NEW JERSEY DEPARTMENT OF TRANSPORTATION

CONGESTION MANAGEMENT SYSTEM ROUTE 571, PENNS NECK AREA FINAL REPORT

W. Windsor Twp., Mercer County N.J.

Prepared for New Jersey Department of Transportation by Frederic R. Harris, Inc.

Final Version Adopted: March 26, 1998

HARRIS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Study Purpose

Under the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, federal funds may only be programmed for projects that will significantly increase carrying capacity for single occupancy vehicles (SOV) in a nonattainment area that results from a Congestion Management System (CMS). This requirement is for both ozone and carbon monoxide. As the entire State of New Jersey is classified as nonattainment for ozone, all projects are subject to this requirement requesting federal funds. A CMS can be defined as a study designed to document the way in which travel demand reduction and operational strategies are evaluated to determine their ability to eliminate the need for the additional SOV capacity proposed by the project. This study is being performed in accordance with the Delaware Valley Regional Planning Commission (DVRPC) interim CMS process.

1.2 Project Background

In December, 1986 the New Jersey Department of Transportation issued the Route 1 Corridor Transportation Study. In this study, the Department identified the Route 1 corridor as an area of intense growth. In 1991, the Department completed an Environmental Assessment (EA) for Route 1 from Quakerbridge Road to Sayre Drive and the Federal Highway Administration (FHWA) issued a Finding of No Significant Impact (FONSI). The study and EA formed the foundation for a series of roadway improvements along Route 1 that have been completed. This included widening from four to six lanes and grade separations at several locations including Alexander Road and Scudders Mill Road and signal eliminations at the Motor Vehicle Inspection Station and Plainsboro Road. The EA recognized that improvements are required in the Penns Neck area and specified the construction of a grade separated interchange between Fisher Place and Logan Drive. The Penns Neck area is shown in the attached Figure 1-1 Project Vicinity and Location Map. However, the development of alternatives and preliminary design of the Penns Neck area improvements were not part of this EA.

To date, Route 1 improvements in the Penns Neck Area have been restricted to elimination of the shoulders to create three travel lanes in each direction and reconstructing the signals. These Transportation Systems Management (TSM) improvements are intended as an interim measure to relieve congestion through the Penns Neck area while more permanent solutions for Route 1 are being advanced. As part of the initial Route 1 corridor studies in 1986, NJDOT developed a series of alternatives for Route 1 through the Penns Neck Area.

These alternatives included grade separations at the Penns Neck Circle, at Harrison Street and other sites in between. Key issues associated with the alternatives included community impacts, impacts to historical

resources and traffic operations. In 1992, a study was performed to evaluate five alternative improvements and the no-build condition on the basis of traffic operation. This study recommended Scheme D-1 for advancement to design and construction.

In 1995 NJDOT performed additional alternatives analysis to refine Scheme D-1. Alternatives analysis included the updating of traffic and environmental studies, and the development of additional schemes based on D-1. The alternative analysis included preliminary discussions with municipalities, the County, regulatory agencies, and major property owners. This process culminated in the selection of Scheme D-1.1c as the best fit alternative in terms of achieving project objectives and minimizing environmental and community impacts. Scheme D-1.1c was presented to the public in a public information center. Scheme D-1.1c is shown in Figure 1-2. In 1996, the Department initiated an Environmental Assessment for improvements in the Penns Neck Area. It is this EA which documents the environmental impacts of the project as presently planned and includes discussion of the foregoing alternatives analysis findings.

1.3 Need for Congestion Management System (CMS)

According to the FHWA, objectives of an EA are to determine what aspects of a proposed project have the potential for social, economic, or environmental impact (*Environmental Impact and Related Procedures*, 23 CFR 771.119(b)). To do this a CMS analysis must be performed prior to FHWA review. Once the CMS analysis is complete it will become a component of the 1996 Environmental Assessment (EA) being prepared for the proposed project. FHWA will then conduct their review of the project and make a determination of impact. The EA is subject to FHWA approval prior to circulation to the public. During EA circulation, a public hearing and comment period will be held. Comments received during the circulation period will be addressed and incorporated into the EA along with the hearing transcript. The FHWA will then make its final review and determination.

In early 1997, the DVRPC and NJDOT met to discuss the need for the CMS. In an April 10, 1997 memorandum, representatives from the DVRPC indicated that a CMS analysis is required for the following reasons:

- The proposed realignment of County Route 571, as proposed by scheme D-1.1c, is over two miles in length, exceeding the one mile threshold,
- The new alignment of County Route 571, as proposed by scheme D-1.1c, is not specifically identified in the NJDOT TIP or the DVRPC 2020 plan,
- The reconstruction of Route 1 bridge over Millstone River, to provide shoulders, was not identified in the TIP or the 2020 plan.

1.4 Study Area

Penns Neck is an established community just east of Route 1 along both sides of County Route 571 (Washington Road). The Penns Neck Circle is located at the intersection of Washington Road and Route 1. To the South of the circle, the ADinky Railroad@ crosses over Route 1 and to the north are signalized intersections at Fisher Place and Harrison Street. Just north of Harrison Street, Route 1 crosses over the Millstone River, into Middlesex County. The Penns Neck area is shown in the attached Figure 1-1 Project Vicinity and Location Map.

It was agreed that the Route 571 improvements trigger the need for the CMS. However in performing the CMS study, strategies should be evaluated on an area wide basis. The analysis is to be conducted relative to where congestion is most prevalent. Therefore, although the proposed project has triggered the CMS, the study should not be confined to Route 571.

1.5 Study Coordination

To coordinate the work performed and to obtain input from other key regional transportation agencies, a steering committee was formed for this CMS Study. This committee includes representatives from NJDOT, DVRPC, Mercer and Middlesex Counties, Federal Highway Administration (FHWA), N.J. Transit, Federal Transportation Administration (FTA), West Windsor Planning Board, Princeton Regional Planning Board, Plainsboro Planning Board, Middlesex-Somerset-Mercer Regional Council, Inc (MSM) and the Greater Mercer TMA. A total of five steering committee meetings were held.

In addition, a public meeting was included as part of the CMS process. The purpose of this meeting was to introduce the project to the public and present the preliminary results of the strategy evaluation. A formal presentation was given, followed by a question and answer period. In general, residents are in agreement that congestion is severe and an improvement in the roadway network is needed. DVRPC distributed a survey requesting public opinion regarding preferences among the CMS strategies discussed previously. See the Appendix for a copy of the survey. Results of the survey have been tabulated by DVRPC and discussed in Section 6 of this report.

2.0 STUDY AREA

The section of Route 1 and Washington Road currently under study is commonly referred to as the Penns Neck Area. This section along Route 1 extends from the south at milepost 10.7, south of Alexander Road to milepost 12.2, north of Princeton-Plainsboro Road and along Route 571 from Nassau Street to Route 535 (Cranbury-Edinburg Road). The study area includes a portion of Plainsboro Township in Middlesex County and portions of Princeton Township, Princeton Borough and West Windsor Township in Mercer County.

Central to the study area is the intersection of Route 1 and County Road 571 (Washington Road). The area is home to Princeton University and many large corporations together with surrounding communities. The Princeton Junction Train Station east of Route 1 provides rail access to the area. With the availability of undeveloped land in the area, a significant growth in employment is expected.

2.1 Existing Roadway Network

Route 1

Route 1 is a major north-south route that serves both local and regional traffic. Route 1 presently experiences heavy traffic flows which result in significant delays at the many signalized intersections along the corridor. Currently, the Route 1 segment between Washington Road and Plainsboro Road is 6 lanes with no shoulders.

Washington Road

Washington Road is an important east-west route in the Penns Neck Area. West of Route 1, the two lane road provides access to Princeton Borough and Princeton University. East of Route 1 Washington Road extends through the community of Penns Neck to a point 500 feet west of the tracks where the roadway bends abruptly to the north. From this point the road crosses over the Northeast Corridor rail lines (Amtrak). This small 0.3 mile segment of roadway/bridge is New Jersey State Route 64. East of the rail lines the roadway is named Princeton-Hightstown Road. The road begins with two lanes and then widens to a 4-lane undivided highway east of Clarksville Road. Together, these roads are designated as County Route 571 that connects Princeton and Hightstown and is heavily used by commuters. It also connects Route 1 in the Princeton area to Hightstown in the vicinity of New Jersey Turnpike, Interchange 8.

Harrison Street (County Route 629)

Harrison Street is a two-lane county road which connects Route 1 with Princeton and the west. A jughandle on the northbound side of Route 1 allows for left turns, U-turns and access to the David Sarnoff Research Center. Harrison Street is a two-lane, 22-foot wide roadway without paved shoulders.

Alexander Road

The Route 1 and Alexander Road intersection has been replaced with a full grade separated interchange. This improvement included the widening of Route 1 to three lanes in each direction with full shoulders.

Fisher Place

Fisher Place is a two-lane, 24 to 40-foot wide residential street with a jughandle along the southbound side of Route 1. The jughandle provides access to Fisher Place and allows U-turns to Route 1 northbound. Traffic from David Sarnoff Research Center and some diversionary traffic from Washington Road also use Fisher Place.

Faculty Road

Faculty Road is a two-lane road with 14-foot travel lanes without shoulders. The road begins at a signal controlled T-intersection with Alexander Road. It extends north and crosses Washington Road with a signalized intersection. It then crosses Harrison Street with a stop controlled intersection where it becomes Hartley Avenue. Faculty Road primarily serves Princeton University and the local residents of Princeton Township and Princeton Borough.

North Post-Wallace-Cranbury Road

North Post Road begins at the community of Post Corner in West Windsor Township. This road crosses Clarksville Road as it extends north towards Princeton Junction. At a stop controlled intersection with Alexander Road, North Post Road becomes Wallace Road which provides access to the Princeton Junction Train Station. At a signalized intersection with Route 571, Wallace Road becomes Cranbury Road. Cranbury Road extends northeast to the to Grovers Mill and Cranbury. Within the study area, this road is one lane in each direction.

Clarksville Road

Clarksville Road is a two-lane road which begins at Quakerbridge Road, traverses northerly and ends at Route 571. At Route 571, Clarksville Road becomes Grovers Mill Road. Grovers Mill Road ends at its intersection with Cranbury Road. Clarksville Road experiences heavy peak hour traffic as it connects West

Windsor Township with Lawrence and Hamilton Townships. Capacity is limited due to kinks in the alignment of the road.

2.2 Transit Services

A review of the study area=s available transit services included a focus on both regional and local alternatives. Within the study area there are rail, bus, and paratransit services available, provided by both the public and private sectors. Developments in the area are constructed in campus-style suburban settings. Such developments provide significant impediments to the implementation of traditional transit services.

Rail Service

The focus of the area transit is the Northeast Corridor Rail Line linking Philadelphia, Trenton, New Brunswick, Newark, and New York City. Both N.J. Transit and Amtrak operate commuter service with frequent service throughout the day. Within the immediate study area, a regional train station is located at Princeton Junction in West Windsor Township. Additionally, the Princeton Line, or AThe Dinky@ as it is more commonly known, operates a 2.7 mile rail shuttle between the Princeton and Princeton Junction train stations. Service is provided throughout the day, with frequency of service highest during the AM and PM peak hours. The Dinky service is scheduled to meet nearly all NYC-Trenton bound trains on the Northeast Corridor.

Bus Service

Local bus service for the project area is provided by N.J. Transit through its Mercer Division. N.J. Transit operates ten routes in Mercer County. NJ Transit began operating Mercer County routes in 1984 with the first full year of operation in 1985. Table 2-1 summarizes project area bus routes.

