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NEW JERSEY
DEPARTMENT OF
TRANSPORTATION

BURLINGTON COUNTY CORRIDOR TRANSPORTATION STUDY

April 1984

An Analysis and Recommendation for
Highway and Transit Improvements In The Corridor

Prepared by the
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Table of Contents

V. TRANSIT POTENTIAL OF CORRIDOR

VI. CONCLUSIONS

APPENDICES

BURLINGTON COUNTY CORRIDOR STUDY

CHAPTER I

INTRODUCTION

BACKGROUND

In February, 1969, the Delaware River Port Authority (DRPA) initiated passenger service on the rail rapid transit line between Philadelphia and Lindenwold. Shortly after the inauguration of speedline service local, county and regional officials pressed for extensions of the rapid rail system into other communities. In response to these demands the DRPA commissioned a technical study in 1970 to examine possible extensions to the PATCO system. In 1975, this study recommended that two extensions to the PATCO system be built: Camden to Glassboro and Camden to Mt. Laurel in Burlington County.

These proposed facilities were included on the 1972 NJ Dot Master Plan and were discussed in 1980 as part of the DVRPC Year 2000 transportation planning process. The proposed Burlington County extension was included in the recommended year 2000 plan ;however, a plan to truncate it at Maple Shade was approved by the DVRPC Board. These extensions were also discussed in the 1981 draft NJ Dot Long-Range Transportation Plan.

New Jersey law requires that local governments maintain land use plans that are current and reasonably reflect development prospects. However, only certain land use plans of municipalities within the study corridor assumed development densities and growth patterns which might have supported the need for these proposed PATCO extensions.

By 1981 the construction costs for the extensions had increased beyond the financial resources available to New Jersey DOT and DRPA. The construction of these extensions in the forseeable future is unlikely even if local matching funds were available, since current UMTA policy is to support less costly transportation services unless there is compelling evidence to support rail projects. Further, funding for new starts is severely restricted.

OBJECTIVES

This study of the Burlington County Corridor is intended to identify other means to satisfy the transportation needs of this corridor and investigate the compatibility of existing and proposed growth patterns with transportation facility improvements that can be implemented. It should also identify transportation problems that will be analyzed in detail in future work programs. A parallel study is being conducted for the Gloucester Corridor.

The 3 principal study objectives can be stated as follows:

1 - Assess municipal land use plans and major development proposals for their impacts on the transportation system.

2 - Evaluate various transportation system improvements and consider growth management techniques which can balance growth and transportation system capacity.

3 - Recommend short- and long-range transportation improvements for consideration by local, county and state agencies.

The transportation recommendations of the study are to pertain to both highway and transit facilities. For highways, improvements for specific problem locations are to be identified. For public transportation, an analysis of the transit potential of the corridor is to be performed. This effort will examine various transportation technologies ranging from bus to rail rapid transit and assess which technologies can be supported by the level of development anticipated by the year 2000.

STUDY AREA

The Burlington County Corridor Study Area, shown on Figure 1.1, is located in Southern New Jersey, directly East of Philadelphia. The various activities and work opportunities available in Philadelphia along with the attractiveness of the region has contributed to growth of population and employment in the study area. However, this growth has caused traffic problems on existing roadways, as described later in this report.

Major roadways that pass through the study area include: US 130, a north-south highway on the western end of the corridor passing through the towns of Merchantville, Pennsauken, Palmyra, and Cinnaminson; NJ 73, also a north-south highway on the western end of the corridor, passing through Maple Shade, Morristown, and Palmyra, and serving as a major route between Philadelphia and Burlington County and the Atlantic City Expressway to shore points on the Atlantic Coast; Route I-295, a major commuter route to Philadelphia and points south through the center of the study area. The New Jersey Turnpike, a major route serving Philadelphia, Delaware, South Jersey and the New York area, runs parallel to Route I-295; and Route NJ 38, the Kaighn Highway, traveling east-west from Maple Shade to Mount Holly, through the center of the corridor.

This corridor was defined by including those municipalities through which the proposed high speed line extension would have passed and several others that share some of the same transportation concerns. The 10 municipalities included in the study cover 61.2 square miles with a 1980 population of 133,929 persons living in 46,393 households. The population of the corridor increased by 2,715 persons between 1970 and 1980. This overall increase consisted of a population decrease within 4 municipalities and a population increase in the remaining 6 municipalities.

As shown in Figure 1.2, the average number of employed adults per household (emp/hhd) was 1.34 for the area, with a high of 1.6 in Cinnaminson and a low of 1.1 in Merchantville.

The percent of households with no cars (% 0 car) is not only an indicator of an areas density of lower income families (those who can't afford an automobile), but is also an indicator of an area's dependence on public transit. This is due to the fact that those without a car must seek alternative means of travel. The percentage of households without cars for the corridor was 7% with a high of 18% occurring in Merchantville and a low of 1% in Mt. Laurel.

As shown in Figure 1.3, most of the growth in the number of dwelling units from 1970 to 1980 has occurred in Maple Shade with 37% of the growth, and Mt. Laurel with 29% of the growth. No growth in the number of dwelling units was reported for the period for both Mt. Holly and Merchantville.

Figure 1.4 shows that one-quarter of the dwelling units in the corridor were located in Pennsauken, while only 2% of the dwelling units were located in Hainesport and only 3% in Merchantville.

Figure 1.1 CORRIDOR BOUNDARY

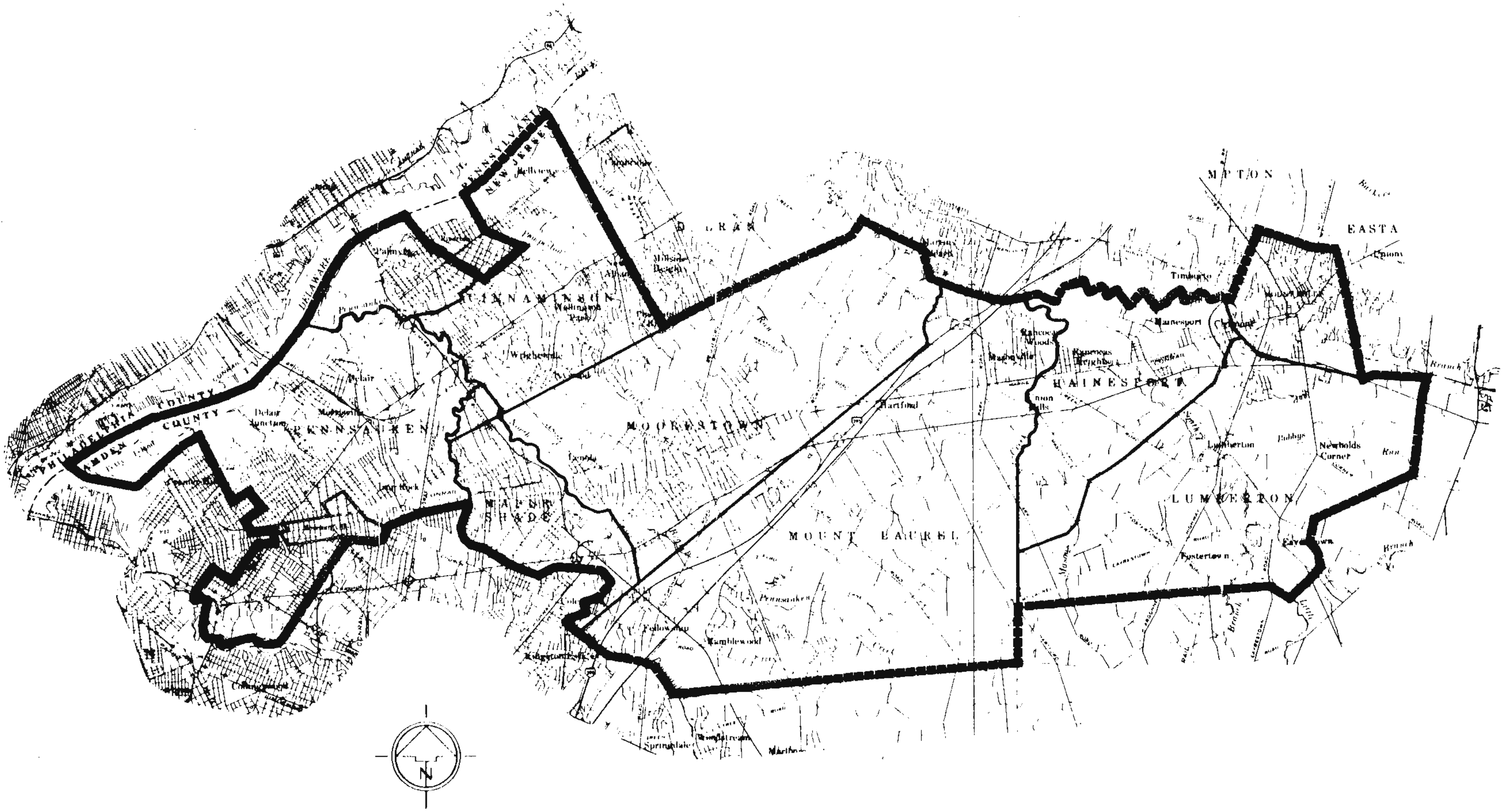


Figure 1.2 CORRIDOR DEMOGRAPHIC DATA

MUNICIPALITY	AREA (SQ. MI.)	--- P O P U L A T I O N --- -1970-	-1980-	% CHG
CINNAMINSON	8.1	16962	16072	-5.2
HAINESPORT	6.9	2990	3236	8.2
LUMBERTON	13.1	3945	5236	32.7
MAPLE SHADE	3.9	16464	20525	24.7
MERCHANTVILLE	.6	4425	3972	-10.2
MOORESTOWN	15.2	15577	15596	0.1
MOUNT HOLLY	2.9	12713	10818	-14.9
MOUNT LAUREL	17.5	11221	17614	57.0
PALMYRA	2.4	6969	7085	1.7
PENNSAUKEN	11.8	36324	33775	-7.0
TOTAL	82.4	131214	133929	2.1

MUNICIPALITY	HOUSE-HOLDS	HHD. SIZE	EMPL'd ADULTS	EMP/ HHD.	0 CAR HHD.	% 0 CAR
CINNAMINSON	4655	3.45	7647	1.64	91	1.95
HAINESPORT	1136	2.85	1507	1.33	16	1.41
LUMBERTON	2015	2.60	2496	1.24	89	4.42
MAPLE SHADE	8521	2.41	10444	1.23	723	8.48
MERCHANTVILLE	1582	2.51	1805	1.14	285	18.02
MOORESTOWN	5289	2.95	6802	1.29	224	4.24
MOUNT HOLLY	3674	2.94	4514	1.23	519	14.13
MOUNT LAUREL	5371	3.28	8220	1.53	52	0.97
PALMYRA	2651	2.67	3469	1.31	212	8.00
PENNSAUKEN	11499	2.94	15231	1.32	1133	9.85
TOTAL	46393	2.89	62135	1.34	3344	7.21

Source: 1970 and 1980 Census of Population

Figure 1.3 DISTRIBUTION OF DWELLING UNIT GROWTH (1970 TO 1980)

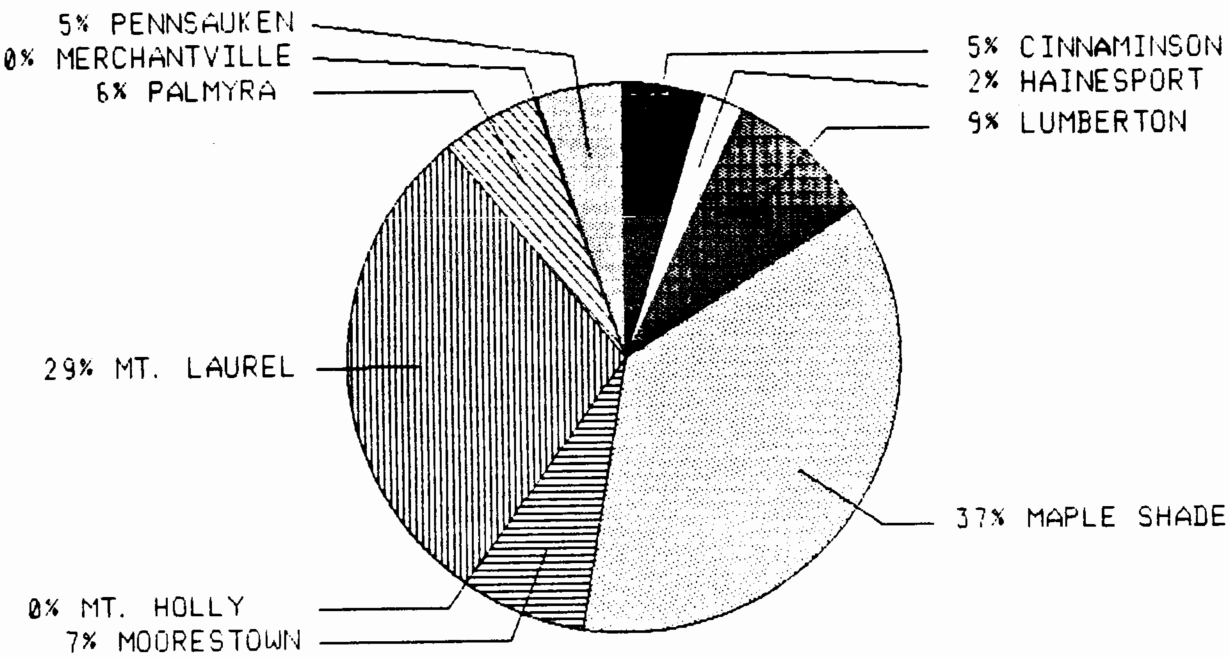
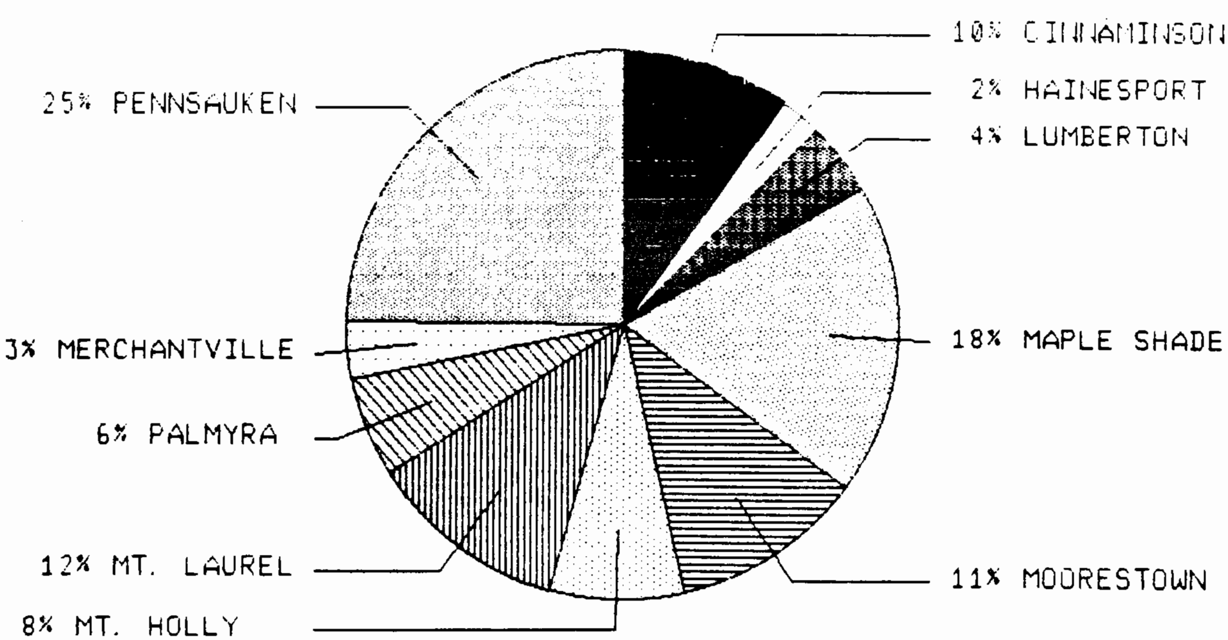


