill Road and turn left. Follow Paper Mill Road to PA 73 and turn right. Follow PA 73 to Station Avenue and turn left. Follow Station Avenue to the station. The total distance is 1.8 miles.
- *Parking* - there are 147 parking spaces available at this station and the daily parking fee is $.50.
- *Travel time to Center City* - seven peak period trains provide local service which takes 28 minutes to get to Market East Station. This station has average peak period headways of approximately 30 minutes.
- *Fare* - This station is located in Zone 3 where peak one-way fare is $3.75.

Glenside Station

- *Access from southbound PA 309* - exit PA 309 onto northbound Easton Road and follow one mile to the Glenside station.
- *Parking* - there are 258 parking spaces available at this station. The parking fee is $.50 per day.

- *Travel time to Center City* - seven peak period trains provide local service which takes 25 minutes to get to Market East Station. This station has average peak period headways of approximately 30 minutes.
- *Fare* - This station is located in Zone 3 where peak one-way fare is $3.75.

R7 - Chestnut Hill East Line

Chestnut Hill East Station

- *Access from southbound PA 309* - exit PA 309 at Paper Mill Road and turn right onto Paper Mill Road. Follow to Bethlehem Pike and turn left. Follow Bethlehem Pike to the station. The station is 1.8 miles from the Paper Mill Road exit of PA 309.
- *Parking* - there are 132 parking spaces available at this station. All parking is $.50 per day.
- *Travel time to Center City* - seven peak period trains provide local service which takes 32 minutes to get to Market East Station. This station has average peak period headways of approximately 25 minutes.
- *Fare* - This station is located in Zone 2 where peak one-way fare is $3.25.

R8 - Chestnut Hill West Line

Chestnut Hill West Station

- *Access from southbound PA 309* - exit PA 309 at Paper Mill Road and turn right onto Paper Mill Road. Follow to Bethlehem Pike and turn left. Follow Bethlehem Pike to Germantown Avenue, the station is just east of the intersection. This station is 2.0 miles from the Paper Mill Road exit of PA 309.
- *Parking* - this station provides parking for 183 vehicles. The parking fee is $.50 per day.
- *Travel time to Center City* - seven peak period trains provide local service which takes 38 minutes to get to Suburban Station. This station has average peak period headways of approximately 25 minutes.
- *Fare* - This station is located in Zone 2 where peak one-way fare is $3.25.

COST ESTIMATES

The unit cost estimates shown in Table 1 were taken from the *Traffic and Incident Management Study for the Philadelphia Area* report and incorporate all incidental costs including construction/installation. The table shows all incident management strategies recommended within this report for PA 309. It does not include hardware and software costs which may be incurred in order for the PA 309 incident management system to tie into the PennDOT Control Center. Costs for Highway Advisory Radio are also not shown because the costs for HAR at the Ft. Washington Interchange have already been accounted for on the Pennsylvania Turnpike in PennDOT's TIMS Study.

TABLE 1: COST ESTIMATES FOR PA 309 TIMS

COSTING ITEM	UNIT	QUANTITY	UNIT COST	CAPITAL COSTS	MAINTENANCE
Fire Service Standpipes	Each	41	$10,000	$410,000	$41,000
Closed Circuit Television (CCTV)	Each	15	$40,000	$600,000	$60,000
Detector Stations					
Loop/Overhead	Each	38	$20,000	$760,000	$76,000
Changeable Message Signs (CMS)					
2-Line	Each	12	$150,000	$1,800,000	$180,000
4-Line	Each	10	$250,000	$2,500,000	$250,000
Supplemental Signs					
Milepost Markers	Each	190	$40	$7,600	$760
Over/Under Pass	Each	48	$100	$4,800	$480
Fire Service Standpipes	Each	41	$100	$4,100	$410
Trailblazer	Each	15	$250	$3,750	$375
Rail Station	Each	16	$250	$4,000	$400
HAR	Each	2	$960	$1,920	$192
Cellular Phone	Each	4	$400	$1,600	$160
Conduit/Cable Installation					
During Construction	Per Mile	19	$50,000	$950,000	N/A
Cross-Overs	Each	30	$3,000	$90,000	N/A
Fiber Optic Cable	Per Mile	21	$20,000	$420,000	$42,000
Power Cable	Per Mile	21	$10,000	$210,000	$21,000
Communication Hubs	Each	1	$80,000	$80,000	$8,000
Engineering/Inspection	Lump Sum	N/A	N/A	$1,726,509	N/A
			Subtotal	$9,574,279	$680,777
			Contingency(10%)	$957,428	$68,078
			Total	$10,531,707	$748,855

Note: Maintenance figures shown reflect annual maintenance costs;
Additional costs which may be incurred at the Control Center have not been shown.