In addition, there are several privately operated transportation services in the study area. Both express and local bus service are provided to the Port Authority Bus Terminal in New York City. Paratransit type services are provided by private operators to link corporation with the Princeton Junction train station. Such services are paid for by the corporations being served.

Park and Ride Facilities

As documented in the *Route 1 Local and Corridor Demand Management Plan* (Reference # 6) a total of twenty-one park and ride lots exist between Trenton and New Brunswick through the Route 1 corridor. The lots range in capacity from 28 spaces to 3,800 spaces. A description of these lots is included in the Appendix. Table 2-2 summarizes park and ride facilities for the Route 1 corridor.

3.0 EXISTING CONDITIONS

Prior to the design of the proposed project traffic studies were conducted which began with the counting of existing volumes in the study area. This raw data was then reduced and adjusted to develop base year 1992 weekday traffic volumes for the AM Peak Hour, the PM Peak Hour, and Daily Volume. The 1992 Volume Adjustment Report (Reference #4) dated July 1, 1992 details the methodologies used to develop the adjusted traffic volumes. Traffic volume counts taken at this time period did not include programed roadway improvements such as the interchange at Alexander Road and the conversion of the Route 1 shoulder to a travel lane. Traffic Flow Maps were developed for existing (1992) conditions and include:

- AM Volume, truck percentage, speed
- PM Volume, truck percentage, speed

See the Traffic Analysis Report Route U.S. 1 - Penns Neck Area (Reference #2) for the traffic flow maps. The required analysis for the CMS Study dictated that current (1997) traffic volume conditions be verified. To accomplish this, sample traffic counts were conducted. Traffic data was collected through Automatic Traffic Recorders (ATR) at key locations within the study area over a 24-hour period. Traffic counts were performed between February and March 1997. See the Appendix for count data. The following are those locations where traffic volume counts were taken.

- Alexander Road between Canal Road and West Drive
- Harrison Street at Lake Carnegie Bridge
- Washington Avenue south of Faculty Road
- Route 1 north of the Millstone River
- Alexander Road at the railroad bridge
- Washington Road at the railroad bridge

A comparison of the 1992 traffic volume counts with the recently conducted 1997 ATR counts was performed to assess the recent traffic growth over the past five years. The 1997 ATR counts indicate that traffic through the area generally increases by about 20% along Route 1 and 10% through along Route 571 east of Route 1. Similarly 1997 traffic volumes could then be compared to the projected 2002 traffic volumes to ensure traffic volume projections have not been under or over estimated. The 1997 traffic volume counts were found to verify the growth projected for the 2002 and 2022 conditions.

3.1 Existing (1992) Analysis

The existing analysis is based on the 1992 traffic volumes and roadway geometries that were present at the time of the counts. The existing roadway was analyzed according to the methods of the 1994 Highway Capacity Manual (HCM). The microbased Highway Capacity Software, Version 2.1 was utilized to assist with the analyses. Roadway segments and signalized intersections were analyzed for level-of-service (LOS). The definition of LOS varies by facility as described in Table 3-1.

TABLE 3-1
LEVEL-OF-SERVICE

LOS		HIGHWAY SEGMENT		SIGNALIZED INTERSECTION
		2-Lane (VPH)*	4-Lane(VPH)*	Delay (sec)
A	Free Flow, No Delays	140	1,170	# 5.0
B	Stable Flow,Short Delays	340	1,170	5.1 to 15.0
C	Desirable Design, Moderate Delays	580	2,300	15.1 to 25.0
D	Minimum Design, Long Delays	960	2,840	25.1 to 40.0
E	Theoretical Capacity	1,600	3,550	40.1 to 60.0
F	Unstable flow	>1,600	>3,500	>60

* Peak Direction Volume

Route 1 TSM and Dinky Railroad Bridge improvements did not begin until 1993, almost one year after the counts. Therefore the 1992 capacity analysis reflects the operation of Route 1 in 1992, but does not necessarily reflect the operation of Route 1 in 1993. A summary of the 1992 AM/PM peak hour levels of service for the roadway network are shown in the Traffic Analysis Report, Route U.S. 1 Penns Neck Area (Reference #2).

Route 1

The intersection at Harrison Street fails in both the AM and PM peak hours with volume/capacity (v/c) ratios of 1.23 in the AM and 1.07 in the PM. All Route 1 links operate within capacity except for the link north of Harrison Street which fails in the AM peak hour.

County Route 571

In the AM and PM peak hours all links and signalized intersections along Route 571 operate at a level of service of E or better. The unsignalized intersections along Washington Road operate above capacity.

3.2 Origin-Destination Investigation

Origin-Destination (O/D) characteristics of trips along Route 1 were examined as part of the CMS process. A review and analysis of this data provides for a comprehensive assessment of travel characteristics through the project area. Such information will aid in the evaluation of proposed CMS strategies and the effects on travel patterns.

The DVRPC performed an O/D study in 1989 titled "Regional Cordon Line Traffic Survey". The survey included a location on Route 1 between Logan Drive and Harrison Street in West Windsor Township, Mercer County. This location was approximately one quarter mile south of the Middlesex County line. A copy of the O/D results for this location is shown in the Appendix.

To summarize, a total of 2013 responses were received from the survey. Results indicate that of the total traffic generated, approximately 70% are for work purposes. Additionally, 82% of respondents travel alone in their vehicles. The origin of trips for the project area included Plainsboro Township (17.8%), West Windsor Township (9.4%), Princeton Borough (7.0%) and Princeton Township (2.2%). Similarly, destinations for the project area included Plainsboro Township (18.3%), West Windsor Township (7.3%), Princeton Borough (8.5%) and Princeton Township (1.1%).

4.0 TRAFFIC FORECASTS

The Route 1 corridor has been the focus of numerous traffic studies. To develop and analyze CMS strategies, traffic data from two studies were utilized, the NJDOT Penns Neck Traffic Study and the DVRPC regional transportation model. The Penns Neck Traffic Study represents a detailed investigation of the existing traffic volumes and forecasts focused on the Penns Neck Area. The other volumes were developed by DVRPC through the use of the regional transportation model. Discussed below are each of these methods and how each will be utilized on this project.

4.1 NJDOT Penns Neck Traffic Study

In 1984 the NJDOT implemented a study of the 20 mile Route 1 corridor between Lawrence and New Brunswick. The corridor was divided into study areas. The Department developed 2004 volume projections from 1984 traffic count data. The 2004 volumes were later superseded by 2005 volumes. Roadway improvements for each study area were developed, analyzed and recommended in a series of feasibility studies using the volume forecasts. Recommended improvements such as the Quakerbridge Road Interchange and Alexander Road Interchange, have been constructed and are presently in service. In other areas the need for improvements has been accepted by the Department and improvements are being investigated . The Penns Neck Traffic Study was performed to supplement the previous traffic volume forecasts for the purpose of developing proposed improvements to the Route 1 Corridor in the Penns Neck area. The Penns Neck Study was focused between the following limits: Alexander Road to the south, Plainboro Road to the north, Faculty Road to the west and South Mill Road to the east.

Traffic volume counts for the Penns Neck Area were taken in 1992 and forecasted to the years 2002 and 2022 where 2002 is the estimated time of construction (ETC) and 2022 is the design year. The existing (1992) volumes were increased by a background growth rate and volume from site specific traffic generators were added. The result was 2002 and 2022 Demand Volumes. The Demand Volumes were distributed over the alternative roadway networks and capacity restraints were applied to locations where volume exceeded capacity. The procedures to develop demand volumes are described in detail in the Traffic Forecast Methodology Report (Reference #3) and the procedures for restraints and redistributions are described in the Traffic Analysis Report, Route U.S. 1 Penns Neck Area (Reference #2). The following is a discussion of the factors that were applied to the base year volumes in determination of future volumes.

4.1.a NJDOT Programmed Improvements

At the beginning of the study process Route 1 was two-lanes in each direction with a full outside shoulder, except under the Dinky Railroad Bridge where the shoulder is eliminated. In the spring and summer of

1993 the shoulder was converted to a third travel lane between the Penns Neck Circle and the intersection at Plainsboro Road. This improvement, often referred to as TSM, is intended to serve as a temporary measure until a build scheme is selected.

North of Plainsboro Road, Scudders Mill Road met Route 1 at a signalized intersection. This intersection was replaced with a grade separated interchange. Also included was the widening of Route 1 to six-lanes with shoulders from the intersection at Plainsboro Road north to meet the previously widened section at the College Road interchange.

South of the Penns Neck circle, the Dinky Railroad crosses over Route 1. The bridge carries a single track over Route 1 and in 1992 only had room underneath for two-lanes in each direction without shoulders. The construction to replace this bridge began in the summer of 1993 and the scope of the project included the construction of one additional lane in each direction, without shoulders. The new bridge provided sufficient under clearances to eventually widen Route 1 to three through-lanes in each direction plus one auxiliary-lane in each direction.

South of the Dinky Railroad, Alexander Road had crossed Route 1 with a signalized intersection. This intersection was replaced with a full grade separated interchange. Included with the Alexander Road interchange is the widening of Route 1 to three-lanes in each direction with full shoulders from the Dinky Railroad Bridge to Woodrow Wilson Boulevard.

Local Roadway Improvements

The intersection of Alexander Road/Wallace-North Post Road has been investigated by West Windsor Township, as yet no improvements have been constructed. Improvements to that intersection included replacing the existing structure carrying Alexander Road over the Amtrak rail lines and creating a direct connection between Alexander Road and North Post Road. Wallace Road would tie into the new alignment at a "T" intersection.

Route 571

County Route 571 controls much of the east-west movements of vehicles through the study area. To develop traffic volume forecasts it was assumed that intersection capacity improvements would be performed at key locations in Princeton Junction, consistent with the NJDOT Route 571 Needs Assessment. These improvements are currently being investigated by the Mercer County Engineers Office.

No-Build

The No-Build alternative was analyzed with roadway improvements that were constructed and are anticipated to be in place prior to the year 2002. These improvements include:

- TSM Improvements
- Replacement of the Dinky Railroad Overpass
- Alexander Road interchange and widening of Route 1 to the south
- Scudders Mill Road interchange and the widening of Route 1 to the north
- Intersection improvements to:
    1) Wallace / North Post / Alexander
    2) Princeton-Hightstown / Clarksville
    3) Princeton-Hightstown / Alexander
    4) Princeton-Hightstown / Wallace-Cranbury

4.1.b Background Growth Rate

The Background Growth Rate is the volume growth applied to the base year volumes resulting from factors not specifically controlled for in the traffic model. Typically, this is population and employment growth in the region surrounding the study areas, but can also include small site specific generators within the study area which are not included in the model. To establish the background growth rate three factors were examined: population growth, employment growth and historical traffic growth.

The population of Mercer and Middlesex Counties is expected to grow at an annual rate of 0.64% to 1.01%. Employment in the two county region is expected to grow at an annual rate of 1.1%. Historical data indicate that background traffic growth follows employment growth so a background growth rate of 1% was selected. Refer to the Traffic Forecast Methodology Report for Details (Reference #3).

4.1.c Site Specific Traffic Generators

The Penns Neck Area has tremendous growth potential. This section of Route 1 is commonly referred to as the "zip strip" with the prestigious Princeton zip code of 08540. With land readily available, many corporations find this area attractive for their corporate headquarters and offices. Princeton University's presence also attracts businesses and residents to the area. Of particular importance are the University's research, office and retail developments at the Forrestal Campus in Plainsboro Township.

Local zoning laws generally allow for office/research development in this area. Access to this area is provided primarily by Route 1. However, Princeton Junction Train Station also provides rail service to the area, linking it to New York and Philadelphia.