Figure 1.4 DISTRIBUTION OF DWELLING UNITS - 1980 CENSUS



STUDY APPROACH

The approach developed for this study combined information received from local officals, engineers, and planners with traffic simulations of the corridor. The approach was selected to provide a transportation problem assessment that is comprehensive since it considers: technical analysis and political view points, present conditions and anticipated growth, highway problems and transit needs. The problem assessment was then used to recommend transportation improvements and growth management strategies for further study and implementation.

As shown in Figure 1.5, the study approach has 10 steps which are described below. Additional detail is provided in Chapters 2 through 5.

1. Demographic Characteristics - 1980 population, household, car ownership, employment, and other imformation was collected for each census tract in the corridor. It was used to provide a profile of the study area and as direct input to the traffic demand analysis. Demographic forecasts for the year 2000 developed by DVRPC provided a profile of the corridor's future and input to the analysis of future problems.

2. Municipal Master Plans - The plans provide statements of each municipality's anticipated type and distribution of growth. They also contain development goals, forecast assumptions, and rocommended infrastructure improvements. Municipal master plans were used to allocate projected population and employment growth (step 1) to traffic zones. A comparative analysis of municipal master plans was also prepared.

3. Travel Demand Estimates - The demographic data, as described in step 1 and allocated to traffic zones by interpreting the master plans in step 2, was used to estimate current (1980) and future (year 2000) traffic volumes in the area. A computer simulation technique based on assigning a trip table to a network provided estimates of 1980 and 2000 traffic on major highways and streets in the corridor. Comparing these traffic volumes to capacities provided an indication of existing and future traffic problems.

4. Traffic Problems Identified by Local Officials - The Mayor from each municipality provided a list of locations where traffic problems exist. Four types of problems were identified: roadway deficiency, spot congestion safety, & bridge. A map of these "perceived" problems was then prepared.

Figure 1.5 STUDY APPROACH

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 ___________________                       _______________
!                 1 !                     !             4 !
!   Demographic     !                     !   Problems    !
! Characteristics   !                     !  Identified   !
!                   !                     !   By Local    !
 ___________________                      !   Officials   !
          !                               !               !
          !                                _______________
          !                                       !
          !                                       !
          V                                       V
  _____________      _____________      ________________      _____________
 !           2 !    !           3 !    !              6 !    !           5 !
 ! Municipal   !    !   Travel    !    !     System     !    ! Problems    !
 !   Master    !--->!   Demand    !--->! Deficiencies   !<--! Identified  !
 !   Plans     !    ! Estimates   !    !  &  Problem    !    ! By NJ DOT   !
 !             !    !             !    !     Areas      !    !             !
  _____________      _____________     !                !     _____________
                           !            ________________
                           !                   !
                           !                   !
                           V                   V
                 _________________     _________________
                !              10 !   !               7 !
                !    Transit      !   !      Field      !
                ! Sketch Planning !   ! Investigations  !
                !    Analysis     !   !                 !
                 _________________     _________________
                         !                     !
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                         V                     V
                  ______________       _________________
                 !           11 !     !               8 !
                 !   Transit    !     !   Recommended   !
                 !  Potential   !     ! Transportation  !
                 !  Of Corridor !     !     System      !
                 !              !     !  Improvements   !
                  ______________      !                 !
                                       _________________
                                               !
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                                       !         9      !
                                       !    Review Of   !
                                       !     Growth     !
                                       !   Management   !
                                       !   Techniques   !
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5. Traffic Problems by NJ Department of Transportation - NJ DOT planners and engineers are establishing a process to identify and rank transportation problems under New Jersey jurisdiction. Thus far, problems in four of eight categories (area or corridor wide congestion, spot congestion, bridges and safety) have been identified.

6. System Deficiencies and Problem Areas - Results from steps 3,4,& 5, were combined to present a composite picture of existing and future transportation problems. A set of problem areas was defined based on an aggregate of individual problems that are interdependent. These problem areas are within one or more municipalities and may consist of a roadway segment, or a grouping of intersections and their connecting roads.

7. Field Investigations - To collect information on the physical and operational aspects of the transportation system and to determine the cause of the problems, field investigations were conducted by DVRPC staff and a local representative. Field investigation reviews and data analysis resulted in problem statements that are presented as part of Chapter V.

8. Recommended Transportation System Improvements - A set of transportation system recommendations was then prepared to address the problems that were identified during the field investigations. Future growth and local constraints were considered in the development of these recommendations. The proposals include a range of strategies such as: parking restrictions, signal interconnections, road widening, channelization and new construction. For locations with complex problems or those requiring signal optimization, additional study is recommended.

9. Review Of Growth Management Technologies - The proposed transportation recommendations developed in step 8 do not represent a complete response to all existing or future problems that were identified in the corridor. Some problems can not be solved with transportation improvements for reasons which include: environmental constraints, historic preservation concerns, community opposition, and budget limitations. For these transportation problems, growth management techniques are suggested.

10. Transit Sketch Planning Analysis - Using the travel demand estimates of step 3, various types of transit service technologies, ranging from local/express bus to rail rapid transit, were investigated. In this sketch planning effort, several growth scenarios were studied.

11. Transit Potential Of Corridor - The cost-effectiveness of each of the transit alternatives was determined. An assessment of the transit potential of the corridor by the year 2000 was made.

STUDY PARTICIPATION

Two levels for participation (by committees) in the Burlington County Corridor Study were established to insure that the overall effort was coordinated and comprehensive. Since many people would be potentially affected by the study recommendations, it was important that the affected interests be involved from the beginning and participate in various decisions. The two committees described below were established to provide appropriate representation and perspective.

Steering Committee

New Jersey DOT and DVRPC staff members were the principal participants in this group which provided overall study guidance. It met once or twice a month to direct all study tasks and review progress. Technical and strategical issues were addressed by this committee. Among the topics of concern were study objectives, assumptions, methods of analysis, nature and scale of recommendations, activity schedules, and so on.

To increase the effectiveness of this committee, other participants in the study, such as the Delaware River Port Authority or Burlington County were asked to participate at selected meetings to provide advice. This flexible approach of establishing a committee core of sponsor (NJDOT) and worker (DVRPC) with adjunct participation was conducive to covering a wide range of topics without unnecessary involvement.

Advisory Committee

The ultimate purpose of this committee was to participate in the development, and to support and assist in the implementation, of the study recommendations. All participants in the transportation study were members of this advisory committee. It met three times during the study to receive progress reports and provide necessary inputs.

This committee was the principal mechanism to articulate local concerns and issues. As such, the mayors of all affected local municipalities, engineers from the county and citizens from the corridor's communities were invited to participate at meetings. NJ TRANSIT as well as the State's Departments of Environmental Protection and Community Affairs were invited to insure the coordination of state-

CHAPTER II

LAND USE ANALYSIS

The magnitude, distribution and type of growth is a primary determinent of highway and transit needs. While it is true that some of the forces which influence growth potential may be beyond any individual municipality's control, the basic land use decisions regarding development are primarily municipal level decisions.

This chapter will examine the growth plans of municipalities in the Burlington corridor. This land use component of the study will examine how the municipalities within the corridor portray their future growth expectations. It will begin with a brief treatment of municipal planning requirements. The plans resulting from these requirements are then examined individually and collectively. Finally, these documents are converted into analytical materials which will be used for a variety of purposes in the transportation analysis.

MUNICIPAL PLANNING REQUIREMENTS & STATUS

In the recent past, nearly every municipality in the state has developed a municipal plan. These plans vary greatly in complexity, concept, content, currentness, and official status. Municipalities are directed to engage in Master Plan Development through provisions in New Jersey State law.

The New Jersey Municipal Land Use Law (Chapter 291, Laws of New Jersey 1975, approved January 17, 1976) defines the municipal role for planning and regulation of land uses. Its stated purpose is "to encourage municipal action to guide the appropriate use or development of all lands in the state in a manner which will promote the public health, safety, morals, and general welfare."

Article 3 of the New Jersey Land Use law specifies the preparation, contents, and modifications of municipal master plans. "The master plan shall generally comprise a report or statement or land use and development proposals, with maps, diagrams, and text" and includes, where appropriate, the following elements:

1) statement of objectives
2) land use plan
3) housing plan
4) circulation plan
5) utility service plan

6) community facilities plan
7) recreation plan
8) conservation plan
9) energy conservation
10) stormwater management

The land use plan element should consider natural conditions and existing or proposed developments and should specify standards of recommended population density and development intensity.

Re-examination Requirements

Article 11 states that a municipality must re-examine its master plan at least every six years and prepare a report noting changes in assumptions, policies and objectives, changes in land development, the extent to which problems have been solved, and recommendations for the plan or regulations.

More recently the New Jersey Supreme Court re-affirmed its position that municipalities must consider regional as well as local housing needs when fulfilling their constitutional obligation to promote the general welfare. This case is popularly known as Mount Laurel II. At present, it is not known just how this mandate to consider regional welfare will affect municipal growth and land use. The effects could be far-reaching and could result in revisions to the Municipal Land Use Law and to requirements for revision to municipal plans especially in "developing areas."

While this issue could call for plan revisions, it is not likely that any revisions will be undertaken or completed during this year. Therefore, the currently available municipal plans are the basis for this study effort.

Status of Municipal Plans and Re-examinations

Master plans must, by law, be filed with county offices. Both the Burlington and Camden county planning departments have maintained files of available plan documents and re-examination reports. Data in this report was obtained from the municipal plans on file with these county agencies. On occasion, municipalities were contacted to provide additional information and documentation.

Data collection was limited to information items regarding statements of objectives, land use plans, housing plans, and circulation plans. One of these elements usually addressed population and/or employment forecasts which were also collected.

All ten municipalities in the Burlington corridor have prepared master plans. Lumberton and Moorestown have the oldest plans (1967 and 1971 respectively). Moorestown accomplished an update of the land use component in 1976. A summary of the status of all plans is contained in Figure 2.1.

It should be noted that Pennsauken does not have a published plan map. A master copy resides at the municipal office and was reviewed for this report. Palymra Boro's master plan was not available for use in this report. The remainder of this report is based on the nine available master plans.

Five municipalities (Cinnaminson, Moorestown, Mount Laurel, Merchantville and Pennsauken) have updated the land use component of their plans. This is helpful since these municipalities had the older original plan documents in the corridor.

Of the nine municipalities five completed re-examinations in 1982. Lumberton, Merchantville and Pennsauken appear to be overdue for re-examination reports. While Merchantville and Pennsauken have updated their land use components, the master plans have not been fully revised. Lumberton has not developed any new plan elements.

SELECTED MUNICIPAL PLAN DATA ELEMENTS

Data was collected from each municipal plan to provide base line local information for the remainder of the study. Of primary interest are plan development concepts, population and employment forecasts, land use plans, and circulation plans.

Plan Concepts

Municipal plans are frequently based on a conceptual framework. These concepts are usually based on a design pattern reflecting a growth philosophy. While concepts are frequently developed to provide some rationale for future change, they are not always explicitly stated in the plan document.

While it is possible to ascribe a growth concept to most municipal plans, such interpretation may not be accurate and was not undertaken for the purpose of this study.

Only three of the nine municipal plans specify a philosophy for growth. The plans for Hainesport, Lumberton and Moorestown are based on "buildout." Buildout is the achievement of maximum growth consistent with full development at the planned densities.

Some municipalities in the corridor are almost fully developed and their growth concepts are oriented toward preservation of existing neighborhoods. Maple Shade, Merchantville, Palmyra and Pennsauken are fully developed and subject to concepts oriented toward restoration, preservation and revitalization of their community resources. Mount Holly is almost fully developed.

FIGURE 2.1: Status of Municipal Plans and Re-examinations

Municipality	Master Plan Date	Land Use Update	Re-examination
Burlington County			
Cinnaminson Twp.	1983	July 1981	1982
Hainsport Twp.	1978	-	July 1982
Lumberton Twp.	1967	-	-
Maple Shade Twp.	1982	-	-
Moorestown Twp.	1971	1976	Sept. 1982
Mount Holly Twp.	1979	-	July 1982
Mount Laurel Twp.	1979	1982	July 1982
Palmyra Boro	*	*	*
Camden County			
Merchantville Boro	1973	1980	-
Pennsauken Twp.	1971	Dec. 1980	-

*Master plan not available.

Population and Employment Futures

Population and employment projections provide insights into the magnitude of municipal growth. There are several possible ways of determining a likely future: projection, forecast and target. Projection implies the extrapolation of past trends toward a future time horizon. Forecasts are projections of trends tempered with assumptions regarding likely future events such as changing birth rates or survival rates. Targets are more policy-oriented reflecting a desired future rather than a trend based on forecast future.