Over the next 30 years, expected development of this area includes approximately 14 million square feet of office space, 1.4 million square feet of commercial and retail space and 3,000 residential units. Proposed developments in the project area were identified and the latest development data was provided by local officials. The approved Traffic Impact Studies were used to obtain trip generation and distribution data, when that information was available. However, some projects were only in the concept stage so Traffic Impact Studies had not yet been developed. In these instances, the ITE Trip Generation Manual was used to generate development volumes. The trip distributions for these developments were derived from available distributions for nearby sites.

Many of the Traffic Impact Studies contained reduced volumes where trip reduction strategies were warranted. For example, transit and car pooling for office developments, pass-by trips for retail developments and internal capture for mixed-use developments are taken into account for reducing trip generation. When applicable, the reduced trips were used in the traffic model. To generate trips for the years 2002 and 2022 the development projects were ranked. Projects with final approval or under construction were assumed to be occupied by 2002 and included in those forecasts. Development projects with only preliminary or concept approval were included with the 2022 forecasts.

Site specific traffic generators used in the development of traffic volumes are identified in the Appendix. It should be noted that as part of the CMS study, the status of these site specific generators was compared recent estimates. The estimated growth for the project area was found to be on target with original estimates. The location of the site specific generators is shown in Figure 4-1. Notable site specific traffic generators in Penns Neck include Carnegie Center (2,436,000 s.f. Office), Princeton Forrestal (928,000 s.f. Office) and Princeton Nurseries (3,000,000 s.f. Office).

4.1.d Demand Volumes

Traffic volume forecasts were developed from the base year volumes, background growth rate and site specific generators. See Figures 4-2 & 4-3 for forecasted traffic volumes. The period between 1980 and 1992 was a time of aggressive development in the Route 1 corridor. In the 1980's numerous developers acquired large tracts of land, applied for and received approvals and started developing their land in a phased scenario. The office projects listed below had been partially developed and have additional phases with preliminary approvals.

- Carnegie Developments
- Nassau Park
- Squibb
- University Square

- Princeton Forrestal Developments

It is anticipated that these developers will continue to build as quickly as they can find new occupants, resulting in traffic volume growth that directly impacts the Route 1 corridor. Over the next 20 to 30 years many of the developments will be completed and fully occupied. However, similar new developments are not likely to follow because there are few remaining large parcels of land that can support office parks of this magnitude. Therefore, as the existing development projects are completed the corridor will approach build-out, and the rate of employment growth will diminish. In other words, as these developments and the surrounding communities approach build-out, traffic volume growth will moderate.

4.1.e Route 92 Adjustments

Proposed Route 92 is an east-west highway which would provide direct access between the New Jersey Turnpike Interchange 8A and U.S. Route 1. In development of the traffic forecasts, Route 92 was assumed to end at its intersection with U.S. Route 1 in South Brunswick Township, north of College Road. The traffic in the Penns Neck area would be affected by this new route and volume adjustments were made.

Route 92 was included in the traffic model associated with the Route 571 Needs Assessment, prepared by NJDOT. A comparison of Build and No-Build volumes revealed that impacts to traffic volumes in the study area are minor. Route 1 peak hour demand volumes were adjusted +/- 200 to account for the effects of Route 92.

4.1.f Capacity Restraints

Much of the anticipated traffic volume growth results from trips between work and home. This growth will have significant impacts on morning and afternoon peak hour volumes. The volume forecasts were examined with respect to the No-Build, and restrained volumes were developed for the AM and PM peak hours. The link capacity of roadways, ramps and the capacity of signalized intersections were evaluated to determine capacity restraints. While many locations within the study area were examined, the peak hour volume is controlled by just a few key restraint points. Table 4-1 depicts the capacity restraints applied by scenario from the controlling links or intersections in the Penns Neck network. Controlling (intersection) restraints are designated with the name of the corresponding cross street.

TABLE 4-1
ROUTE 1 PENNS NECK CAPACITY RESTRAINTS

	RESTRAINT	

SCENARIO	ROUTE 1		ROUTE 571	
	NB	SB	EB	WB
2002 AM No-Build	Harrison Street	Harrison Street		
2002 PM No-Build	Harrison Street	Harrison Street		
2022 AM No-Build	Harrison Street	Harrison Street		Clarksville Rd
2022 PM No-Build	Harrison Street	Harrison Street	Clarksville Rd	

4.2 DVRPC=s Regional Transportation Model

The regional transportation model includes estimate of demographic and employment data for small areas or zones. This enables the model to assign trip making characteristics associated with households and businesses to the streets and transit facilities serving them. For regional travel, a traffic analysis zone system is employed based on census tracts within the nine-county region making up DVRPC=s regional area. This results in 1,335 traffic zones for the entire DVRPC region, which encompasses 3,833 square miles. The regional model projects traffic volumes to the year 2020.

In development of the model, each roadway has a fixed capacity. The capacity is determined through a series of look-up tables. Once the roadway reaches its capacity, the excess volumes are redistributed over the roadway network. The model goes through 15 iterations to Asmooth out@ the traffic volumes.

The DVRPC regional model includes the Penns Neck Area, however, the model limits only include Mercer County. The Penns Neck Area is therefore on the fringe of the DVRPC regional model. This causes the traffic analysis zones to be larger therefore, diminishing the effectiveness of the model. In addition, the model is Aunfocused@ through the area representing a more regional perception of traffic conditions. Finally, there is a cordon station at the Millstone River which serves as one of the entrance points to the model. At this location, the traffic volumes do not vary with the roadway capacity. This is due to the model having no way of determining alternate routes for traffic because the model limits do not go into Middlesex County.

4.3 Recommendations

As discussed above, although the regional model developed by DVRPC is an excellent tool for estimating traffic growth on a region-wide bases, however is not suitable for such a small traffic corridor as the Penns Neck area. The traffic forecasts developed by NJDOT represent a more accurate gage of expected traffic volumes in the Penns Neck area. On the other hand, the regional model provides a secondary tool in evaluating regional CMS strategies. This is discussed further in Section 6 of this report.

5.0 CAPACITY ANALYSIS

Traffic volumes have been forecast to the Estimated Time of Construction (ETC) which is the year 2002 and for the design year of 2022. The study area roadway network was evaluated to determine No-Build levels of service. The roadways were analyzed with 2002 and 2022 traffic volumes using the methods described in the 1994 Highway Capacity Manual. The computer based Highway Capacity Software, version 2.1 was utilized to perform the capacity/level of service computations. In evaluating CMS strategies, traffic volumes developed for the design year will be utilized. In addition, the evaluation of strategies will be performed assuming No-Build roadway conditions.

5.1 Traffic Analysis

The No-Build year 2002 and 2022 roadway network is different from the existing. For instance, the signalized intersection at Route 1 and Alexander Road has been replaced with a grade separated interchange. These changes are reflected in the 2002 and 2022 no-build traffic volumes. In performing the traffic analysis, the traffic volume forecasts developed for the restrained condition was utilized. Summary of the traffic analysis is shown in the Traffic Analysis Report, Route U.S. 1 - Penns Neck Area (Reference #2).

Route 1

The north-south movement along Route 1 dominates the flow of traffic in the study area. Route 1 volume is controlled by the capacity of the six lane segment north of Harrison Street and south of Plainsboro Road. Intersections of key importance in the No-Build are Route 1/Harrison Street, and Route 1/Washington Road. These intersections serve as primary or secondary restraint points that govern the traffic volumes permitted in the No-Build Network. Under the restraint condition all roadway links operate at a level of service of E or better in the peak hour in 2002 and 2022. However, if the demand volumes are used in the analysis all roadway links will operate at over capacity conditions.

County Route 571

County Route 571 controls the east-west traffic movement in the study area. No-Build traffic volumes on Route 571 are controlled by the capacity of the intersection at Washington Road/Clarksville Road. Traffic peaks westbound in the AM peak hour and eastbound in the PM peak hour, in the years 2002 and 2022. Capacity restraints are applied in the peak direction to the 2022.
In the year 2002, Washington Road will operate at levels of service D or better at the intersections and links. In 2022 the links and intersections degrade to a level of service E.

6.0 CMS ANALYSIS METHODOLOGY

The intent of the CMS analysis is to analyze all reasonable available travel demand reduction and operational management strategies for the corridor. This is accomplished through an analysis (both quantitatively and qualitatively) of existing and projected traffic conditions in the corridor and evaluation of the impacts of various congestion management system strategies. The analysis demonstrates how effective such strategies are in eliminating the need for additional SOV capacity in the corridor. If the analysis demonstrates that additional SOV capacity is warranted, then reasonable strategies to manage the facility effectively (or to facilitate its management in the future) will be incorporated into the proposed facility or recommended for further action.

Preparation of the CMS analysis will be done in accordance with DVRPC requirements. In preparing the CMS study, the following methodology has been utilized in determining a reduction in congestion due to the outlined strategies:

6.1 Project Initiation

A steering committee was formed to coordinate the work performed and to obtain input from other key regional transportation agencies. This committee includes representatives from NJDOT, DVRPC, Mercer and Middlesex Counties, Federal Highway Administration (FHWA), N.J. Transit, Federal Transportation Administration (FTA), West Windsor Planning Board, Princeton Regional Planning Board, Plainsboro Planning Board, Middlesex, Somerset, and Mercer Regional Council, Inc (MSM) and the Greater Mercer TMA. To date, four steering committee meetings have been held.

At the first meeting, the DVRPC presented a screening of improvement strategies, using a systems-wide approach, to identify applicable strategies in the corridor. The committee discussed each strategy and based on local considerations evaluated the study needs. Each strategy was categorized into three designations of study types which include quantitative, qualitative and not applicable to the study area. Table 6-1 shows a list of the 37 strategies provided by DVRPC and the results of the first steering committee meeting relevant to the type of analysis to be performed for each strategy.

TABLE 6-1
CMS STRATEGY IDENTIFICATION

Strategy	Type of Study	Coordinate with Strategy #
Mode Shift		
1. Carpool/Vanpool	Quantitative	2, 9, 11
2. Guaranteed Ride Home	Quantitative	1, 9, 11

3. Paratransit Services	Quantitative	
4. Transit Marketing	Qualitative	
5. Pedestrian Improvements	Qualitative	
6. Bicycle Improvements	Qualitative	19
7. Park and Ride	Qualitative	
PARKING MANAGEMENT		
8. Parking Regulations/Ordinances	Not to be Studied	
9. Preferential HOV Parking	Quantitative	1, 2, 11
TDM		
10. Transportation Management Associations (TMA)	Qualitative	
11. Ride Matching	Quantitative	1, 2, 9
12. Telecommuting	Quantitative	
GROWTH MANAGEMENT		
13. Activity Centers	Qualitative	14
14. Land Use Policies/Regulations	Qualitative	13
ACCESS MANAGEMENT		
15. Median Control	Qualitative	
16. Driveway Controls	Qualitative	
TRANSIT SERVICE/OPERATIONS IMPROVEMENTS		
17. Transit Coordination	Not to be Studied	
18. New Transit Service	Quantitative	
19. Bicycle Improvements at Rail Stations	Qualitative	6
20. Transit Enhancement/Expansion	Qualitative	

TABLE 6-1
CMS STRATEGY IDENTIFICATION

Strategy	Type of Study	Coordinate with Strategy #
TRAFFIC OPERATION IMPROVEMENTS		
21. Intersection & Roadway Widening	Quantitative	22
22. Channelization	Quantitative	21
23. Traffic Surveillance and Control System	Quantitative	
24. Ramp Metering	Not to be Studied	
25. Computerized Signal System	Quantitative	27
26. Elimination of Bottlenecks	Not to be Studied	
27. Coordinate & Upgrade Traffic Signals	Quantitative	25
28. One-way Streets	Not to be Studied	

INCIDENT MANAGEMENT		
29. Incident Detection/Verification	Qualitative	30, 31
30. Emergency Response Time Improvements	Qualitative	29, 31
31. Alternative Routing Techniques	Qualitative	29, 30
32. Construction Management	Qualitative	
ALTERNATIVE WORK HOURS		
33. Staggered Work Hours/Flexible Work Schedules	Quantitative	34
34. Compressed Work Weeks	Quantitative	33
TRANSIT CAPITAL IMPROVEMENTS		
35. Expand Parking at Rail Stations	Not to be Studied	
INTELLIGENT TRANSPORTATION SYSTEMS		
36. Traveler Information Services	Not to be Studied	
GENERAL PURPOSE LANES		
37. SOV Roadway Widening	Quantitative	

As the CMS process evolved, the grouping of the strategies was modified to help better evaluate the potential benefits of such strategies. Upon further examination of the 29 remaining strategies to be evaluated, it was concluded that these strategies could be organized into 8 groups. These eight groups include a car/vanpool program, pedestrian/bicycle facilities, transit improvements, physical improvements, traffic signal improvements, advanced traffic control, travel behavior modifications and growth and development modifications. From these 8 groupings three distinct categories of strategies can be formed. These categories are Mode Shift, Traffic Improvements and Travel Demand Reduction. Figure 6-1 illustrates the strategy groupings and their relationship to the grouping in a flow chart format. In addition, Figure 6-2 exhibits the relationships between the strategy groupings and the different agencies facilitating the CMS process.

6.2 Evaluation Methodology

The DVRPC region consists of a total 72 planning districts. These districts are used as the basic analysis zones in the regional model. The Penns Neck traffic impact corridor is only included within one of these districts (#57) as shown in Figure 6-3. County districts are then broken down into traffic analysis zones to replicate the study area. See Figure 6-4. For the purposes of this study, district 57 has remained intact and is not separated into smaller traffic analysis zones. This was done to take into account the full effects of the project area. Figure 6-5 shows the roadway network within the analysis zones. This will provide the best representation of the project area including Route 1, Washington Avenue and the proposed improvement.

Quantitative Analysis

With the strategies identified and categorized into the level of analysis to be performed, the methodology to evaluate each strategy was developed. The first type of analysis to be performed will be a quantitative study. This type of analysis will use specific data and documented means such as the Regional Transportation Model developed by DVRPC and computer programs to analyze each strategy or a group of strategies by one or a combination of the following means:

1. To evaluate the strategies, one tool which has been utilized is the Travel Demand Management (TDM) Evaluation Model developed by the COMSIS corporation. The model was developed in the late 1980's drawing upon nationwide research in TDM. A version of this model was sponsored by FHWA in 1993 which was available to the public to help States and Metropolitan Planning Organizations (MPO's) evaluate transportation strategies with respect to estimates in a reduction of vehicle trips and Vehicle Miles Traveled (VMT).

   The TDM model was developed to address employer-based strategies such as transit, carpool/vanpool, and alternative work schedules including flexible and staggered work hours, compressed work weeks and telecommuting. Additionally, the model will evaluate area wide applied strategies such as regulatory requirements, transit service improvements, and High Occupancy Vehicle (HOV) priority lanes.
   Model input consists of trip tables for home-based person trips, home-based vehicle trips and home-based transit trips provided by DVRPC's TRANPLAN trip tables. The model uses a series of computer spreadsheets where information on the type and scope of strategy, level of program (voluntary/mandatory) and type and size of employer. All assumptions to be used in this development will be consistent with those employed in DVRPC's requirements. Output of the model consists of both tabular and graphical reports which characterize the effectiveness of a strategy or group of strategies. It does this through such measures as modal split, vehicles occupancy, VMT and number of person trips and vehicle trips. Due to the location of the project area and the fact that the DVRPC regional

transportation model is unfocused through the project area, this analysis was used as a secondary tool.

2. Congestion Mitigation/Air Quality (CMAQ) Program is an analysis tool used by the Pennsylvania Department of Transportation (PennDOT) to estimate travel and transportation system impacts. In discussions with DVRPC, it was recommended that as many strategies or groups of strategies be evaluated using this methodology. This was done to provide an alternative analysis to the TDM evaluation model which bases the estimated benefits in travel reduction through use of the DVRPC regional transportation model. As previously discussed, DVRPC=s regional model has limitations regarding the location of this project. The CMAQ program calculates the change in vehicle trips and VMT by estimating conditions prior to the implementation of a strategy or group of strategies.

3. Conventional traffic engineering analyses, such as capacity and level of service analyses using the principals outlined in the 1994 Highway Capacity Manual. Tools to be utilized will include the Highway Capacity Software (HCS94), Passer II or Transyt-7F.

It is anticipated that strategies analyzed in this fashion may only result in small reduction in congestion that may be too fine to measure using available techniques. Therefore, as discussed above, the Committee has determined those strategies may be grouped and evaluated collectively.

In looking at certain strategies, DVRPC requested that Route 1 also be considered in the analysis. The CMS analysis has focused on the project area but the regional strategies such as a Car/Vanpooling Program or Park and Ride lots will consider effects to Route 1. This analysis will depict the overall effectiveness of CMS strategies with regard to the reduction of traffic on Route 1 such that capacity along Washington Road may improve, specifically at the intersection of Washington Road and Route 1.

Qualitative Analysis

The Second type of analysis to be performed will be that of a qualitative analysis. This type of analysis will rely on existing studies that have been performed in the project corridor and are approved by the applicable jurisdiction and national or regional statistics which have been published by industry accepted agencies such as ITE, AASHTO and FHWA.

6.3 Public Involvement

To further tailor a CMS program to the project area, a public meeting was held on November 5, 1997 in West Windsor Township. The purpose of this meeting was to introduce the project to the public and present the preliminary results of the strategy evaluation. Approximately 100 people attended the meeting. A formal presentation was given, followed by a question and answer period. In general, residents are in agreement that congestion is severe and an improvement in the roadway network is needed. DVRPC

distributed a survey requesting public opinion regarding preferences among the CMS strategies discussed previously. See the Appendix for a copy of the survey. Results of the survey have been tabulated by DVRPC and categorized into 5 groups from very high support to not supported. These results are shown in Figure 6-6 and graphically in Figure 6-7.

The survey also sought additional comments regarding the CMS study or other aspects of the project. Most of the comment at the public meeting focused around the following items:

- Pedestrians and Bicycles
- Regional Traffic Issues
- Local traffic Issues
- Truck Traffic
- Better Utilization of the Dinky Right-of-Way
- CMS Study too Narrowly Focused
- Depressing Route 1 at Washington Road

At the third Steering Committee meeting, the committee reviewed each of these concerns and developed an action item as part of the CMS process commitments. This will be discussed as part of the CMS commitment presented in Section 8 of this report.

7.0 CMS STRATEGY ANALYSIS

As presented earlier in this report, traffic volumes during the peak periods and throughout the average day are projected to exceed capacity. Local traffic activity will continue to compete with regionally oriented through traffic of Route 1. These conditions will adversely impact operations resulting in congestion and delays.

To determine the most appropriate improvement measure, a CMS analysis was conducted. The intent of the CMS analysis is to evaluate all reasonable available travel demand reduction and operational management strategies for the corridor. This is accomplished through an analysis (both quantitatively and qualitatively) of projected traffic conditions in the corridor and evaluation of the impacts of various congestion management system strategies. The analysis demonstrates how effective such strategies are in eliminating the need for additional Single Occupancy Vehicle (SOV) capacity in the corridor. If the analysis demonstrates that additional SOV capacity is warranted, then reasonable strategies to manage the facility effectively (or to facilitate its management in the future) will be incorporated into the proposed facility or recommended for further action. The following sections describe the analysis of those strategies studied for the Penns Neck Area.

As previously discussed, the Route 571 improvements triggers the need for the CMS. However in performing the CMS study, strategies are to be evaluated on an area wide bases. The analysis is to be conducted relative to where congestion is most prevalent. Therefore, although the proposed project has triggered the CMS, the study has not been confined to Route 571.

7.1 Mode Shift

Increases in capacity and reductions in congestion can be achieved by reducing vehicular travel. Work-based travel is the most consistent daily trip type and has the greatest potential for reductions. Providing a shift in the mode of travel is one of the more effective ways to realize such reductions. Discussed below are the analysis of strategies aimed at determining whether such measures will provide the needed reduction in vehicle trips.

Carpool/Vanpool

Increasing ridesharing is difficult. People want the flexibility to leave home and work when they wish to, and have a vehicle available for running errands and in case of emergencies. Other factors that discourage ridesharing include child care needs, free parking at work sites and the low cost of driving. However, for many, ridesharing can be a way to save commuting costs.

Carpooling and Vanpooling is primarily attractive to long distance commuters and are easier to form at

locations with large employers. Average trip lengths for the Route 1 corridor are approximately 15 miles making this strategy well suited for the corridor. Within the Route 1 corridor, approximately 12% of work trips are through the use of carpools. To increase this share, employers can promote ridesharing by designating an individual to coordinate the program, provide subsidies and/or provide information and ridematching capabilities. In modeling this strategy, it has been analyzed as a group with other strategies. These strategies include **Guaranteed Ride Home**, **Preferential HOV Parking** and **Ride Matching** services to increase the attractiveness of ridesharing to the motorist and its trip reduction potential.

In performing the analysis for this group, certain key assumptions had to be made. These assumptions relate to the employment make-up of the area and the level of participation the program can achieve. It is assumed that this type of program is most effective at large employment sites of 500 or more workers. Nationwide, approximately 25% of employment situations meet this criteria. This percentage was used in the analysis performed for this project. The level of participation assumed in the analysis was that of a low and medium effort. Additional assumptions are shown on the analysis work sheets shown in the Appendix.

Results of the analysis showed a potential range of reduction in work trips of 1.7% to 3.7%. This percentage equates to the elimination of 321 to 704 vehicle trips during both the AM and PM peak hours. This reduction in vehicle trips was then reviewed with respect to the effects to the specific roadways. As previously discussed, this strategy is a regional strategy which will have its primary benefits to the Route 1 corridor. To apply the reduction of vehicle trips to the specific roadway corridors, the traffic volumes of each was reviewed. The share of Route 1 traffic to Washington Road traffic is approximately 85% and 15% respectively. Using these percentage splits, the number of eliminated trip on the specific roadway could then be calculated. As a check to the determination of the eliminated trips with the implementation of a car/vanpool program, the Strategy Evaluation Handbook (Reference #10) developed by NJDOT was checked for input. As outlined in this document, the upper limit for vanpooling in reducing vehicle trips is 2.2 percent of all trips. This percentage may be slightly higher where more large employers are located. This reduction percentage is within the range found in the analysis for the Penns Neck area.

In order to facilitate the car/vanpool program, the use of a **Transportation Management Association (TMA)** was investigated. TMA=s were created to promote partnerships between government and businesses to solve transportation problems. By supporting the TMA=s, employers can receive assistance in the task of influencing and alerting employees= of the commuting options. The Greater Mercer and Keep Middlesex Moving are TMA=s which have presently established such programs in Mercer and Middlesex Counties. However, for the purposes of this report in establishing the effects of a TMA=s on congestion, no separate reduction in vehicle trips was considered. Generally TMA=s are supportive of other CMS strategies. Support of the local TMA=s is critical to the success of any program if further implementation of a car/vanpool program is to continue. This will ensure that the benefits estimated for the specific strategies be realized.

Park-and-Ride Lots are areas where individuals park their cars or are dropped off to use an adjacent transit line or carpools. The existence of such facilities enables commuters to share a portion of their work trip with others traveling by auto, paratransit or public transportation. Park-and-ride lots that are secure and free of charge increase the convenience of those who choose to carpool, vanpool or take transit.