In actuality, the population and employment numbers expressed in most municipal plans reflect an anticipated or desired future, rather than a systematic evaluation of likely future events. Therefore, they should be interpretted as targets rather than projections or forecasts. However, there is usually no way of determining this in most cases so the term "future" is used in this report.

Municipal plans are most often simple statements of growth. Figure 2.2 indicates that all nine of the municipal plans contain population futures. Seven of the futures have associated target years. Eight contain information indicating the methodology and three of these were derived from other sources.

Employment futures, the expected number of jobs held by workers, are rarely found in municipal plans. Two of the nine municipal plans indicate an expected future employment level. These two municipalities, Hainesport and Mount Laurel, have identified employment futures of 3,912 and 8,000 employees respectively. The lack of employment futures is likely due to the complex nature of business location decisions and the difficulty of determining the employment potential of small municipal jurisdictions.

Population and employment futures are an important tool in the evaluation of transportation networks. The level of future population and employment determines the magnitude of future highway and transit trips. Modeling procedures use these levels to 'load' the current networks and determine how well the existing systems could handle future trip levels. Thus, problem areas can be identified and potential solutions evaluated.

Since the municipal population futures are not always current, lack target years, or use different projection methods, it may be necessary to use other sources to supplement population futures data. Estimates of future employment are non-existent at the municipal level and may need to be created for any further analytical work.

FIGURE 2.2: Municipal Population Projections

Municipality	Population	Target Year	Method/Source
Burlington County			
Cinnaminson Twp.	13,444 (low) 15,000 (high)	2000	Trend
Hainesport Twp.	9,587	-	Buildout
Lumberton Twp.	15,000	2000	Buildout
Maple Shade Twp.	21,300	2000	DVRPC
Moorestown Twp.	28,000	-	Buildout
Mount Holly Twp.	12,713	2000	-
Mount Laurel Twp..	27,600	2000	DVRPC
Palmyra Boro	*	*	*
Camden County			
Merchantville Boro	4,674	2000	Trend Analysis
Pennsauken Boro	38,000	1979	Trend Analysis

*Master plan not available

Land Use Plans

While population and employment futures provide insight into the magnitude of municipal growth, municipal land use (and zoning)plans provide data regarding the desired pattern and type of municipal growth. Plans, by definition, are guides to future growth distribution. Since municipalities play the most direct role in growth decisions, their plans are reasonable sources in formulating assumptions about growth patterns.

It should be noted, however, that these plans do not always provide suitable guidance, especially when they are not properly maintained and updated, or where they may conflict with zoning maps. The latter case is rare since consistency between land use plans and zoning maps is a basic tool for municipal growth management.

Figure 2.3 summarizes the status of land use plans in the corridor. Four of the nine municipal plans contain existing land use maps and five have provided tabular summaries of existing land use. Six of the municipalities have proposed land use plan maps, two of which include tabular summaries. None of these plans indicate a target year for expected completion of any component.

Municipal plans vary considerably in their arrangement of land uses. Little consistency among categories can be identified. Figure 2.4 summarizes the land use categories in each plan as they relate to the five basic plan categories.

The plans for Cinnaminson, Merchantville and Moorestown contain only five plan categories while Mount Laurel is the most complex with fourteen categories. The distribution and detail of plan categories provide some insight into the aspects of land use which are of greatest concern. Most plans provide several categories of residential land use. Commercial and industrial land uses generally receive less detail.

This variety among plan categories poses some problems for preparation of uniform analytical materials to be used in the corridor study. Note that Mount Laurel has nine categories of residential land use, while Moorestown has only two; Mount Laurel has three categories of industrial land use while Merchantville has none; Lumberton has one major and 13 sub-categories of community service use, while Mount Laurel has none.

FIGURE 2.3: Availability of Municipal Land Use Data

Municipality	Existing Land Use Map	Existing Land Use Table	Proposed Land Use Map	Proposed Land Use Table	Horizon Year
Burlington County					
Cinnaminson Twp.	Yes	Yes	Yes	No	No
Hainesport Twp.	No	Yes	No	No	No
Lumberton Twp.	No	Yes	Yes	No	No
Maple Shade Twp.	Yes	Yes	Yes	Yes	No
Moorestown Twp.	No	No	Yes	Yes	NO
Mount Holly Twp.	Yes	No	No	No	No
Mount Laurel Twp.	Yes	Yes	No	No	No
Palmyra Boro	*	*	*	*	*
Camden County					
Merchantville Boro	No	No	Yes	No	No
Pennsauken Twp.	No	No	Yes	No	No

*Master plan not available

FIGURE 2.4: Municipal Plans, Land Use Category Summary

NUMBER OF SUB-CATEGORIES IN MUNICIPAL PLANS

Municipality	Res.	Comm.	Ind.	Rec.	Comm. Serv.	Other
Burlington County						
Cinnaminson Twp.	1	1	1	-	1	Floodplain
Hainesport Twp.	6	2	1	2	4	-
Lumberton Twp.	4	4	2	-	1 (13)	Conserv. 2
Maple Shade Twp.	3	3	1	3	1	-
Moorestown Twp.	2	2	1	0	0	Public Parking
Mount Holly Twp.	3	2	1	1	1	Hist. Dist.
Mount Laurel Twp..	9	3	2	0	0	-
Palmyra Boro	*	*	*	*	*	*
Camden County						
Merchantville Boro	4	1	0	0	0	-
Pennsauken Twp.	**	**	**	**	**	**

*Master Plan not available

**Plan map not available

Circulation Plans

All nine municipalities have circulation plan elements. Six of these refer to the proposed high speed line extension and of those, five indicate that the speed line either will be built (Mount Laurel), or might be built (Maple Shade, Merchantville, Mount Holly and Pennsauken). Moorestown's plan indicates that the extension will not be built. In the plan re-examinations by the municipalities, Moorestown assumed that the speed line extension will not be built and Merchantville and Mount Laurel indicate that the extension might be built. Circulation plans are summarized in Figure 2.5.

Circulation plans, while addressing the speed line in some cases, are oriented toward other kinds of improvements. These range from improvements requiring the construction of major facilities to minor modifications of intersections or parking regulations.

It should be noted that the recommended improvements are contained in plans which are frequently several years old. Therefore, situations exist where some of these improvements have been implemented, and the need for others no longer exists. Some new improvement needs have developed as a result of changing and unforeseen circumstances.

FIGURE 2.5: High Speed Line Consideration In Circulation Plans

Municipality	Circulation Plan Component	Circulation Plan Reference to High Speed Line	Re-examination Reference to High Speed Line
Burlington County			
Cinnaminson Twp.	Yes	no statement	no statement
Hainesport Twp.	Yes	no statement	no statement
Lumberton Twp.	Yes	no statement	-
Maple Shade Twp.	Yes	might be built	no statement
Moorestown Twp.	Yes	won't be built	won't be built
Mount Holly Twp.	Yes	might be built	no statement
Mount Laurel Twp.	Yes	will be built	might be built
Palymra Boro	*	*	*
Camden County			
Merchantville Boro	Yes	might be built	might be built
Pennsauken Twp.	Yes	Might be built	-

*Master plan not available

MASTER PLAN ANALYSIS PROCESS

Diversity in the municipal plans (different plan scales, plan categories, time horizons, population and employment projection methodologies, etc.) necessitate some standardization to facilitate uniform treatment in the transportation analysis.

Preparation of Standarized Municipal Plan Maps

Since municipal plans have not been updated to current land use information, a uniform photo base was created in April 1980 for each of the eleven municipalities from 1 inch = 800 feet aerial photographs. This photo base serves several purposes: it provides a common working scale for all municipalities in the corridor, provides visual evidence of current development as of a common date, and identifies areas in the corridor where new growth could take place.

Following completion of the photo composite, it was necessary to achieve some uniformity among the diverse categorization in the municipal land use plans. This was accomplished by establishing a set of categories that is useful for transportation analysis purposes.Selected were three residential categories (high density, medium density and low density), two commercial categories (major and minor), and one category each for industrial, institutional and open space.

Figure 2.6 shows how the municipal plan categories were collapsed into the standard system. It should be noted that no hard statistical criteria were applied. Rather, general guidelines were established to assist in this process. "High density residential" is defined as any residential category permitting multi-family dwellings. Medium density includes those residential categories with a typical subdivision pattern, and low density contains residential areas with 1-acre lots or larger. Major commercial was limited to large shopping centers, commercial strips, and the larger central business districts of older communities. All other commercial is defined as minor.

After standard categories were determined, a set of overlays was created for each of the municipal photo-composites. These municipal land use plans (or zoning maps) were converted into the standard categories and transferred onto transparent overlays for the municipal photo composites. The result is a set of photo composites and plan overlays that serve several purposes:

* A resource showing current development
* An analytical tool for allocating growth based on municipal plans
* A clearly understandable tool for discussions with participants in the planning process

FIGURE 2.6: Standard Land Use Categories

Jurisdiction	Residential High Density	Residential Medium Density	Residential Low Density	Commercial Major	Commercial Minor	Industrial	Institut.
Burlington County							
Cinnaminson Twp.	R-4	R-2, 2A R-3, R-5	R-1	Highway	Neighbor- hood Comm.	Offices/ Warehouse Mfg. Small Oper.	No new sites Public/ Quasi Public
Hainesport Twp.	Res. High 8 acre	Res. High 4 acre Res. Med. 15,000 sq.ft. Res. Med. 20,000 sq.ft.	Rural-Agr.	Spec. Reg. Comm.	Highway Comm. Comm.		Passive Open Space Park/ Buffers Public/ Quasi Pub. State Park
Lumberton Twp.	Apts.	Res. Med. 7,500 sq. ft.	12,000 sq. ft.		Hgwy. Neighbor- hood Comm.	Lt. Ind. Offices/ Mfg. Gen. Avi- ation	Schools/ Rec. Municipal Bldgs.
Maple Shade Twp.	High (R-2) PUD with Mixed Uses Hgwy. Comm. w/Hi-Rise Apts.	Medium (R-1)	Low Den. (RA)		Gen./Comm. Hgwy.Comm.	Limited Mfg.	
Moorestown Twp.		Res: Short Term Res: Intermed. Term	Rural/Agr.		Gen. Bus./ Res. Ltd. Comm./ Res. Restricted Comm.	Restricted Lt. Ind.	Parks, Playgr. Op. Sp. School Grounds Pub. Prk. Lots Cem.

Figure 2.6 (cont')

Jurisdiction	Residential High Density	Residential Medium Density	Residential Low Density	Commercial Major	Commercial Minor	Industrial	Institut.
Mount Holly Twp.	Res/High 6-12/Acres	Res/Low Res: Plnd. Dev.- 6-7 Acres			Comm. Retail Office & Business	Industrial	
Mount Laurel Twp.	Med.-High PUD Senior Citizen(s)	Low-Med. Medium	Rural Very Low Den. Low Den.		Neighbor-hood/ Comm. Business Major Comm.	Industry Special Industry	Park Schools
Palmyra Boro	*	*	*	*	*	*	*
Camden County							
Merchantville Boro	R-3 R-4/3-story Multi-Fam.	R-2			B-1 Bus. R1:Low Den.& Prof. Office		
Pennsauken Twp.	**	**	**	**	**	**	**

*Master plan not available

**Plan map not available

CHAPTER III

TRANSPORTATION DEFICIENCIES

EXISTING CORRIDOR TRAFFIC

Existing traffic volumes used in this study were obtained from DVRPC's Traffic Count records. These counts were collected by DVPRC staff in conjunction with NJDOT and were supplemented with counts collected by local officials in the corridor. Although some counts were taken for durations as short as one hour, most counts are for 24-hour periods. The counts obtained were then adjusted for the day of the week and time of the year to arrive at the AADT (annual average daily traffic).

Figure 3.1 shows the volumes along major routes that were used for this study. As shown on the map, volumes tend to be highest as you approach the western and central portion of the corridor. For example volumes of 35-70,000 are common along the NJ Turnpike, I-295, NJ 73, and NJ 38. Volumes on roads in the eastern section of the corridor do not exceed 20,000 vehicles per day.

The number of daily vehicle trips which originate in each municipality (MCD) and their destinations is reported in Figure 3.2. These numbers were generated by a computer model from input data that included actual vehicle counts and known factors governing trip destinations. As shown, the number of total daily trips produced by a municipality ranged from 115,800 by Pennsauken Township to a low of 8,100 by Hainesport residents for a corridor total of 402,000 trips per day.

Those municipalities with the highest percentage of trips within their own boundaries, including Lumberton and Mt. Holly, are those which are situated farthest from Philadelphia. Conversely, those with the least percentage of trips within their own area were those in the western end of the corridor, closer to Philadelphia. Also, as would be expected, those municipalities closest to Camden County including Merchantville and Pennsauken are those with the highest percentage of trips into Camden County.

Figure 3.1 CURRENT TRAFFIC VOLUMES
(Thousands of vehicles daily)

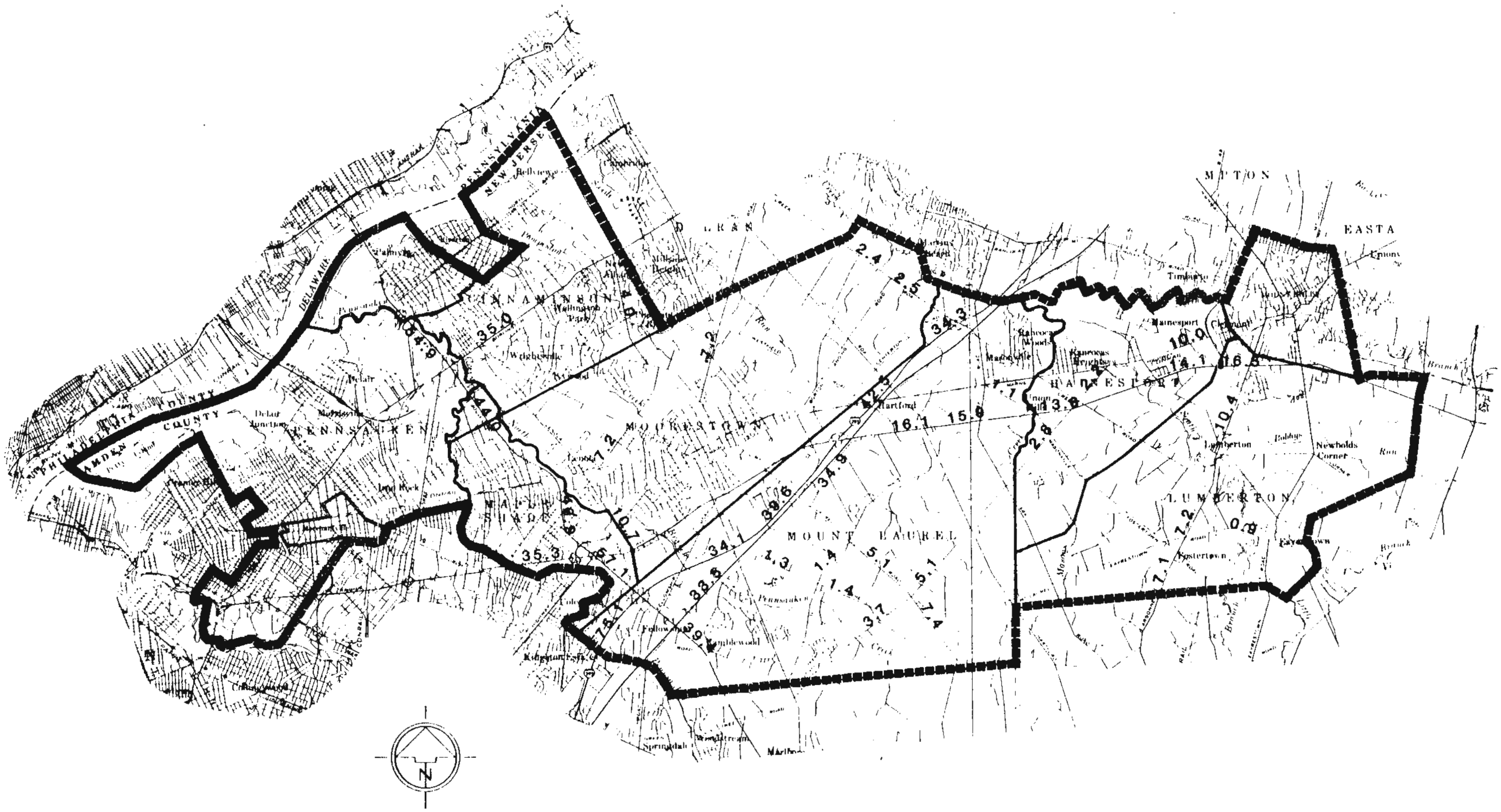


Figure 3.2 DISTRIBUTION OF 1980 TOTAL DAILY VEHICLE TRIPS

MUNICIPALITY OF ORIGIN	TOTAL DAILY TRIPS	AREA OF DESTINATION (PERCENT) WITHIN MCD	OTHER WITHIN CORR	NON-CORR IN COUNTY	NON-CORR CAMDEN COUNTY	OTHER
CINNIMINSON	43700	27	28	21	13	12
HAINESPORT	8100	30	35	21	7	6
LUMBERTON	22200	50	7	21	4	18
MAPLE SHADE	51500	27	31	6	28	8
MOORESTOWN	69100	34	28	13	18	7
MT. HOLLY	30700	42	18	31	3	6
MT. LAUREL	30200	27	32	15	19	8
PALMYRA	19100	19	37	15	13	16
MERCHANTVILLE	11800	7	40	4	40	10
PENNSAUKEN	115800	28	16	5	37	13
TOTAL	402156					

DEFICIENCIES ON STATE ROADS

The New Jersey Department of Transportation is establishing a process to identify, rank, and assess problems on state roads. Problems have been separated into eight categories. A description of the four categories relevent to this study follows:

Category 1, Area or Corridorwide Congestion Problems

There are numerous highways throughout the state that routinely experience traffic congestion over long expanses of road, especially during commuting hours, prompting proposals for roadway widening, bypass routes, etc. This type of problem will often warrant costly improvements, but also provides in many instances considerable opportunity for transportation system management (TSM) remedies.

Category 2, Spot Congestion Problems

Localized traffic bottlenecks are characteristic of spot problems, generally prompting proposals for grade separation of at-grade intersections, upgrading of existing grade separations to increase capacity, intersection approach widenings, etc. Since the problem is localized, the affected area and the repercussions of the improvement options are usually confined.

Category 3, Bridge Problems

In conformance with the federal mandate to use "sufficiency ratings" in the identification and ranking of bridge problems, this category includes all bridge-related problems. The sufficiency rating includes, among others, measures of congestion and safety. Details of the process can be found in "Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges," USDOT/FHWA, January 1979.

Category 4, Safety Related Roadway Problems

This can be either a localized or more pervasive problem, exhibiting any of the following more specific sources of concern: poor drainage, poor traction, deficient or absent shoulders, roadside hazards, sight distance restrictions, poor horizontal or vertical alignment, etc.

DEFICIENCIES IDENTIFIED BY LOCAL OFFICIALS

The DVRPC conducted a survey involving the mayors of the municipalities contained in the corridor study. The purpose of the survey was to identify the current highway deficiencies in the municipalities as perceived by local officials. Figure 3.3 is a sample of the form and directions sent to the mayors.

The list of deficiencies received was then compiled into a preliminary list for the entire corridor. This list and an accompanying map were presented to mayors, traffic control personnel, planners, and engineers that attended the advisory committee meeting in late October. That meeting provided each committee member the opportunity to present his concerns and allow the other members to react.

Figure 3.3 SURVEY LETTER AND QUESTIONNAIRE

This letter was sent to the Corridor Studies Advisory Committee members in Burlington and Gloucester Counties.

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
The Bourse Building, 21 South 5th St. Philadelphia, PA 19106 (215) 592-1800

September 27, 1983

Dear :

As we explained in our June 1983 letter, the Delaware Valley Regional Planning Commission is currently conducting a transportation study on a travel corridor that includes your municipality. As part of the project we are compiling an inventory of problem locations that may need further investigation. Upon completion of the inventory and an analysis of future travel in the corridor, we will fieldview the most important problem locations and outline strategies to meet the identified needs.

To help us compile an initial set of problem locations, please list on the attached form the locations in your municipality with severe traffic problems. If possible, provide your comments on the nature of these problems.

Since we expect to discuss these transportation problems at the second study meeting—to be held later in October—we would like to receive your response before October 10. Please contact me at (215) 592-1800, Ext. 163, if you have any questions concerning this request.

Thanks for your cooperation. We will notify you about the date and location of the next advisory committee meeting. We look forward to seeing you on that date.

Very truly yours,

Rasin K. Mufti, PhD
Manager, Systems Analysis Section

RKM:EP
Enclosure

Please provide the name and phone number of person to contact for additional information about transportation problems:

____
(Name) (Phone #)

LOCATIONS WITH TRANSPORTATION PROBLEMS

	Name of Street or Road	Intersecting Street(s)	Comments
(Example) Location A	Rt. 41	From Rt. 47 (Delsea Dr.) to Rt. 42 (N-S Freeway)	Severe congestion during peak hours, left turn lanes and widening required.
(Example) Location B	Rt. 537 (Monmouth Rd.)	At Rt. 630	Heavy congestion, poor sight distance.
Location 1	______	______	
Location 2	______	______	

SIMULATION OF CURRENT AND FUTURE TRAVEL

The staff of the Delaware Valley Regional Planning Commission developed a focused travel simulation process. This approach, selected to estimate current and future traffic for the Corridor Study, involved the aggregation of the DVRPC highway simulation network and traffic zones in the areas outside of the study area. Additional network and small zones were required in the area of analysis. A focused traffic assignment was then performed.

The process has several characteristics which made it desirable for use in the study:

It provides link volumes for nearly all streets within the detailed study area.

It significantly reduces the computer cost of travel simulation.

It allows the use of the DVRPC regional simulation process, without recalibration.

It increases the accuracy of travel volume estimates within a detailed study area.

Areal System

Travel forecasting models require that the estimates of socio-demographic and employment data be made for small areas or zones. This requirement derives from the need to assign the trip-making associated with households and businesses to the streets and transit facilities serving them. Typically, the average size or grain of the zone system must be about that of the street or transit system being tested. In practice, the highway street system is the denser of the two and controls the zone size.

In the analysis, 599 zones throughout the region were used. These zones tend to be very large in areas far removed from the study area and small in the area of interest where estimated traffic volumes on local streets were required. An additional buffer of relatively small analysis areas surrounds the detailed study area to preserve a smooth traffic assignment on all facilities crossing into the area.

Demographic and Employment Data

The first step in simulating travel demand is the estimation of demographics and employment for each zone in the region. In the process, the following variables were examined:

Population;

Households;

Employed residents;

Households stratified by auto ownership class;

Total Automobiles;

Employment stratified by 12 Standard Industrial Classifications (SIC) groups

The most recent detailed estimates for many of these data were available from the 1980 Census. The information required to supplement the Census data were prepared for the year 1977 by DVRPC staff.

Travel Estimations

The trip generation procedures were developed during earlier studies at DVRPC. Estimates of trip productions by Census tract are established on the basis of trip rates per dwelling unit of a specified type. Trip attractions were estimated for trip rates per employee of a specified industrial class.

Three categories of internal person trips account for the most significant travel modes (auto driver, auto passenger, and transit passenger). Truck trips and taxi trips are estimated separately.

Trip distribution is the process whereby the zonal trip ends that are established in the trip generation analysis are linked together to form origin and destination patterns in trip table format. It is not sufficient to know only how many trips will originate or be destined to a zone on a daily average. It is also necessary to know between which pair of zones these trips will occur. That is the function of the distribution models.

The purpose of the modal split model is to allocate the trips that were previously generated and distributed to either the highway system or the public transit system. The auto occupancy model further subdivides the highway-oriented trips into auto drivers and auto passengers. The auto driver trips were added to the truck and taxi trips in preparation for assignment to the highway network. This model is documented in "The Simulation of 1977 Travel On The Current (1977) Transportation Systems", Delaware Valley Regional Planning Commission, June, 1977.

Highway Network

The preparation of the study simulation network required two steps:

a. Focus the network by reducing detail of the DVRPC regional simulation network outside of the study area.

b. Increase network detail inside of the study area by adding missing streets and intersections.

A computerized procedure was used to aggregate the network outside of the study area. Network detail inside of the study area was increased by examining the regional simulation network and manually adding missing facilities and recoding network approach links for the smaller zone system.

Travel Assignment

The final step in this forecasting process was the assignment of the estimated trips to the highway network so that facility volumes could be obtained. A "stochastic" assignment model, based on many paths from a given origin to a destination, was used.

The trips associated with an interchange were divided among the paths on the basis of the relative travel time for each path. The paths with smaller travel time received proportionately more travel.

Accuracy Examination

The prinicpal output of the travel forecasting process is simulated volumes for the highway facilities. Output of the simulation run on the existing 1980 network (or no-build alternative) was compared with counted volumes collected between 1979 and 1983 to determine the accuracy of these models.

As a principal check of the highway assignment, a series of screenlines were established for a comparison between predicted and counted crossings. These comparisons validated both the estimates of total travel obtained from the trip generation, trip distribution, and modal split/auto occupancy models and the routings predicted by the highway assignment model.

Future Growth and Traffic

After completion of an adequate simulation of current traffic on the existing highway network, a simulation of future growth (traffic) was made using the same focused simulation process. A trip table of growth in trips from 1980 to the year 2000 was established as follows:

> The 1980 trip table and a year 2000 trip table developed during the long-range transportation planning program at DVRPC were aggregated to the minor civil division (MCD) level of detail.
>
> The 1980 trip table was subtracted from the year 2000 trip table to provide an estimate of trip growth by MCD.

The trip table of growth was disaggregated to the smaller zones within each MCD in the study area. This was accomplished considering seven common categories of land use:

High density residential

Medium density residential

Low density residential

Major Commercial

Minor Commercial

Industrial

Institutional and other

For each land use category, trip estimates were made based on rates per acre of available land designated (in the municipal plans) for development. The generated travel associated with the seven categories was summed for each small zone. The resultant totals for each zone were then normalized by factoring to the pre-established MCD total.

The resultant distribution of future travel for the study corridor is directly related to the distribution of dwelling unit growth shown in Figure 3.4. Of the 11,781 dwelling unit increase projected for the corridor by the year 2000, about 29% is forecasted to occur in Mt. Laurel Township, 16% in Morrestown Township and 14% in Maple Shade.

The distribution of the corridor's vehicle trip growth is shown in Figure 3.5. Maple Shade and Mt. Laurel are projected to capture about 43% of the corridor's trip growth. On the other hand, Hainesport, Mt. Holly, and Palmyra are expected to capture the smallest portion of the trip growth (approximately 10% total).

The estimated growth in trips for each municipality is displayed on Figure 3.6. Projected growth tends to be greatest in the southeastern portion of the corridor with an increase of 63 percent in Mt. Laurel and 40 percent in Lumberton. The smallest increases have been estimated for the older urban areas that have already been developed including Pennsauken, Merchantville, and Mt. Holly.

Figure 3.7 displays the distribution of the travel growth from each municipalitiy in the corridor to other locations. Of the nearly 90,000 trips made in the corridor daily, 19,800 originate in Maple Shade and 19,000 originate in Mt. Laurel. For Mt. Laurel, 24% are made to destinations within the MCD and another 31% are destined to other locations in the corridor. For Mt. Laurel, 41% of the trips are intra-municipal trips, and only 23% are to other townships in the corridor.

The projected travel growth (trip table) was added to the 1980 trip table and was assigned to the Year 2000 Transportation Plan Highway network to determine future link volumes on each road in the system. Figure 3.8 provides projected traffic estimates for selected streets in the corridor which were used to identify and assess traffic problems.