In performing the analysis for this strategy, the Princeton Area Transportation Study (Reference #8) was utilized in determining possible lot location and size. Based on an analysis of employee residence locations, a screening was conducted by location, access and market potential. Potential sites determined were:

- I-95 Corridor (Scotch Road Interchange area)
- US 130/I-295 (Rising Sun Road area)
- US 1 North Corridor (Adams Lane area and/or Johnson & Johnson/Squib area)

Lot sizes for each of the above locations were estimated to be 100 spaces each and assumed to be 100% full for the purposes of the analysis. Additionally, to obtain the maximum benefit of each lot it was assumed each lot would be serviced by transit to increase the attractiveness of lot usage.

To estimate the effectiveness of the Park-and-Ride Lots in reducing congestion in the project area, the CMAQ program was utilized. The results of the CMAQ analysis were applied such that the reduction in vehicle trips created from the three lots above would be only applied to Route 1. The results of the analysis showed a reduction of less than 1% in work trips along Route 1. The total number of trips eliminated is approximately 70 vehicles in both the AM and PM peak hour.

Pedestrian and Bicycle Improvements

Pedestrian facilities such as sidewalks, pedestrian overpasses and walkways are typical pedestrian

facilities. One important role for pedestrian facilities is to provide connectivity to transit services. Pedestrian amenities for the project area are mostly limited to sidewalks that are required for subdivision approval and are not part of a rational, comprehensive system designed to link different land uses and provide alternatives to driving.

According to the 1990 Nationwide Personal Transportation Study, the length of a walking trip for different purposes ranges from 0.4 to 1.0 mile. Typically, through the Route 1 corridor trips are made over long distances. Pedestrian alternatives in the corridor would not address regional travel (through trips) and truck-based goods movements. However, with the proximity of the Princeton Junction Train Station and the Dinky Rail Line, some benefit may be realized along Washington Road. To achieve such benefits, special consideration should be given to providing pedestrian facilities to connect the community destinations, transit facilities and make recreational facilities accessible and convenient.

Bicycle facilities may be utilized as a primary mode directly connecting origins and destinations, as a feeder providing a connection to transit modes or for circulation at activity centers. In evaluating this strategy, **Bicycle Improvements at Rail Stations** was included in the analysis. A key factor in deciding whether to use bicycles is the trip distance. According to the 1990 Nationwide Personal Transportation Study, the length of a bicycle trip for work trips is 2.1 miles. As far as an alternative to regional traffic, bicycle improvements would not be appropriate. However, similar to the discussion for pedestrian facilities the proximity of the Princeton Junction Train Station and the Dinky Rail Line some benefit may be realized along Washington Road. To achieve such benefits, special consideration should be given to providing bicycle facilities to connect the community destinations, transit facilities and make recreational facilities accessible and convenient. Bicycle storage facilities should be provided at the destinations.

As an alternative to help meet the capacity needs for the Penns Neck area, pedestrian and bicycle facilities would not be appropriate. However, comment from the public meeting showed strong support for such facilities. Implementation of such features would not so much relieve congestion through the project area but would improve the quality of life. The analysis performed in the study has focused on trip reduction with respect to work trips. However, the majority of uses of such facilities would be recreational.

Presently, NJDOT is conducting a pedestrian/bicycle mobility study which includes the Penns Neck area. It is recommended that findings from this study be further advanced to examine a series of rational alternatives to provide improved pedestrian and bicycle access between Princeton and Penns Neck. Local representatives should be brought into the process in order to help flush-out the most viable alternatives. For instance, representatives of Princeton recommended that there may be an opportunity to provide a pedestrian/bicycle link along the Dinky railroad corridor.

Transit Improvements

Transit service has been one of the strategies considered in an effort to improve travel conditions, reduce congestion and meet the need for future traffic growth in the project area. Through the project area, as documented in Section 2 of this report, existing transit services are extensive in the project area and include both bus and rail service. Due to this extensive service, this study will consider any **New Transit Service** to be implemented as an enhancement or expansion of the existing service. Results of the analysis have been considered under the strategy Transit Enhancement/Expansion for reducing congestion and vehicle trips. Several transit options have been investigated and a discussion of the applicability to the study area is discussed below.

Transit Coordination involves cooperation in the delivery of transit services so as to enhance services and make them more attractive to transit riders. In evaluating this strategy, the Steering Committee determined at the first committee meeting that the strategy Transit Enhancement/Expansion is a more appropriate strategy. Any reduction in congestion would therefore be included within that strategy. Transit Coordination will therefore not be analyzed separately.

Transit Enhancement/Expansion involves increasing transit capacity by expanding the number of vehicles operated, constructing new facilities and providing better overall coordination between systems. There are many variations of providing such improvements. For the purposes of this report, each condition was examined individually. This would be an overestimate of possible users in that some enhancements/expansions are drawing from the same pool of potential users. Discussed below are those options which were considered in the evaluation of providing an enhanced or expanded transit service.

- Hamilton Train Station - N.J. Transit is presently constructing a train station along the Northeast Corridor line. The station is located in Hamilton Township in the area of I-295 off Sloan Avenue. Preliminary estimates have been made to assess the impacts construction of this train station will have on the roadway network surrounding the Princeton Junction train station. N.J. Transit estimates that the Hamilton Train Station will attract approximately 980 riders per morning peak period. This translates into approximately 800 parking spaces that are expected to be freed up.

- Interim stop along the Dinky Railroad (Faculty Road) - As part of the CMS analysis process, the steering committee determined that an additional stop along the Dinky rail line was worthy of consideration. The initial reasons for consideration were to provide additional parking for permit holders to free up spaces for daily travelers at the Princeton station and to serve developments in the stations vicinity with the rail. As documented in the Princeton Area Transportation Study (Reference #8), a 50 space parking lot was proposed. It was estimated that with the addition of this

interim Dinky station during the peak hour a reduction of 14 trips would be realized.

New Jersey Transit has reviewed this proposed station and has made the following observations:

The 2.7 mile Princeton Branch is a single track line served by one train. With this constraint the peak period schedule has been defined to meet as many Princeton Junction arrivals and departures as possible, with preference for peak direction trips. Currently the peak periods feature several stretches of continuous shuttle operations, up to 77 minutes, without a minute of recovery time. A new station would add about 1 to 1.5 minutes per trip, which would result in an added 2 to 3 minutes to each round trip. This would result in less peak service for passengers and as a result fewer Northeast Corridor trains would have connection with shuttle trains to/from Princeton. Such a change would assuredly draw customer Criticism.

By adding a second train to the Princeton Branch current service levels could be maintained, but this would involve a significant investment in rail equipment and infrastructure (a mid-line passing siding), which we have not even begun to define.

- West Trenton Rail Line - At the November 5, 1997 public meeting residents expressed an interest is the effects of the West Trenton rail line may have on the project area if put back into service. As documented in the November 14, 1997 Star Ledger, N.J. Transit has initiated a passenger rail line study to examine the potential of restoring service from West Trenton to Bound Brook.

- Increase Bus Service - In examining the effects of increased bus service the Princeton Area Transportation Study (Reference #8) was utilized. Four potential bus routes were considered for implementation and include:

    - A - Princeton Borough downtown circulation and feeder to the Dinky station
    - B - Hightstown to Princeton Junction feeder
    - C - North Brunswick to Jersey Avenue station feeder
    - D - Hamilton to Route 1 corridor

Figure 7-1 depicts the bus routes for services A & B. Bus service under Route C serviced North Brunswick and New Brunswick Townships and was considered too far north of the project area to effect travel patterns along Washington Road. Service D would provide transfer opportunities from N.J. Transit=s Mercer County routes. The route would serve Route 1 and West Windsor Township and either feed the Dinky or Princeton Junction train station. Such a service could possibly service the new Hamilton rail station and the Quakerbridge Mall.

In analyzing the effects of such bus service, potential benefits to the project area could only be realized from services B & D. Ridership estimates for these two routes during the AM peak period (6:30 - 8:30 am) were projected to be 245 persons for service B and 134 persons for service D.

Paratransit Services cover a wide variety of transit services, usually in smaller vehicles, often without fixed routes or schedules, and for a variety of special purposes. These services can act as feeders to long-haul bus and rail for pick-up of reverse commuters. Paratransit vehicles can also be used to bring commuters to mid-day activities such as restaurants and shopping. Such a service is important to encourage ridesharing and traditional use of transit.

Currently, there are paratransit services being operated in the area. New Jersey Transit is operating a pilot project called Wheels, which is a flexible fixed route van service. Service is provided from Lawrence and West Windsor Townships to the Princeton Junction Train Station, Carnegie Center, and Nassau Park during morning and evening peak hours. Similarly in New Brunswick, service is provided which picks-up passengers at the train station during the morning peak and provides service to area businesses north of New Brunswick. The reverse service is provided in the evening peak. This is a reservation based service and reservations must be made the day before.
The Greater Mercer TMA also administers the Train Link Shuttle. This is a shuttle system providing service from the Princeton Junction Train Station to businesses along Scudders Mill Road and College Road East. In addition, a host of shuttles are operated by local businesses and town centers providing service to the Princeton Junction Train Station.

In addition to the expansion of these services, providing a ADial-a-Commute@ type of service to the residential areas (Princeton Landing and Canal Point) was investigated. This type of program would provide direct service to residents who may not have any other option but car to get to the train station or bus stop. This type of program is effective where development area are of a campus type style generating densities too low to support traditional mass transit.

In performing the analysis for expected ridership of such services, the Princeton Area Transportation Study (Reference # 8) was utilized. Increasing existing services, which primarily addresses a reverse commute, showed and increase of 83 users. This result would primarily affect congestion on Route 1. The second type of service which is geared towards the residential communities in providing service to Princeton Junction Train Station for commuters bound for New York City and Philadelphia would result in an estimated increase of 94 riders. This increase in ridership would provide relief to congestion along the local roadway network.

Efforts to publicize the existence of transit of various special programs can be viewed as part of a **Transit Marketing** strategy. As outlined in the Strategy Evaluation Handbook (Reference #10), a 0.5

percent increase in transit usage is estimated as the result of a Atypical@ package of marketing and information actions. This translates to a less than 0.1% reduction in work trips.

7.2 Traffic Improvements

The capacity of a traffic facility is the measure of its ability to accommodate a stream of moving vehicles. It is a rate instead of a quantity. All flow rates can be effected by a number of factors including the roadway, vehicle performance characteristics, operational controls, and environmental elements. The following discussion considers ways to increase the flow rate without increasing capacity. With the implementation of this type of improvement, it should be noted that vehicle trips are not reduced, however, delay may be reduced and levels of service improved.

Physical Improvements

One of the first physical improvements that was investigated was **Intersection and Roadway Widening**. This is a strategy to widen existing lanes, to provide shoulders where there are no shoulders and/or widen existing shoulders to increase the traffic flow rate. According to the survey distributed to the public at the November 5, 1997 meeting, this strategy was not supported by local residents. Similarly, **Channelization** was also investigated to separate conflicting traffic movements thereby reducing the delay. To do this would require intersection widening along Route 571. At the public meeting this strategy was the least supported strategy. In addition, widening of intersections along Route 571 may diminish the character of downtown Millstone. As part of the traffic analysis performed for the Penns Neck project, roadway improvement projects were considered in the development of traffic volumes and future operational conditions. Results from this analysis showed poor levels of service and excessive delay.