Figure 3.4 DISTRIBUTION OF DWELLING UNIT GROWTH (1980 TO 2000)

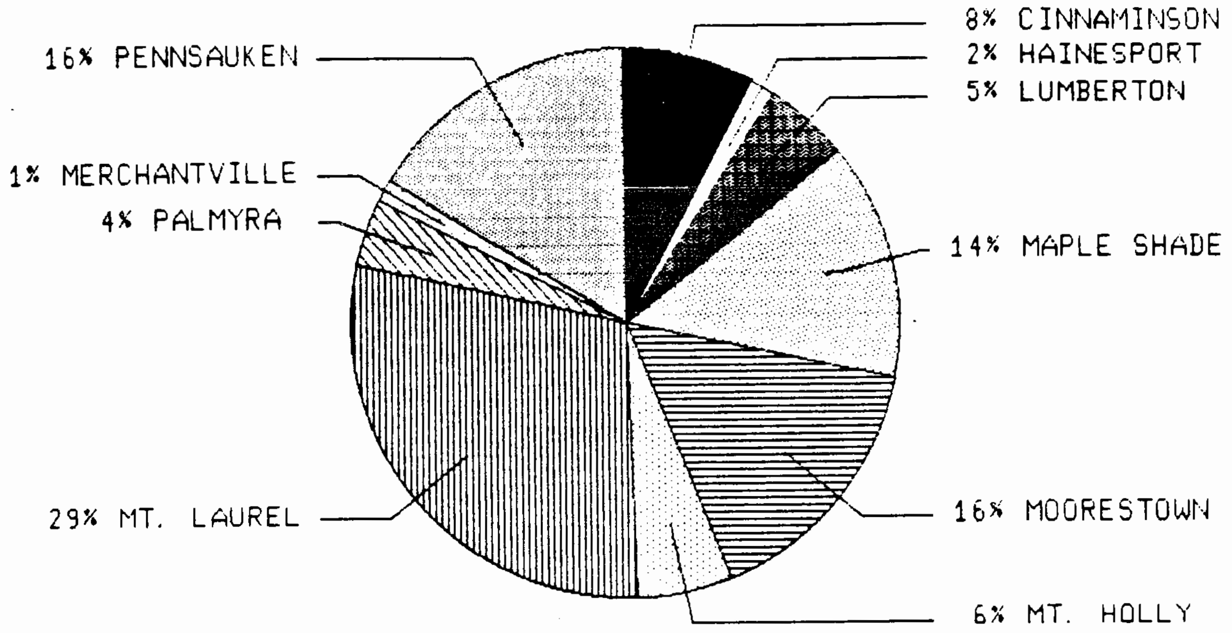


Figure 3.5 DISTRIBUTION OF VEHICLE TRIP GROWTH (1980 TO 2000)

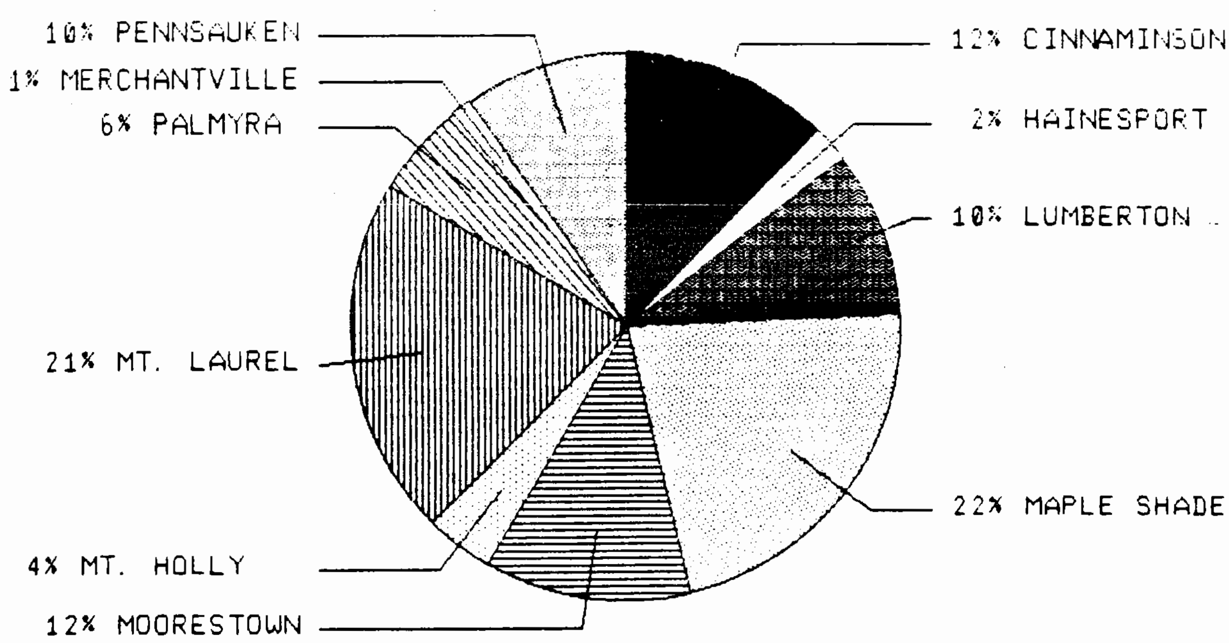


Figure 3.6 TRIP GROWTH BY MUNICIPALITY
(Percent change 1980-2000)

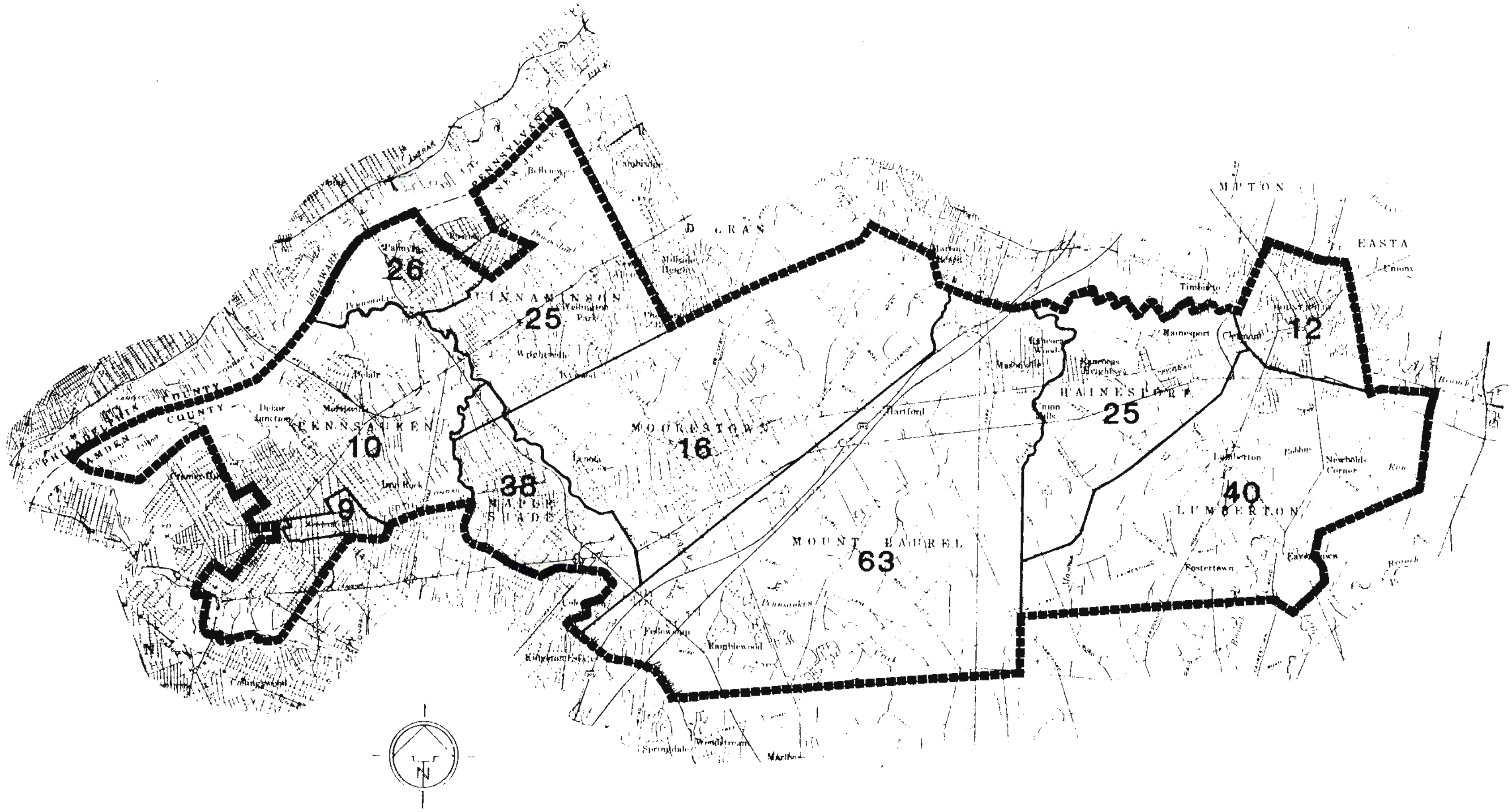
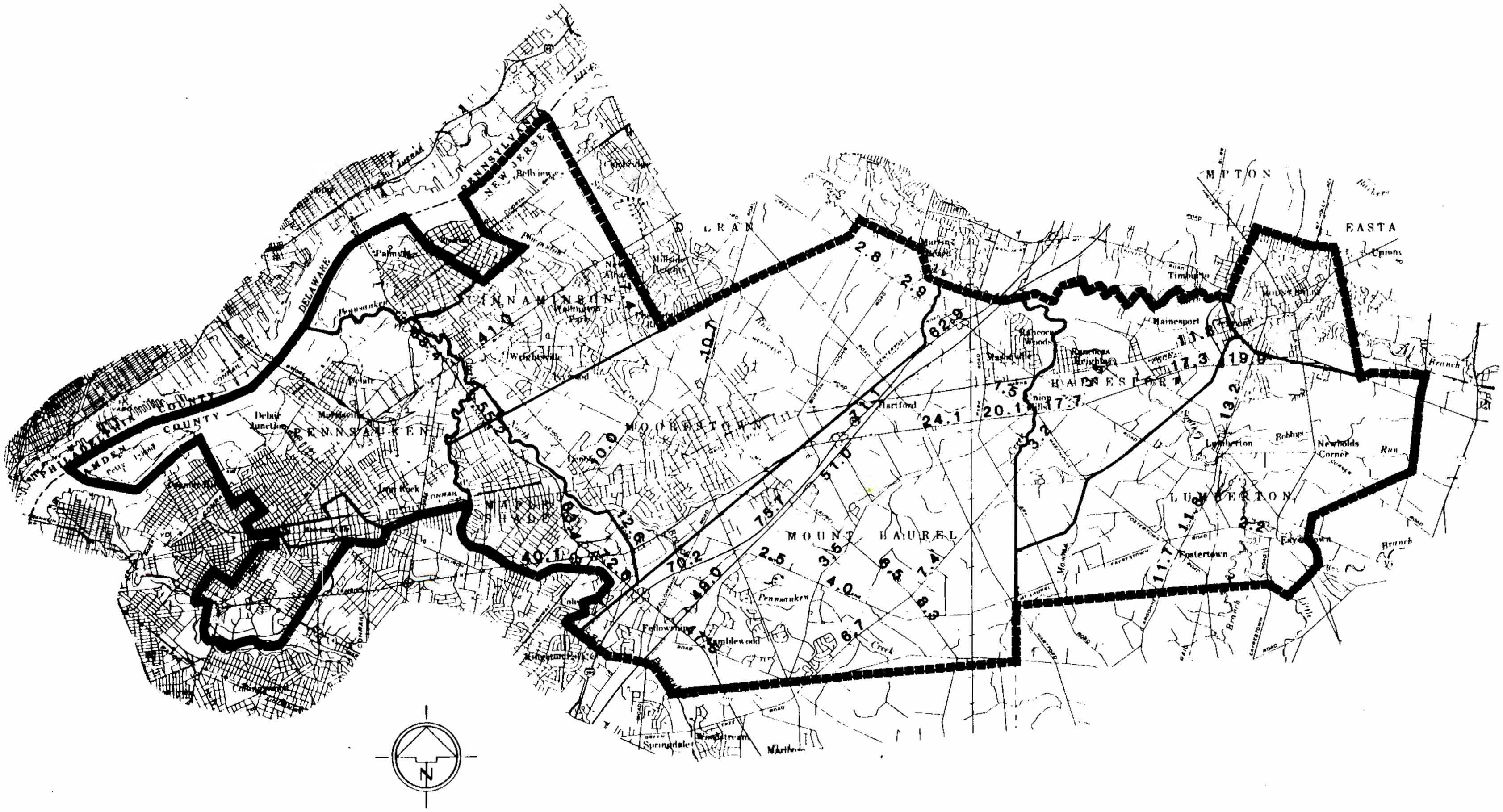


Figure 3.7 VEHICLE TRIP DESTINATIONS (1980 TO 2000) GROWTH

MUNICIPALITY OF ORIGIN	TOTAL DAILY TRIPS	AREA OF DESTINATION (PERCENT)				
		WITHIN MCD	OTHER WITHIN CORR	NON-CORR IN COUNTY	NON-CORR CAMDEN COUNTY	OTHER
CINNIMINSON	11000	25	27	27	8	12
HAINESPORT	2000	31	27	22	7	12
LUMBERTON	8800	58	12	21	4	5
MAPLE SHADE	19800	24	31	8	25	12
MOORESTOWN	10900	17	42	12	18	11
MT. HOLLY	3600	44	11	28	5	12
MT. LAUREL	19000	41	23	12	17	8
PALMYRA	5000	25	31	12	12	20
MERCHANTVILLE	1100	14	35	8	18	26
PENNSAUKEN	8600	19	33	8	21	19
TOTAL	89782					

Figure 3.8 PROJECTED YEAR 2000 TRAFFIC VOLUMES
(Thousands of vehicles daily)



PROBLEM AREA IDENTIFICATION

A set of ten problem areas, each consisting of a major travel route section and/or an inter-connecting set of roadway segments and intersections, were defined from the three sources discussed in chapter I.

- o Deficiencies identified by local representatives
- o Deficiencies identified by N.J. DOT
- o Simulation of current and future travel

These problem areas, as shown on Figure 3.9 provide a framework for the assessment of problems and recommendation of improvements that are discussed in Chapter IV. Recognizing that the perceived and simulated deficiencies discussed earlier were only symptoms of the actual problems within each area, inquiries into the causes of the problems required a more comprehensive approach.