A cause of congestion on roadways with uncontrolled access is vehicles turning across the centerline to and from adjacent land uses. Controlling access is an operational improvement strategy that has the potential to increase mobility and reduce congestion. Generally, such control is most effective where significant development has not occurred. Implementation of such a measure can involve concentrating movements generated by several land uses at a single driveway or require that ingress and egress be conducted from an adjacent signalized intersection controlled side street. The result is reduced vehicle friction and better mobility. To reduce congestion the strategy, **Median Control** was investigated. Presently, Route 1 has median control in place. It is a 3 lane arterial with a center median barrier prohibiting crossing of the roadway centerline. Washington Road is a two lane arterial consisting primarily of residential properties to the east and University property to the west. Prohibiting crossing of the roadway centerline along Washington Road is not an appropriate strategy given the local conditions. Given these conditions providing median control through the project area does not appear to be appropriate and would provide minimal reduction in congestion.

Similar to a strategy for median control is **Driveway Controls**. This strategy addresses congestion from vehicles turning from or entering the roadway from adjacent land uses. Presently, along Route 1 driveway controls are in place. Adjacent land uses have common driveways and are often only permitted exiting the facility at a side street where available. As stated above, Washington Road consists primarily of residential properties. Providing driveway control through this area is not an appropriate strategy given the local conditions. Given these conditions providing driveway control through the project area does not appear to be appropriate and would offer only minimal reduction in congestion.

Traffic Signal Improvements

Computerized Signal System and **Coordinate and Upgrade Traffic Signals** are similar and have therefore been reviewed as one strategy. This type of system allows for control of individual and/or groups of traffic signals. NJDOT is presently implementing Traffic Signal Contract #10 which extends from New Brunswick to Trenton. This system will provide a fiber optic interconnection of traffic signals along Route 1 and include updated timing plans, Variable Message Signs, CCTV cameras and a Highway Advisory Radio system. Control of the system will be through a central command center allowing the intersection operations to respond to changing traffic conditions given local conditions.

The ideal saturation flow rate for a signalized intersection is 1900 passenger cars per hour of green time per lane (pcphgpl). Presently, the green time split between Route 1 and Washington Road is about 70/30, respectively. This will reduce the ideal flow rate by 30% on Route 1 and 70% on Washington Road. In addition, if factors for trucks, lost time due to clearance phases and response start up times will further reduce the flow rate. Early studies on implementing such a system have shown an 8-15% reduction in delay. Reduced emissions are also achieved by allowing platoons of vehicles to travel in the traffic stream minimizing disruptions in flow due to a red signal. This allows for a smoother flow of traffic through a designated area.

Construction Management addresses disruption of traffic flow due to maintenance and construction operations that must take place periodically. In addition to a reduction in capacity as a result of a loss of roadway space, additional capacity is lost due to restricted roadway use. Construction management strategies may include such activities as maintaining a given number of lanes, restrict work to off-peak hours or phase work to minimize traffic impacts. This type of coordination is presently employed by the transportation agencies through the project area. In addition, any construction impacts are of a non-recurring type of congestion and does not provide relief to the everyday congestion problems that exist in the Penns Neck area.

Advanced Traffic Control

Congestion on a roadway network can be classified into two types: recurring and nonrecurring. Congestion that occurs at regularly at particular locations during certain times is recurring congestion while congestion caused by random events such as accidents, incidents, and special situations is nonrecurring congestion. Both types of congestion lead to driver frustrations. There is however, a difference. With recurring congestion drivers plan there trips according to the expected congested conditions. With nonrecurring congestion a trip which may normally be satisfactory could be detrimental in terms of delay. A **Traffic Surveillance and Control System** is primarily aimed at addressing traffic operations improvements along a highway, corridor or region. Incorporating communications networks and intelligent transportation systems offer technology based measures to reduce congestion. Many specific systems such as CCTV cameras, Variable Message Signs, and advanced detection systems as discussed above are presently being implemented by NJDOT under TSC #10.

Additionally, by coordinating personnel, equipment (such as closed circuit television cameras) and techniques, the strategy **Incident Detection/Verification** could help to facilitate early detection of incidents and provide a quick response to clear such incidents thereby limiting unnecessary delays. To enhance the effects of this strategy, **Emergency Response Time Improvements** and **Alternative Routing Techniques** were included as support strategies. Typically, such systems are used on limited access roadways to allow for possible diversions. This eliminates the condition where once a motorist has passed a certain portion of the roadway where there are no exits to divert to in order to avoid such delays. Currently, NJDOT is installing TSC#10, which includes the implementation of CCTV cameras, a Highway Advisory Radio System and a Variable Message Sign system along Route 1. This system will be controlled by a central command center and be able to monitor traffic activities throughout the Route 1 corridor to help provide relief from certain types of congestion.

An expansion of the system to include Washington Road was considered infeasible because it is a local roadway consisting mainly of residential properties. Any installation of this type of surveillance system along such a roadway would be excessive. In addition, installation of CCTV cameras along any type of residential area often is often met with opposition due to concerns about privacy. Any further expansion of this type of system would not solve the need in meeting future traffic growth.

7.3 Travel Demand Reduction

Transportation Demand Management is designed to increase the efficiency of moving people by encouraging the use of other modes of transportation. Such programs are effective in developing travel alternatives, providing incentive/disincentives and establishing alternative work arrangements.

Travel Behavior Modifications

Increases in capacity and reductions in congestion can be achieved by reducing vehicle travel. Work-

based travel is the most consistent daily type trip and has the greatest potential for reductions or adjustments. Alternative work hours is an employer based strategy where the employees= schedule is such that the peak times for roadway traffic may be avoided. **Compressed Work Weeks** is one such strategy. Compressed work weeks can be defined as a program where employers offer their employees the option to work either a 9-day/80 hour (9/80) schedule or a 4-day/40 hour (4/40) schedule. For the purposes of this report, a 4/40 schedule was assumed. This type of analysis will provide for a higher reduction in vehicle trips. In performing the analysis, the strategy for **Staggered Work Hours/Flexible Work Schedules** was included as a complementary strategy. To estimate the trip reduction potential of this strategy, assumptions on the level of effort were required. As previously discussed, a low and medium level of effort were considered. The analysis yielded a total reduction of 1% to 1.6% in work trips. This percentage equates to a reduction of 385 to 616 vehicle trips per day. The reduction in vehicle trips would primarily benefit Route 1. It is estimated that the trip reduction potential along Route 1 and Washington Road would be distributed approximately 85% along Route 1 and 15% along Washington Road.

Similarly, **Telecommuting** is a work based employer demand management program designed to reduce the number of work trips and the length of trips for those working at satellite centers. The fax machine, personal computer and modem are making it possible for employees to work at home or at work centers closer to their homes. As communication technologies improve, telecommuting could become a significant factor in reducing demand and congestion.

A recent survey found that six percent of Americans already telecommute. The benefits of telecommuting vary by how it is conducted. The greatest benefits are realized from employees who telecommute from home since they eliminate the work trip entirely. Measures to promote telecommuting include educating employers, establishing work centers and implementing tax incentives for companies with telecommuting programs.

The analysis yielded a total reduction of 0.9% to 1.4% in work trips. This percentage equates to a reduction of 332 to 532 vehicle trips per day. The reduction in vehicle trips would primarily benefit Route 1. It is estimated that the trip reduction potential along Route 1 and Washington Road would be distributed approximately 85% along Route 1 and 15% along Washington Road.

Growth & Development Modifications

The adoption and application of land planning or zoning requirements by local municipalities were also considered. By limiting the development to land use proposals that have low vehicle generation characteristics, or by regulating the density of site development vehicle trips can be reduced. However, this is a strategy that can only be implemented on a local level.

It has been estimated that growth in the project area is to expand significantly over the coming years. Presently, the project area consists of campus type developments. Many land development projects are already approved and committed to making it extremely difficult to realize the effects of implementing growth management policies in the near future. In addition, such a change in zoning would need to be performed on a regional basis to account for through trips. Specific strategies analyzed to achieve a reduction in generated trips is **Activity Centers**. This is designed to encourage more efficient patterns of retail or entertainment development. Development patterns surrounding the study area are well established. Similarly **Land Use Policies/Regulations** is designed to encourage more efficient patterns of residential or commercial development. Any change in zoning would be difficult to establish and but could have an effect on future vehicle trips.

Unless widespread and timely cooperation in the area and surrounding communities can be achieved and maintained, it is unlikely that development regulations will lead to significant reductions in future traffic in the area. Nevertheless, adoption of the principals of a growth management policy would certainly be a beneficial element in a complete package of managing future traffic conditions in the area.

7.4 Eliminated Strategies

As discussed previously, the steering committee reviewed the potential strategies for the Penns Neck area. During the review process, the steering committee found certain strategies were not applicable to the study area. In such cases, the strategy was not considered during the CMS process. Discussed below are those strategies which were eliminated from consideration and the reasoning for such exclusion.

Parking Regulations/Ordinances

Parking management programs, such as cash-out parking, are designed to provide incentive/disincentives that would reduce vehicle demand on the existing transportation system. In general, parking management strategies are most effective when implemented in dense Central Business Districts (CBD) that have limited parking. There are no CBD=s within the study area and parking is available. This type of strategy does not provide relief for through trips which is one of the main concerns through the project area. In discussions with the Steering Committee, it was determined that this strategy would not be included in the analysis.

Ramp Metering

Ramp metering is a flow management technique which, by controlling the rate of vehicles entering the highway, reduces congestion and improves flow on the highway. This involves the placement of a signal on an entrance ramp to stop for a specified amount of time before entering the highway. This eliminates platoons of vehicles attempting to merge into the traffic flow simultaneously. Washington Road and Route 1 are both arterial roadways with unlimited access. A ramp metering type of installation is not

feasible for the project area. The steering committee therefore eliminated this strategy from the analysis process.

Elimination of Bottlenecks

Bottlenecks are areas where lane drops or constricts significantly reduce traffic capacity. Bottlenecks frequently occur at bridge crossings with narrow lanes and at entrance ramps with high traffic volumes. Intersections can also be considered bottlenecks, however, intersection improvements were previously discussed. This strategy was therefore eliminated from consideration by the steering committee.

One-way Streets

One-way streets are usually considered for corridor studies where two parallel streets are used to carry traffic in each direction. Washington Road is an arterial that has no immediate parallel route making one-way streets an unrealistic strategy in reducing congestion. The steering committee therefore eliminated this strategy from analysis.

Expand Parking at Rail Stations

In evaluating this strategy, the committee determined that expanding parking at rail stations within the study area (Princeton and Princeton Junction) may increase trips to the study area. Expanding parking facilities outside the study area, such as at Monmouth Junction train station would not have a significant impact on trips in the Penns Neck area. Additional parking which may be implemented due to the construction of an additional train station such as the Hamilton train station or an interim stop along the Dinky have been included under Transit Enhancement/ Expansion. Therefore this strategy was eliminated from the study.

Traveler Information Services

Incorporating communications networks and intelligent transportation systems offer technology based measures to reduce congestion. Many specific systems such as CCTV cameras, Variable Message Signs, and advanced detection systems have been discussed under separate strategies. This strategy would provide up-to-date or real time information about transit operations or roadway conditions. For this strategy to be effective through the Route 1 corridor, the information would need to be supplied to the user before the trip is to begin. This type of program is relatively new and to a large extent in the demonstration stages. Reliable information on their effectiveness is not yet available. The committee therefore eliminated this strategy from analysis.

Cumulative Effects of Strategies

Each of the strategies was evaluated individually or as a group. The results of this analysis were then combined to evaluate the total cumulative reduction in traffic and are shown in Table 7-1. It should be noted

that this may be an overestimate, in that some of the strategies overlap and may not be additive. Strategies such as Telecommuting and Compressed Work Weeks are competing for the same pool of workers. The table below presents the total reduction in vehicle work trips during the peak hour. The percentages outlined below, although relatively low do represent measurable reduction in vehicle trips.