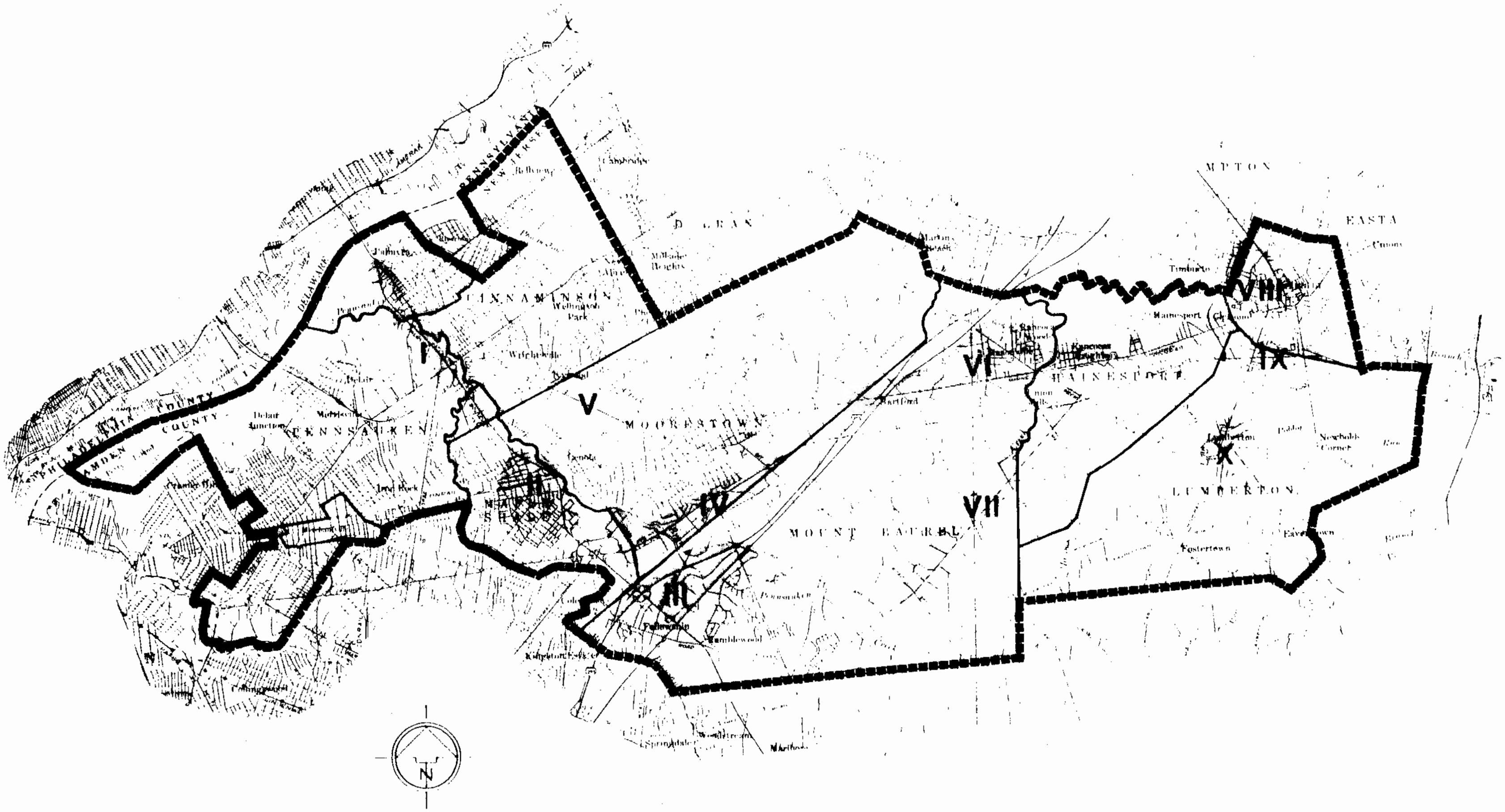
The definition of problem areas is also useful for identifying possible solutions to existing and future traffic problems. The inter-relationship of activities and transportation system within the area necessitated that a full range of options be explored.

Though problem areas (listed below) were developed from various sources and represent a composite view of the needs of the corridor, the process had certain limitations: On the technical side, computer simulation results are a product of assumptions that must be made with limited data and considerable uncertainity about the future. On the non-technical side, the deficiency identifications are a product of the perceptions of those who participated in the corridor study.

Chapter IV provides descriptions, maps, discussions of futrue growth, and recommendations as a starting point for improving transportation service in the corridor. The ten areas, referred to as corridor sub-areas are listed below by name:

I. NJ 73, North of Maple Shade
II. Maple Shade
III. Western Mount Laurel
IV. NJ 38 in Moorestown
V. Northwestern Moorestown Industrial Zone
VI. Marne Highway
VII. Hainesport - Mt. Laurel Road
VIII. Mount Holly
IX. NJ 38, Mt. Holly Bypass to Pine Street
X. Lumberton

Figure 3.9 TRANSPORTATION PROBLEM AREAS



CHAPTER IV

TRANSPORTATION AND GROWTH MANAGEMENT

OVERVIEW

This chapter summarizes the corridor's transportation problems, identifies short and long range highway improvements, and suggests a number of growth management tools. These recommendations are based on an evaluation of traffic demand and the traffic problems identified by local officials and transportation planners. Field investigations together with other studies, planned projects and funding constraints have been considered in these proposals.

Each set of improvements for a problem area is preceded by a description of the area and the deficiencies that have been observed. A schematic of the street system indicating the location of problems cited in the text is provided.

The proposed transportation improvements do not represent a complete response to all problems that exist or will occur in the corridor. Other traffic studies should be integrated into these recommendations. Continuous monitoring of corridor growth and traffic is also encouraged to enhance and modify this set of projects. Evaluation is required to prioritize and estimate costs for the improvements and to stage implementation activities.

As a step toward developing priorities, the transportation improvements have been divided into short- and long-range recommendations. A short range improvement should be completed by the end of 1990. Long range improvements (indicated by an asterisk in the listings) have targets beyond 1990. Planning costs, developed from the field investigations, are provided in Chapter VI. These costs are short-range and long-range totals for each problem area.

For some locations in the corridor, cost-effective transportation improvements can not be recommended. The existence of environmental features, historic districts, residential neighborhoods, and other factors make it difficult to add system capacity to the network of streets and roads. In these areas, general congestion levels may be expected to increase, if special efforts at growth management are not made. Development strategies that reduce the demand for travel and the implementation of transit service improvements may contribute to better performance of the transportation system.

The end of this chapter lists and describes some of the growth management strategies that are available to local and county planners and officials to redirect development. Careful consideration should be given to their application potential including legal implicatons and their consequences on growth before they are selected for use.

Specific growth management recommendations for individual problem areas have not been made in this study since they would require considerable discussion with local officials and detailed analysis of existing community ordinances and regulations. As a starting point, it may be useful to conduct a seminar for interested local officials and planners to introduce them to the growth management techniques and to initiate the discussion of a corridor strategy.

TRANSPORTATION PROBLEM AREA ASSESSMENTS

The assessment of each of the problem areas that were identified in Chapter III is presented on the following pages.

PROBLEM AREA 1: NJ 73 NORTH OF MAPLE SHADE

NJ 73 is a major highway which serves as a connection between South Jersey points and the Tacony-Palmyra Bridge. The bridge links I-95 with Burlington and Camden counties. This problem area includes the length of NJ 73 between High Street in Maple Shade and Souder Street, south of the Tacony-Palmyra Bridge. The primary land uses along the corridor are commercial and business activities, which contribute significantly to traffic volumes. In the vicinity of Palmyra, traffic volumes range from 51,000 to 54,000 vehicles per day. Turning movements between High Street and the Tacony-Palmyra Bridge are controlled by jughandles.

Future Growth and Transportation Issues

Even with the construction of NJ 90 in the area which will add to the system capacity and relieve traffic congestion to the west of its connection with NJ 73 traffic growth along NJ 73 to the east may increase by nearly 20% by the year 2000. This growth will cause a spreading of peak travel periods to partly accommodate demand.

Since this major artery serves many residential communities and employment locations, localized growth management strategies will not be able to alleviate the congestion problem.

Travelling from south to north, some specific problems are noted:

A From High Street to Fork Landing Road

The intersections are well designed. The jughandles appear to accommodate adequately all vechicles.

The roadway between the two intersections has two lanes by direction with a wide shoulder which could be mistaken for an additional travel lane. The median barrier is only about two feet high.

B At Fork Landing Road

North of the signalized intersection at new Fork Landing, northbound traffic on NJ 73 is permitted to turn right onto old Fork Landing, this is an unnecessary and possibly dangerous situation.

C At the Interchange with US 130

The interchange of NJ 73 and U.S. 130 is properly designed; turn lanes are adequate and signing for each direction of U.S. 130 is clear.

The bridge deck across U.S. 130 has been patched often causing a bumpy road surface.

D At Remington Avenue

NJ 73 north of U.S. 130 is three lanes by direction and well marked; a fourth lane serves as a weaving lane from U.S. 130 and as a turning lane for Remington Avenue. It is difficult, however, to identify Remington Avenue because the street sign is missing.

E At Hylton Road

Between Remington Road and Hylton Road, the roadway has two lanes by direction with wide shoulders. The Hylton Road/NJ 73 intersection forms a "T". The eastbound approach of Hylton Road is too narrow for two approach lanes due to a curb which extends out onto the road. Turns on red are permitted on the approach even though there are high traffic volumes and visibility is poor.

F In the vicinity of North Broad Street

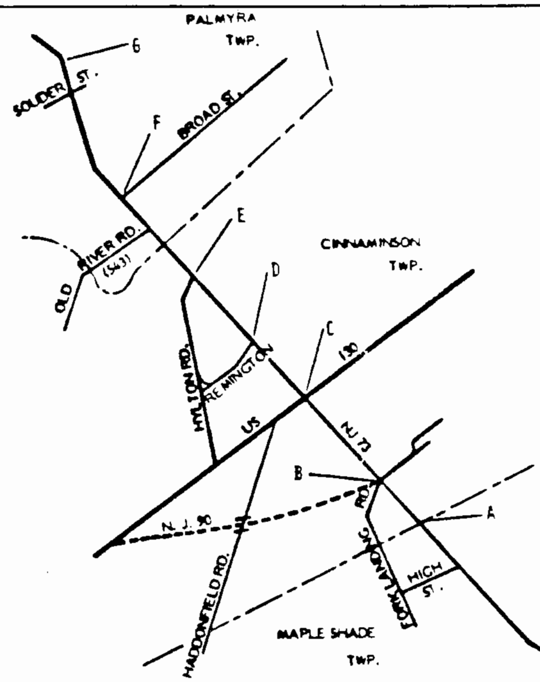
North of Hylton Road, buildings abut the roadway, and there are more driveway cuts. Traffic in Palmyra becomes more congested as the Tacony-Palmyra Bridge is approached. Shoulder widths are not adequate to serve as acceleration or deceleration lanes.

The railroad bridge and the North Broad Street intersection comprise a congested and hazardous area. The roadway narrows approaching the underpass. At night, the bridge abutments are difficult to see because the warning markings have not been maintained. North Broad Street is located directly north of the underpass. Vehicles turning on this street cause northbound NJ 73 traffic to slow, because a deceleration lane does not exist. The westbound North Broad Street approach is misleading, because it is wide with a center line that appears to permit all movements. However, only right turns onto northbound NJ 73 are allowed.

G South of the Toll Plaza

Between North Broad Street and the Toll Plaza, the roadway is three lanes by direction with narrow shoulders. Weaving movements in this section may cause a hazardous situation.

Figure 4.1 NJ 73, NORTH OF MAPLE SHADE



RECOMMENDED IMPROVEMENTS

A Stripe shoulder; erect higher median barrier.

B Erect signing to designate Old Fork Land Road one way westbound and to prohibit turns onto Old Fork Landing Road; replace missing route and stop signs; stripe curb lane to designate shoulder.

*C Replace bridge deck.

D Replace street signs.

E Improve turning radius to create approach lane; erect "no turn on red" signs at eastbound approach

F Paint bridge abutments and roadway markings for improved turn lane; erect signing to prohibit turns onto North Broad Street and to indicate access to Broad Street via Spring Garden Street; acquire right-of-way for additional shoulder.

G Widen northbound NJ 73 to four lanes between the northern-most signalized intersection at the drive-in theater and the toll plaza.

---

* Long-range improvement to be complete after 1990

PROBLEM AREA 2: MAPLE SHADE

Maple Shade Township is a residential community of 3.8 square miles located in the western part of the county. The 1980 population estimated by the Census for the township was 20,431, representing an increase of nearly 4,000 persons or 25% from 1970. NJ 73 is the principal travel route traversing the municipality in north-south direction. Co. 537 (Maple Avenue) provides a connection between Camden County to the west and Moorestown Township to the east. Railroad tracks bisecting Maple Shade (parallel and to the north of Maple Avenue) contribute to the traffic problems that are summarized below.

Future Growth and Transportation Issues

The travel simulation indicates that traffic growth in the problem area will increase by about 35-40% from 1980 to the year 2000. The growth on local streets will be caused by increased population and employment in the township as well as growth from areas to the north, east, and south.

A Intersection of Mill Road and South Fork Landing Road

The intersection, located near an elementary school, has alignment problems and poor sight distance. Both roadways have one lane by direction.

A Jog movement at the intersection is required by vehicles travelling on South Fork Landing Road to and from NJ 38.

A crossing guard helps school children cross the street during three time periods indicating the safety concerns of the community.

B Intersection of NJ 73 and CO. 610

Change of grade near the intersection contributes to a sight distance problem.

Heavy "merge" movement from Fellowship Road onto NJ 73 is especially bad when vehicles on NJ 73 are travelling to NJ 41.

Nearby land uses include an airfield, apartment complex and townhouses (more than 1,000 units).

Roadway surface is good.

C Intersection of CO. 610 and Mill Road

Fellowship Road (CO. 610) is a travel route from NJ 73 into Maple Shade.

Vehicles on Mill Road are delayed when crossing principal traffic flow.

Poor intersection geometrics and nearby parking contribute to problem.

D Intersection of NJ 73 and CO. 537

Entrance and exit from NJ 73 are on opposite sides of a tavern.

Deteriorated pavement and limited informational signing contribute to problems of traffic that has a complex set of destinations.

Sight distance problem exists on entrance to northbound NJ 73 especially in poor weather.

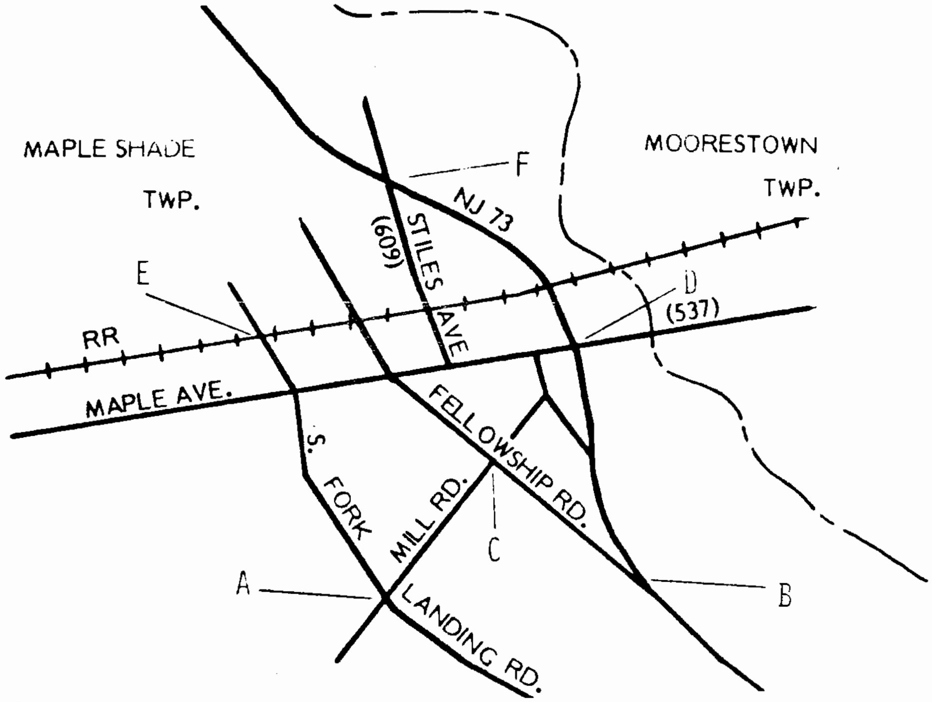
E Railroad Crossing on North Fork Landing Road between Lippencott and Maple

This is one of three railroad crossings in town. Vehicles encounter bumpy surface when crossing trackage for both the mainline and spur.

F Intersection of NJ 73 and CO. 609

Restaurant on NJ 73 has access to the side street (Princeton Avenue). Vehicles on NJ 73 ignore stop line and do not allow traffic into mainstream. The problem is especially aggravated during lunch periods.

Figure 4.2 MAPLE SHADE



RECOMMENDED IMPROVEMENTS

*A Reduce jog of South Fork Landing Road at intersection by acquiring the property on the eastern corner of the intersection and realigning the southeast leg.

B Install traffic signals where Fellowship Road merges with NJ 73 traffic (the signal would not affect northbound NJ 73 traffic); interconnect with the traffic signals at the entrance to Villages of Deerfield.

C Restrict parking in the vicinity of the intersection.

D Install informational signing; reconstruct deteriorated pavement and add medians to separate ramp movements; investigate need for traffic signals.

E Improve roadway surface and railroad tracks.

F Install additional traffic signal faces at Princeton Avenue and NJ 73 North; interconnect with traffic signals at Stiles Avenue.

----

* Long-range improvement to be completed after 1990.

PROBLEM AREA 3: WESTERN MOUNT LAUREL

The area is located on the western side of a township of 22.2 square miles and one of the county's most rapidly growing communities. Population of the municipality increased by more than 6,000 persons (from 1970 to 1980) to a total of 17,562.

NJ 73 in the center of the area serves as a connection between the New Jersey Turnpike in the north with NJ 70 in the south. Land uses along this segment are primarily residential and open space. Many realtor signs suggest that further development is going to take place. Traffic volumes to the north of the interchange range from 55,000 to 57,000 vehicles per day. Traffic volumes along Route 73 in the southern portion of the problem area are nearly 40,000 vehicles per day.

The roadway is two lanes by direction with wide shoulders and a grass median, approximately two lanes wide. On northbound NJ 73, the inadequate shoulder could cause problems especially for traffic accessing the turnpike interchange.

Future Growth and Transportation Issues

Projections for NJ 73 in the area indicate that year 2000 traffic may exceed 70,000 vehicles per day north of the interchange with I-295. Daily traffic in the southern portion are forecasted to approach 50,000 vehicles by that time.

This increase in traffic along NJ 73, combined with the continuing development in the area, may cause growth rates to reach nearly 50% on portions of the street system.

Some traffic problems in the western Mount Laurel area are outlined below.

A Intersection at Church Street and Ramblewood Parkway

Heavy traffic occurs on Church Street, which has two lanes by direction.

Stacking of vehicles occurs on Ramblewood Parkway which has one lane by direction and controlled by a stop sign. The parkway is the main artery through the Ramblewood development.

The WaWa retail store entrance is too narrow for turning movements.

Other commercial development in the area contributes to the problem.

B Intersection of Springdale Road and Church Road

The northbound approach of Springdale Road is narrow with unstable shoulders. There is no direct connection between Springdale Road and Fellowship Road to the north.

C Intersection of NJ 73 and Church Road

This intersection is complex. Church Road west of NJ 73 intersects NJ 73 north of the point where Church Road east of NJ 73 intersects, requiring through-traffic on Church Road to "jog" right and then left across the traffic lanes of NJ 73. Both parts of Church Road meet NJ 73 at an angle of about 30 degrees.

The northern intersection is signalized and includes the intersection of Ramblewood Parkway. The southern intersection is not signalized.

Traffic congestion occurs when eastbound Church Road straights are forced to weave into two left-turn stack lanes on NJ 73. It was observed during midday that this traffic spilled out onto southbound NJ 73 causing significant delay. Westbound straight Church Road traffic was observed to make the "jog" movement with less delay, because the movement is controlled by a traffic signal. This intersection is dangerous, because the weaving movement on NJ 73 is not well protected.

On the northbound NJ 73 approach at Church Road, right turning vehicles are required to make a sharp turn. This maneuver is difficult for trucks and increases traffic delay at the intersection.

D Intersections of Fellowship Road with East Park Drive, West Park Drive, and East Gate Lane

Heavy traffic on Fellowship Road intersects with traffic on West Park Drive, East Park Drive and Gaither Drive.

Problem occurs during A.M. and P.M. peak periods because of increasing activity of industrial and office park development.

Trees and sign cause sight distance problem for vehicles exiting East Park Drive.

E Intersection of Church Road and Waverly Avenue

Traffic at this intersection is increasing, because of apartment buildings in Maple Shade and other activity.

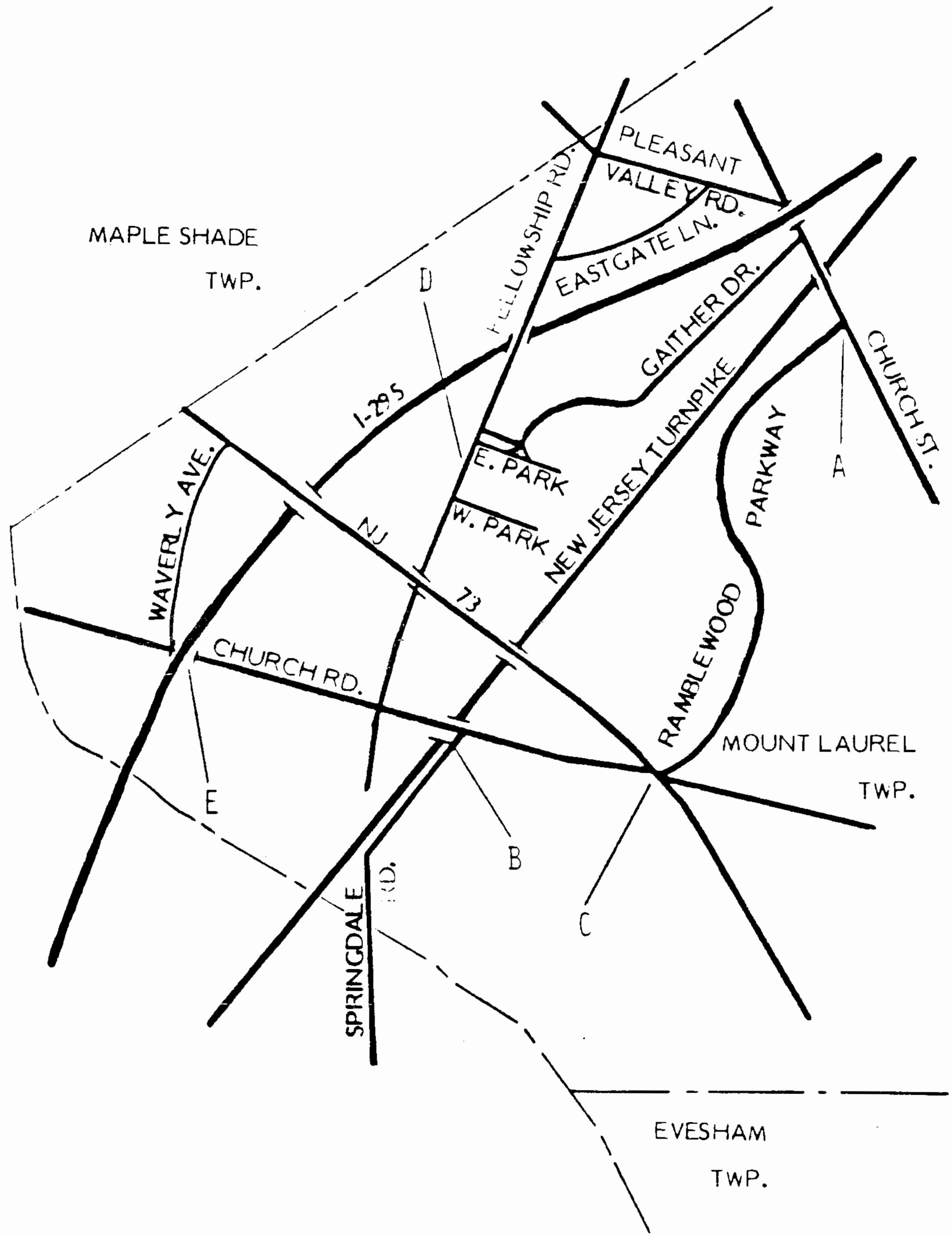
Sight distance problems are associated with two bridges, vegetation, and poles located near intersection on Church Road.

There is no sign on Church Road to indicate a "T" intersection or to slow traffic.

F Intersection of Pleasant Valley Avenue and Church Street

The traffic backs up on Pleasant Valley Avenue, especially during the P.M. peak period. Many traffic violations associated with double-right turns were observed during this time period.

Figure 4.3 WESTERN MOUNT LAUREL



RECOMMENDED IMPROVEMENTS

A Signalize intersection (programmed for implementation); investigate circulation to WaWa store, including the need for a deceleration lane in front of WaWa on Church Street.

B Lengthen the two-lane approach of northbound Springdale Road to Church Road by stabilizing the shoulder and adding fill on the eastern side of the road. Relocate utilities and guardrail; study the need and feasibility of providing a direct connector between Springdale and Fellowship Roads, requiring a new bridge over the New Jersey Turnpike.

*C Consolidate Church Road approaches; improve shoulders; cutback NJ 73 curb. (Under review by the Bureau of Surface Design)

D Eliminate crown on Fellowship Road at East Gate Lane and investigate need for traffic signal (under current study by the county). Relocate informational sign at corner of East Park Drive; investigate staggered work hour strategies for the industrial and office park area.

E Install signs on westbound Church Road warning about heavy traffic movements at Waverly Avenue. Restripe Church Road to include an eastbound left turn lane to Waverly and to eliminate passing, and to include a westbound left turn at Glenn Brook Boulevard. Install a "no turn on red" sign at Glenn Brook Boulevard; remove vegetation and relocate power poles.

F Note: The intersection of Pleasant Valley Avenue and Church Street was a late addition by Mount Laurel Township to the list of transportation problems. It was not subject to field investigations and improvement recommendations were not made.

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* Long-range improvement to be completed after 1990.

PROBLEM AREA 4: NJ 38 CORRIDOR IN MOORESTOWN

NJ 38 is the principal east-west travel route in the study area. Connecting the Philadelphia-Camden metropolitan area with Mount Holly and other points east, the highway traverses Moorestown in the southern part of the township. Traffic volumes are about 30,000 vehicles per day. The posted speed limit is 55 miles per hour.

The corridor extends westerly along Route 38 from Lenola Road to Mt. Laurel Road. Two intersections immediately north of the corridor on Lenola and Mt. Laurel Roads and an intersection directly south on Church Street are included in this problem area because of their proximity to NJ 38 and the interrelationship of their traffic problems.

Though the roadway in this section of NJ 38 is a well-designed, four lane facility (6 lanes in the vicinity of Moorestown Mall) with grass medians and some jughandles for turning movements, intersection problems exist. Moorestown Mall, in the vicinity of the intersection of NJ 38 and NJ 73 is part of a large commercial area that includes small suburban office buildings and single family homes. Increasing development in the area, the major shopping mall, some environmentally sensitive areas, residential communities, and traffic demand to cross the facility contribute to these problems.

The public transportation service provided in the corridor is fairly extensive. On a given day, 33 buses depart from Mt. Holly and 54 from the Morrestown Mall for Philadelphia.

Future Growth and Transportation Issues

The simulation of future traffic indicates a growth rate of nearly one percent per year, or about 20 % by the year 2000. The traffic growth rate on several cross streets may exceed the one estimated for NJ 38 by two- or three-times, because of the growing demand to travel north-south in the area. The continuing issue in this NJ 38 corridor involves balancing the traffic flow along the principal route with the vehicular flow of the cross streets.

A summary of traffic problems is outlined below:

A Intersection of Kings Highway and Lenola Road

Located at the boundary between Maple Shade and Moorestown Townships; the intersection experiences congestion, especially during peak periods.

Two gas stations, an open field, and a residence occupy the four corners. Nearby apartments and the Kings Way Shopping Plaza contribute to the traffic generation.

B Intersection of NJ 38 and CO. 608 (Lenola Road)

This intersection has small signal faces and requires interconnection with nearby signal north on Lenola Road.