Table 7-1
Summary of Results

STRATEGY	RANGE OF TRIP REDUCTION
MODE SHIFT	**2.7% to 5.5%**
Car/Vanpool	
Pedestrian/Bicycle Improvements	
Transit Improvements	
TRAFFIC IMPROVEMENTS	**0%**
Physical Improvements	
Traffic Signal	
Advanced Traffic Control	
TRAVEL DEMAND REDUCTION	**1.9% to 3.0%**
Growth & Development Modifications	
Travel Behavior Modifications	
TOTAL CHANGE	**4.6 - 8.5%**

7.5 Conclusion

As can be seen above, implementation of CMS strategies to reduce traffic demand will provide a reduction of 4.6% to a 8.5% reduction in work trips through the study area. Given the traffic demand in the area, congestion management strategies alone will not meet the need in reducing congestion. Figure 7-2 shows the relationship between existing capacity, the reduction in vehicle trips due to implementation of CMS strategies and the unmet traffic demand. It is therefore recommended that the additional SOV capacity

improvement be made to help alleviate congestion. The percentages outlined above, although relatively low do represent measurable reduction in vehicle trips. Implementation of traffic management strategies along with the construction of a Bypass will provide for the tools needed to help relieve congestion through the Penns Neck area.

8.0 RECOMMENDATIONS FOR COMPLEMENTARY STRATEGIES

The alternative analysis conducted for this CMS study assessed a full range of options with the potential to improve mobility through the Penns Neck area. Development of TDM programs encompass a variety of strategies designed to optimize the efficiency of the transportation system and better manage traffic by reducing the number of vehicles using the system or by influencing when travel occurs. The most effective TDM programs are comprised of several complementary and coordinated strategies. Certain strategies were determined to provide a measure of operational, safety, or mobility improvement and enlist public support. However, the level of improvement which could be expected either alone or in combination would not adequately address future year capacity needs through the project area. The Steering Committee therefore determined that a capacity increase was unavoidable.

The construction of a general purpose lane was found to be the most effective method of addressing future travel demands in the study area. The purpose of the proposed construction is to improve traffic flow along Route 1 through the elimination of the traffic signals and the Penns Neck Circle, while still maintaining an east-west connection between west Windsor and Princeton. During the process of this determination, it was found that other strategies proved to be appropriate for the corridor. These strategies will play a role in managing the area=s travel demand and trip activity. Thus, if such strategies are implemented along with the project construction, the potential to increase the service life of the facility, provide a means of managing future travel demand and providing a better quality of life through the project area can be realized.

As discussed in the previous sections of this report, several strategies were found to have varying measures of benefit to the area. However, some strategies such as increased bus service and an interim stop along the Dinky, were judged by the Steering Committee to not have an immediate, sizable or long term benefit associated with this project. While these strategies are not being dismissed as inappropriate strategies for the area, a compelling need has not been defined for further consideration at this time. Other strategies that showed benefit, such as **Computerized Signal Systems** and **Park-n-Rides**, have either been programmed for construction/implementation prior to this study or are considered part of other proposed commitments that are recommended within this section of the report. Therefore, upon the consensus of the Steering Committee, the strategies contained within the following commitments have been recommended as the most favorable actions at this time.

8.1 Complementary Strategies

Commitment #1 - Pedestrian and Bicycle Improvements

The leading concern of area residents is the implementation of pedestrian and bicycle facilities. With the removal of the traffic signals under the project, Route 1 may act as a barrier for pedestrian access

across Route 1. The Steering Committee has agreed that the need for such facilities to provide a connection between Penns Neck and Princeton is essential, as well as, to achieve the goal of improving mobility through the project area. A commitment to incorporating strategies into the facility as currently proposed (scheme D-1.1c) will include the following:

- *Millstone Bypass Sidewalk/Bicycle Mobility* - The proposed project will include facilities for bicycles/pedestrians along the proposed improvement by providing a connection between the two communities. The Steering Committee recommended and NJDOT has committed to providing a 5 foot wide sidewalk for the length of the proposed roadway to be constructed as part of the project construction. It is recommended that the sidewalk begin where a Bypass would connect with Washington Road to the east of Route 1 and continue along the south side of such a Bypass to the proposed traffic signal at the Sarnoff driveway. At the traffic signal, pedestrian actuation will be provided with a crosswalk to the north side of the roadway. The sidewalk will continue west over Route 1 to where the facility connects back to Washington Road. Destination signing will also be included to indicate to users where the sidewalk will provide access to *i.e.* West Windsor and Princeton. See Figure 8-1

  The Steering Committee recommended and NJDOT has committed to providing paved shoulders for bicycle travel for the length of the proposed facility. Special signing and markings will be included as part of this commitment providing clear direction for pedestrian and bicycle usage. In addition, Mercer County has committed to providing regular street sweeping of the shoulders to allow for safe bicycle travel.

- In an effort to increase pedestrian and bicycle safety, treatments will be employed at the intersection of Washington Road and the proposed facility west of Route 1. Just east of this intersection are two large vacant tracks of land, both owned by Princeton University. It is anticipated that this land will be developed by the University. The development of this land will increase pedestrian and bicycle traffic through the intersection necessitating the need for safe access to the future development.

NJDOT will, as part of the design documents, include provisions for pedestrian/bicycle treatments at this intersection. Such treatments could include painted crosswalks, appropriate warning signs, a flashing beacon system warning approaching motorists of the presents of a pedestrian or bicycle, or other treatments which may be developed as part of the design documents. These treatments would also help to further realize the benefits of the sidewalk along the proposed improvement.

Cost: $285,000
Funding: New Jersey Department of Transportation - Construction Funds
Lead Agency: New Jersey Department of Transportation

- *Route 1 Pedestrian/Bicycle Crossing* - NJDOT is committed to providing a feasibility study to allow pedestrian access across Route 1 relative to the residential neighborhoods. The feasibility study will establish the need for the crossing and determine if such a crossing is supported by area residents. If the feasibility study determines the crossing is warranted, a location for the crossing will be determined. Implementation of the crossing would then occur with the construction of the project. The crossing would be located between the Dinky railroad bridge and Washington Road. A pedestrian/bicycle crossing must be linked to a local network or system of pedestrian/bicycle facilities, requiring at a minimum, connections on both the east and west sides of the crossing. Connection to the east and west of the pedestrian bridge would need to be provided by local jurisdictions. Establishing such connections would be one of the criteria which the crossing will be evaluated on for implementation. Other criteria may include environmental, safety, aesthetics and traffic impacts considerations. These issues would be addressed in the feasibility report. As part of the development of this report NJDOT is committed to working with the County and local municipalities to further define and refine the implementation of this commitment.

  As a precursor to this study, field meetings were held to investigate possible location options. Three options merit further investigation. A description of possible crossing is discussed below. See Figure 8-1 for possible connection to the Route 1 crossings.

  Option 1 - Provide a pedestrian overpass at Washington Road. Connection to this overpass would be along Washington Road. This location does not seem to be well suited for a pedestrian overpass as it may alter the historical character of Penns Neck, and likely not be permitted under current historical regulations. In addition, long approach ramps would be required to accommodate bicycles. An alternate to this option would be to have Washington Road pass over a depressed Route 1. This alternate was not pursued due to the high cost of such a proposal.

Option 2a - Provide a pedestrian overpass at the Mather Avenue cul-de-sac, adjacent to the Dinky Rail Line. Connection to this overpass could be through the local roadway system *i.e*. Washington Road, Wilder Ave, Pierson Ave. The site appeared to be well suited for a bicycle/pedestrian overpass. The Route 1 grade is depressed by approximately 8-10 feet at this location in order to pass under the Dinky Railroad. A new overpass structure would not require long ramps to meet the approach grades. There appeared to be a worn path from the cul-de-sac to the Dinky overpass, indicating that pedestrians are currently using the railroad bridge as a means to cross Route 1. This location is at the edge of the Penns Neck community and may not be ideally situated for all residence.

Option 2b - This crossing would also be at Mather Avenue but would provide connections via the Dinky right of way. Mostly open fields were observed between the Dinky railroad bridge over Route 1 and the Princeton Junction Train Station. However, as the proposed connection to the east gets closer to the Princeton Junction train station, right of way becomes more restrictive due to the residential neighborhood and the crossing of Little Bear Brook. The bridge at Little Bear Brook was not sufficiently wide to accommodate pedestrian/bicycles. An adjacent bridge would be required possibly impacting wetlands.

N.J. Transit is in favor of such local access improvements, however, it must be designed such that it would provide a suitable separation from the railroad track and N.J. must be indemnified from liability related to such a facility.
Option 3 - Provide a crossing at Varsity Avenue. This location would be very similar to the Mather Avenue crossing but may serve the community better do to its proximity to the Penns Neck residents.

Cost: $50,000 Feasibility Study/$600,000 Construction
Funding: New Jersey Department of Transportation - Design/Construction Funds
Lead Agency: New Jersey Department of Transportation

- *Bicycle lockers at Princeton Junction & Dinky train stations* - Both Princeton and Princeton Junction train stations have bicycle locker or racks. There are 60 bicycle lockers at the Princeton Junction Rail Station. These can be rented for only $12.00 a year, however only 40 are presently being used. This marginal participation may be due to the lack of adequate facilities providing access to the train station.

The Steering Committee recommended and NJDOT has committed to increase awareness of this program as part of the project commitments. This could be done with informational signing

instructing users of the process. The Steering Committee also recommended and NJ Transit has committed to revisiting its bike-on- board policy to permit more bicycles on trains and buses. This commitment will be addressed after the project construction is complete.

Cost: $10,000
Funding: New Jersey Department of Transportation
Lead Agency: New Jersey Transit

Commitment #2 - Central Jersey Transportation Forum

A majority of local concerns were related to the regional traffic impacts due to planned roadway improvement projects, area development, and transit improvements. The Steering Committee discussed the concerns of the local residents and agreed that such issues need to be addressed to effectively manage future traffic conditions in the area. However, it was also agreed that this is beyond the scope of this CMS Study. Many studies regarding these issues have been performed over the past several years. The committee felt that these studies should be combined into one document and that this study will be a way to address additional issues.

To do this, a Central Jersey Transportation Forum is included as part of the project commitments. This Forum would address a number of issues facing Central New Jersey. Such as the need for better traffic management, truck traffic, population forecasts, roadway projects such as Route 92 and provide the much needed coordination effort between member agencies. The Forum=s goal will be to develop a transportation action plan and priority of projects for NJDOT and the Counties/Municipalities and to form a mechanism to aid in the decisions made at both the State and Local levels. An outline of the Forum is as follows:

Proposed Study Area

Cranbury, East Windsor, Franklin, Highstown, Lawrence, Montgomery, Plainsboro, Princeton Borough, Princeton Township, South Brunswick, and West Windsor.

Policy Committee

NJDOT, FHWA, FTA, NJ Transit, DVRPC, NJTPA, Middlesex County, Mercer County, Somerset County, Middlesex-Somerset-Mercer Regional Council, Keep Middlesex Moving, Greater Mercer TMA, Office of State Planning and the study area municipalities.

Project Tasks

- Identify land use, transportation and economic issues
- Identify Transportation policies and issues
- Map proposed site plans/subdivisions

- Identify transportation improvements and studies in the area. Obtain periodic status updates
- Review previous transportation studies and models. Determine study elements requiring updating
- Compile a composite traffic map showing AADT=s, historical growth trends, and major areas of traffic flow
- Public involvement program
- Review transit routes and opportunities for transit improvements
- Identify opportunities for Travel Demand Management programs and improve coordination among existing programs
- Evaluate proposals from the previous efforts and input from the policy committee
- Develop a transportation plan and prioritize high priority projects
- Identify additional transportation improvement needs for the area.
- Identify a need for a continued effort and a means to maintain policy committee
- Identify next steps and implementation schedule.

Project Duration
Multi-year

Cost: $350,000
Funding: Public Sector Partnership
Lead Agency: Delaware Valley Regional Planning Commission & North Jersey Transportation Planning Authority

Commitment #3 - Ridesharing Program

Greater Mercer TMA receives funding from NJDOT to provide rideshare matching services to employers within its service area. This includes conducting on site registration and transportation fairs at employment sites, providing an emergency ride home and vanpool subsidy program for new vanpools at member companies. The Steering Committee recommended and NJDOT has committed to continue current levels of funding for TMAs to administer and market these services. This commitment will be part of the 1999 funding program. In addition, the following expansion of the program are part of this commitment.

- Placement of signs along the proposed facility, Routes 571 and Route 33 to promote the toll free rideshare assistance telephone number.

- Provide preferential parking for people who carpool to the Princeton Junction train station. Presently, 92 spaces are dedicated for carpool parking, all of which are being utilized. Commitments could include providing additional preferential parking for carpools at the train station. This commitment should be contingent on the completion of the Hamilton Train station and

an assessment of its impact on the Princeton Junction train station. Completion of this train station may impact current conditions at the Princeton Junction train station which may alter present needs.

- Funding for the TMA to provide rideshare matching services and supply registration forms can be absorbed through the existing TMA/NJDOT grant.

Alternate Work Schedules

The Steering Committee recommended and NJDOT has committed to providing seed money for interested large employers along the study area to develop and implement an alternate work schedule program with their TMA. The Smart Moves Challenge Grant program is a potential funding source for this.

Cost: $150,000
Funding: NJDOT Core Program
Lead Agency: Greater Mercer TMA

Commitment #4 - Transit Service

This commitment is a combination of the NJDOT and NJ Transit core programs with the greater Mercer TMA. Distribution of funding will be determined under final scoping of such programs.

Transit Marketing

- NJ Transit recently approved a vanpool subsidy program, which will provide approximately $150.00 per month to qualifying, registered vanpools. The Steering Committee recommended and a commitment has been is be instituted to market this program. TMAs have limited funding for marketing this program through their NJ Transit work programs; however additional funding for advertisements, signs, etc. will be included as a project commitment.

- Greater Mercer TMA is in the process of developing a brochure to make it easier for commuters to take the train at Princeton Junction. The brochure explains ticket purchasing, parking, how to read schedules, bus connections and is intended to address common concerns about using transit. Greater Mercer TMA has limited funding for the design and production of this document through the NJ Transit work program. The Steering Committee recommended and a commitment has been established for additional funding for mass distribution to targeted residential areas near the study area ($10,000-$20,000).

Coordination of Regional Transit Feeder Service

- There are a multitude of shuttles and corporate vans that regularly travel to and from the Princeton Junction Rail Station. As part of this project, a commitment is made to develop a coordinated east-west shuttle system that might connect East Windsor, Princeton Junction Station, Sarnoff Center, Princeton University, Princeton residential areas and CBD, outlying Princeton employment sites (Institute, hospital) and the Dinky. This could be included as part of the Central Jersey Transportation Forum.

Cost: $35,000
Funding: NJDOT/N.J. Transit Core Program
Lead Agency: Greater Mercer TMA

Commitment #5 - Signing Program Coordination

As representatives/residents of Princeton have expressed a concern that drivers may have difficulty knowing which route to take into Princeton, the Steering Committee has recommended and NJDOT has committed to a signing program being performed jointly by NJDOT and the Princetons. The signing program coordination is to determine whether traffic can be more efficiently directed to their destination in Princeton. The program would include identification of major destinations, such as the business district or university facilities, routes and mode options in the Princeton area, evaluation of current usage, and development of strategies to direct drivers to efficiently use Princeton's transportation infrastructure. As part of the development of this program NJDOT is committed to working with the County and local municipalities to further define and refine this commitment. One key element of this program would be to evaluate the opportunities associated with utilizing Faculty Road as a secondary traffic sorting facility.

Cost: $20,000
Funding: NJDOT - Design Funds
Lead Agency: NJDOT/Mercer County/Local Municipalities

Commitment #6 - Traffic Monitoring Program

Members of the steering committee have expressed concern that the construction of the proposed project may unduly strain certain roadways in the project area not originally anticipated. To document the effect of distribution of traffic with the construction of the proposed project, the steering committee has recommended that a traffic monitoring program be instituted as part of the CMS process. NJDOT has committed to working with the County and local municipalities to further define and refine this commitment. The traffic monitoring program will conduct seven day-24 hour traffic counts through the use of Automatic Traffic Recorders (ATR=s) at key locations in the

project area.

Middlesex County has committed to providing the resources to perform the data collection effort, development of the findings report and presentation to local officials. NJDOT will provide resources in support of the data collection and technical input in development of the report of findings. The following roadways have been identified as possible locations for data collection:

- Alexander Road between Canal Road and West Drive
- Alexander Road over the Amtrak railroad tracks
- Harrison Street at Lake Carnegie Bridge
- Washington Road east of Faculty Road
- Route 571 over the Amtrak railroad tracks
- Faculty Road between Alexander Road and Washington Road
- Faculty Road between Harrison Street and Washington Road
- Hartley Avenue north of Harrison Street
- Prospect Avenue between Harrison Street and Washington Road

Counts will be taken prior to construction of the proposed project to establish a base case for traffic volumes. Prior to performing the traffic counts a meeting will be conducted with local officials to establish count procedures, identify count locations and coordinate all counting efforts. Counts will subsequently be taken at 1 year intervals for a period of three years after construction of the proposed project is complete. At the conclusion of each counting period results will be summarized in a report of findings. A meeting will be held with the local officials to present the report and discuss findings.

Cost: $10,000/yr. ($40,000)
Funding: Mercer County/NJDOT
Lead Agency: Mercer County

8.2 Summary

The construction of a general purpose lane, was found to be the most effective method of addressing future travel demands in the study area. During the process of this determination, it was found that other strategies proved to be appropriate for the corridor. Table 8-1 shows a summary of the recommended strategies for implementation as part of the Penns Neck CMS process.

Table 8-1
Summary of Commitments

No	Commitment	Funding Source	Time Frame	Lead Agency	Approx. Cost
1	Pedestrian/Bicycle Improvements				
	-Millstone Sidewalk/Bicycle Mobility	NJDOT Const. Funds	w/Project Construction	NJDOT	$285,000
	-Route 1 ped./bicycle crossing C Feasibility Study	NJDOT Dgn. Funds	w/Project Design	NJDOT	$50,000
	-Route 1 ped./bicycle crossing C Implementation	NJDOT Const. Funds	w/Project Construction	NJDOT	$600,000
	-Bicycle lockers	NJDOT	Post Project Construction	NJ Transit	$10,000
2	Central Jersey Transportation Forum	Public Partnership	Multi-year	DVRPC/ NJTPA	$350,000
3	Ridesharing Program	NJDOT Core Prog.	Multi-year	TMA	$150,000/yr
4	Transit Service	NJDOT/NJ Transit Core Prog.	2yr. Study/ Implement	TMA	$35,000
5	Signing Program Coordination	NJDOT Dgn. Funds	w/Project Design	NJDOT	$20,000
6	Traffic Monitoring Program	Mercer Co./ NJDOT	Multi-year	Mercer Co.	$10,000/yr.
				Total	$1,510,000

9.0 CONCLUSION AND RECOMMENDATIONS

This Penns Neck CMS Study was performed to document current and future conditions through the project area. The existing physical and operating conditions of Washington Road and Route 1 were assessed, future conditions and operational characteristics for the year 2022 were forecasted and analyzed. A full range of traffic management strategies were evaluated to meet the need of the forecasted increase in congestion. The study analyzed such strategies and the impact they would have on congestion. Recommendation were developed to provide support in managing future congestion.

The findings of this study validate the earlier study findings, that a capacity increase is necessary in the Penns Neck area to allow the facility to function more effectively now and in the future. Complementary strategies were investigated and those determined to be feasible and appropriate for the project area are recommended for inclusion under the CMS process. Such strategies will serve to aid in managing the proposed facility. Major conclusions of the analysis are as follows:

9.1 Conclusions

1. Route 571 is an important roadway in the regional transportation network. The corridor is residential and commercial in character and supports trip activity for area residents and businesses.

2. Through the Route 1 corridor approximately 70% of the vehicles have only 1 occupant. Estimates show approximately 12% of commuters are presently in some form of carpool.

3. Route 1 carries substantial traffic volumes. Peak hour operations are characterized by volumes which exceed capacity. The result is poor levels of service, low travel speeds and long delays. Other off peak periods, also encounter congestion and delays.

4. The growth trends are anticipated to result in significant increases in traffic demand over the next 20 years through the project area.

5. Comparison of 1992, 1997 and 2002 traffic volumes validate the traffic forecasts developed as part the traffic studies performed for the project.

6. Physical conditions along Route 1 hamper the roadways ability to function as a regional and local travel facility. Traffic signal along Route 1 operate at oversaturated conditions.

7. The study findings verify conclusions reached in previous studies of the Route 1 Corridor. The congested conditions are projected to continue and that a capacity increase is needed.

9.2 Recommendations

1. A capacity increase is necessary in the Penns Neck area to allow the Route 571 and Route 1 to function more effectively now and in the future.

2. Incorporate findings from the Route 1 Bicycle and Pedestrian Corridor Case study as it relates to the proposed project.

3. Provide 5' concrete sidewalk along the proposed improvement from Washington Road in the vicinity of Princeton Junction train station to Washington road at the D & R Canal.

4. Provide paved shoulders along the proposed roadway for bicycle use.

5. Investigate potential locations for a Route 1 pedestrian crossing. As part of this investigation commitments into providing adjoining access to the facility should be investigated.

6. Initiate a Central Jersey Transportation Study. This study would address a number of issues facing Central New Jersey. Such as the need for better traffic management, truck traffic, and roadway projects such as Route 92. The study will result in a transportation action plan and priority of projects for NJDOT and the Counties/Municipalities to form a mechanism to aid in the decisions made at both the State and Local levels.

7. Continue to provide current levels of funding for local TMA's to administer and market services effecting ridesharing and transit usage.

REFERENCES

1. Frederic R. Harris Inc., *Traffic Analysis Report, Route U.S.1 - Lawrence Area*, June 25, 1993.

2. Frederic R. Harris Inc., *Traffic Analysis Report, Route U.S.1 - Penns Neck Area*, September 20, 1993.

3. Frederic R. Harris Inc., *Traffic Forecast Methodology Report, Lawrence Section and Penns Neck Area*, August 10, 1992.

4. Frederic R. Harris Inc., *Lawrence Section and Penns Neck Area 1992 Volume Adjustment Report*, July 1, 1992.

5. New Jersey Department of Transportation, *Route 571 Transportation Needs Assessment*, December, 1990.

6. Lehr & Associates, Inc. and MSM Regional Council, Inc., *Route 1 Local & Corridor Demand Management Plan*, January 1997.

7. Lehr & Associates, Inc. and MSM Regional Council, Inc., *Traffic Reduction Strategies for the Route 1 Region*, December, 1993.

8. New Jersey Transit Corporation, *Princeton Area Transportation Study*, May 1990.

9. New Jersey Department of Transportation, *Route 1 Corridor Transportation Study Technical Report*, December, 1986.

10. New Jersey Department of Transportation, *Congestion Management System Strategy Evaluation Handbook*, February, 1996.

11. New Jersey Department of Transportation, *Congestion Management and Intermodal Systems Development, Technical Memorandum* No. 13, June 1996.

12. COMSIS, *Implementing Effective Travel Demand Management Measures*, institute of Transportation Engineers, Washington D.C., June 1993.