C Intersection of NJ 38 and Nixon Drive

The intersection has lane problems associated with Moorestown Mall traffic.

D Intersection of NJ 38 and Pleasant Valley Avenue

Peak period congestion is associated with turning movements at the intersection.

Inadequate length of westbound NJ 38 left turn lane to Pleasant Valley Road causes dangerous standstill of high speed NJ 38 traffic.

Narrow bridge on Pleasant Valley Road requires more excessive green time for vehicles to clear queue on that approach.

E Triangle of NJ 38 with Church Street and Fellowship.

This complex area is composed of three intersections (two signalized, one controlled by stop signs) that are in close proximity.

A capacity problem exists for several movements because of roadway geometrics.

Optimal signal timing by time of day is critical to avoid excessive delays.

F Intersection of NJ 38 and Mt. Laurel Road

Congestion occurs on northbound Mt. Laurel Road in morning peak period.

Westbound jughandle for southbound Mt. Laurel Road traffic may have insufficient capacity.

Conflicts occur between opposing left turns on Mount Laurel Road.

G Intersection of Mt. Laurel Road and Main Street

A sight distance problem exists because Mt.Laurel Road intersects Main Street at a grade and a large tree is located on the southwest corner of the intersection.

Traffic on Main Street (which is one lane by direction) turning left toward Route 38 obstructs westbound through-traffic flow.

H Intersection of Church Street and Hooten Road

This "T" intersection experiences heavy traffic on Church Street, which creates delays for traffic on Hooten Road.

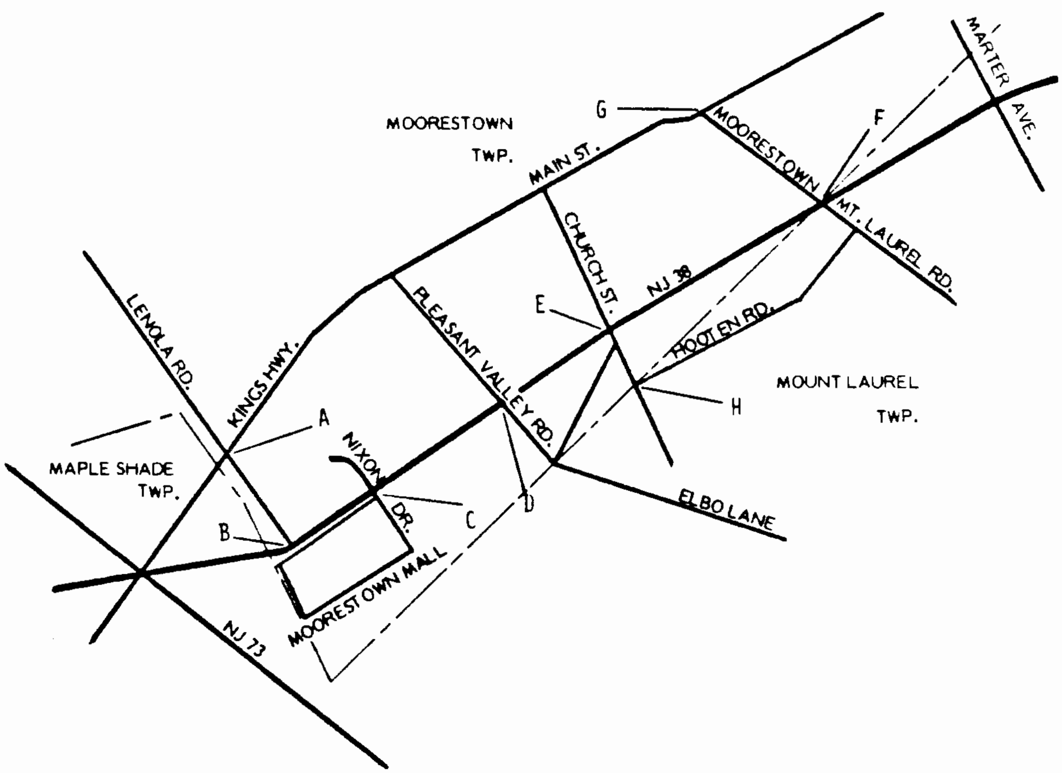
A hillcrest is located near Moorestown.

Future development may aggrevate problems at this location, which extends from NJ 38 to residential areas.

I Intersection of NJ 38 and Marter Avenue

New development in the vicinity of the intersection will cause future congestion in the area.

Figure 4.4 NJ 38 CORRIDOR IN MOORESTOWN



Recommended Improvements

A Widen two of four intersection approaches (northbound Lenola Road and eastbound Kings Highway) to accommodate a third lane. Cut-back curb on southwest corner (closed Gulf Service Station) to improve radius. Designate exclusive left turn lane on the existing westbound roadway; improve signals and relocate utility poles and sidewalks.

B Interconnect the signals at Route 38 and the K-Mart/Silo Plaza entrance-exit road on Lenola Road; enlarge signal faces to 12" lenses, as programmed.

C Designate traffic lanes on Nixon Drive out of Mall.

D Continue to investigate the widening of the Pleasant Road Avenue Bridge to provide a left turn lane; consider split phasing on Pleasant Valley Road. Lengthen the westbound left turn slot by 150 feet. (1,2)

E Perform traffic study including delay analysis during peak periods to investigate provision of left turn lanes at Church Street for NJ 38 traffic. Consider the elimination of the existing jug handle and the westbound left turn to Fellowship Road. In conjunction, consider signalizing the intersection of Church Street and Fellowship Road, and designate Fellowship one-way from Church Street to Route 38. (1)

F Designate lane use on Mount Laurel Road. Study the alternatives to modifying turning movements (especially westbound Route 38 to southbound Mt. Laurel Road). Increase the jug handle length or utilize the center left turn lane.

G Study the need for traffic signal at Main Street, Chestnut Avenue, and Moorestown-Mt. Laurel Road.

H Study the need for traffic signal and the right-of-way that may be required for a shoulder or deceleration lane for right turning, northbound Church Street traffic. Improve the sight distance for the westbound approach by replanting shrubbery on the northeast corner.

I Study the impact of new development in the two southern quadrants of the intersection.

---

(1) Currently under review by the Bureau of Surface Design, N.J. DOT.
(2) Local officials did not want to increase the width of the bridge the northerly leg of Pleasant Valley Road when it was recently re-constructed.

PROBLEM AREA 5: NORTHWESTERN MOORESTOWN INDUSTRIAL ZONE

This area is located between North Church Street and the Pennsauken Creek and extends north of New Albany Road to the Cinnaminson Line. The area faces potential problems because it contains parcels of undeveloped land that are currently planned for office and warehouse development.

The difficulty of constructing NJ 90 at Forklanding Road in Cinnaminson was a set-back to the development goals of the industrial area. Traffic must flow through Moorestown, primarily along Church Road, Lenola Road, New Albany Road, and Main Street. In the midst of residential communities and limited transportation access, the township must establish a balanced plan for development and infrastructure improvements that takes into consideration the different needs of the residential and industrial communities.

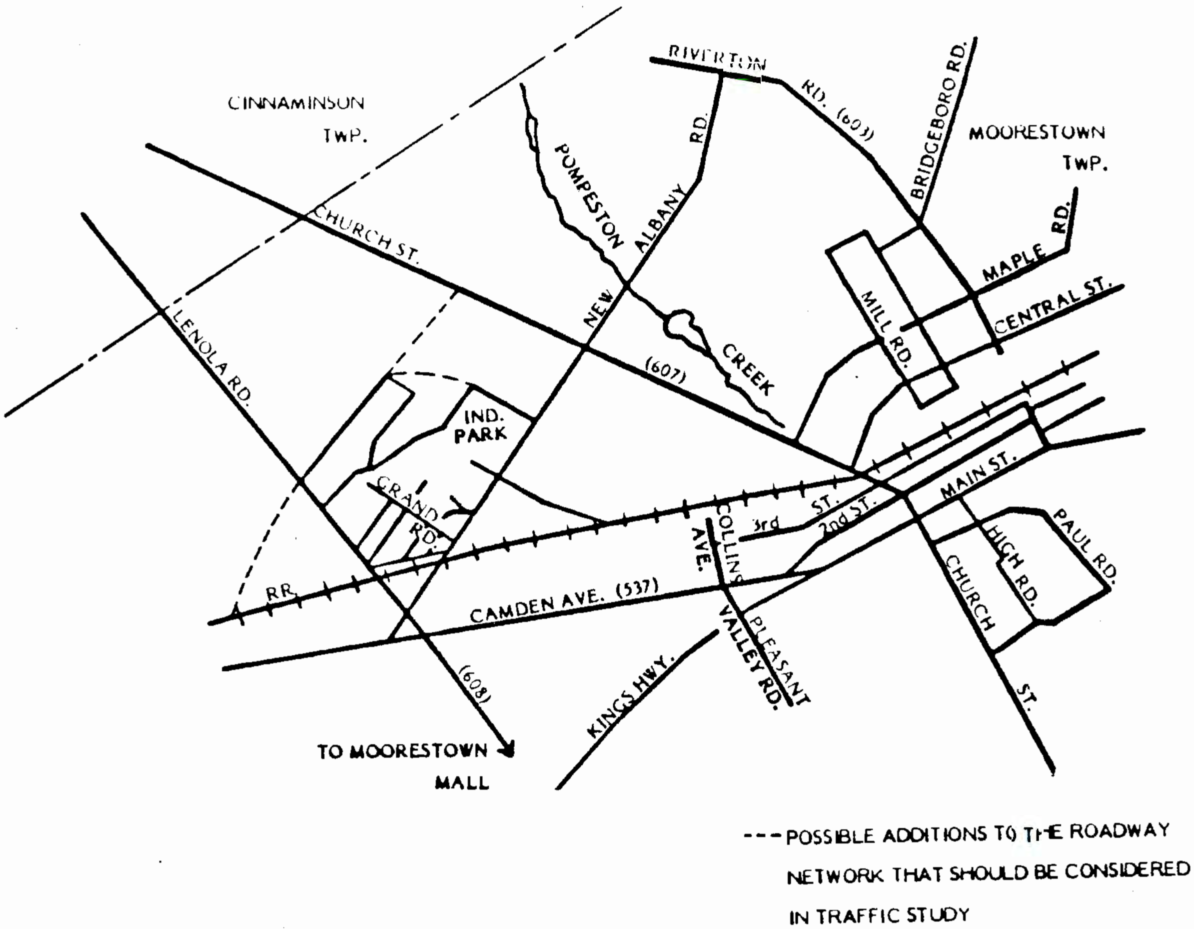
DRPA once envisioned an alternative for the High Speed Line extension which would curve south at the intersection of the existing rail right-of-way. The extension would then proceed along the NJ 90 right-of-way to a "park-and-ride" transportation hub south of the Moorestown Mall, near the intersection of the New Jersey Turnpike, I-295, and NJ 90.

This route could have provided the opportunity for a station to serve the Moorestown Northwestern Industrial Zone. Such a station would have alleviated traffic congestion in and out of the Industrial Zone.

Peak hour traffic congestion currently exists at the following locations:

- o Church Road (Co. 607) from Main Street to Central Avenue
- o Lenola Road (Co. 608) intersections with Camden Avenue and New Albany Road
- o New Albany Road intersections with Camden Avenue and Church Road

Figure 4.5 NORTHWESTERN MOORESTOWN INDUSTRIAL ZONE



RECOMMENDATION

A detailed transportation study should be performed for the industrial zone and surrounding area shown on the schematic. Alternative growth scenarios in the context of potential transportation improvements should be assessed. Improvements to provide new highway access to the Industrial Zone should be identified and recommended for implementation. A task force including business leaders, local residents, and governmental representatives should be established to initiate and provide guidance to the effort.

PROBLEM AREA 6: MARNE HIGHWAY CORRIDOR IN MOORESTOWN, MOUNT LAUREL AND HAINESPORT

This problem area extends from Main Street and Borton Landing Road in Moorestown along Marne Highway through Mt. Laurel to the Rancocas Creek in Hainesport Township. The roadway section provides direct access between Moorestown Township to the West and Mt. Holly to the East.

The intersections of Conrail and Borton Landing Road, and Creek Road and Masonville - Centerton Road are included in the problem area, because they are on nearby routes that intersect the Marne Highway.

Future Growth and Transportation Issues

Travel simulation results indicate that traffic along Marne Highway will increase by nearly one percent per year over the next 20-year period, or by about 20% by the year 2000. This growth will be caused by an increased demand to travel east-west in the corridor and by new development that will have access to Marne Highway.

An improved NJ 38, also providing an east-west route south of Marne Highway, will carry more of the thru traffic in the future. The remaining traffic on Marne Highway will be more localized, requiring a greater percentage of turning movements on and off the highway.

(Travelling along Marne Highway from Moorestown through Hainesport Township)

The following transportation problems at critical intersections have been observed:

A. Intersection of Borton Landing Road and Marne Highway

   Heavy directional movements require additional approach lane on Main Street.

B Intersection of Conrail and Borton Landing Road

   Peak hour congestion is caused by constriction of Borton Landing Road traffic from three to two lanes. This restricts the right turn lane onto nearby Main Street.

C Intersection of Westfield Road and Marne Highway

   Because the Marne Highway and Westfield Road do not intersect at 90 degrees, a sight distance problem exists for traffic on Westfield Road.

D Intersection of Hartford Road and Marne Highway

This is a high accident location with sight distance problems. Signalization is under design and programmed for 1984.

There is a railroad crossing at the intersection which is not aligned.

The problem is especially acute for Westfield Road traffic which must proceed cautiously onto Marne Highway.

E Creek Road and Marne Highway

This is a wide-open four-legged intersection. Creek Road approaches Marne Highway at an angle and Rancocas Boulevard intersects the highway at nearly 90 degrees. The condition causes confusion and conflicts to drivers.

On Creek Road south of the Marne Highway, a narrow Conrail underpass has insuffícent height. The situation is hazardous with limited capacity for vehicular flow.

F Bridge on Marne Highway Over Rancocas Creek

The two-lane bridge is in deteriorated condition with a pedestrian walkway that is condemmed.

Over the past several years it has been closed periodically for minor repairs.

(Bridge reconstruction is now in final design.)

G Intersection of Broad Street, Lumberton Road, and Marne Highway

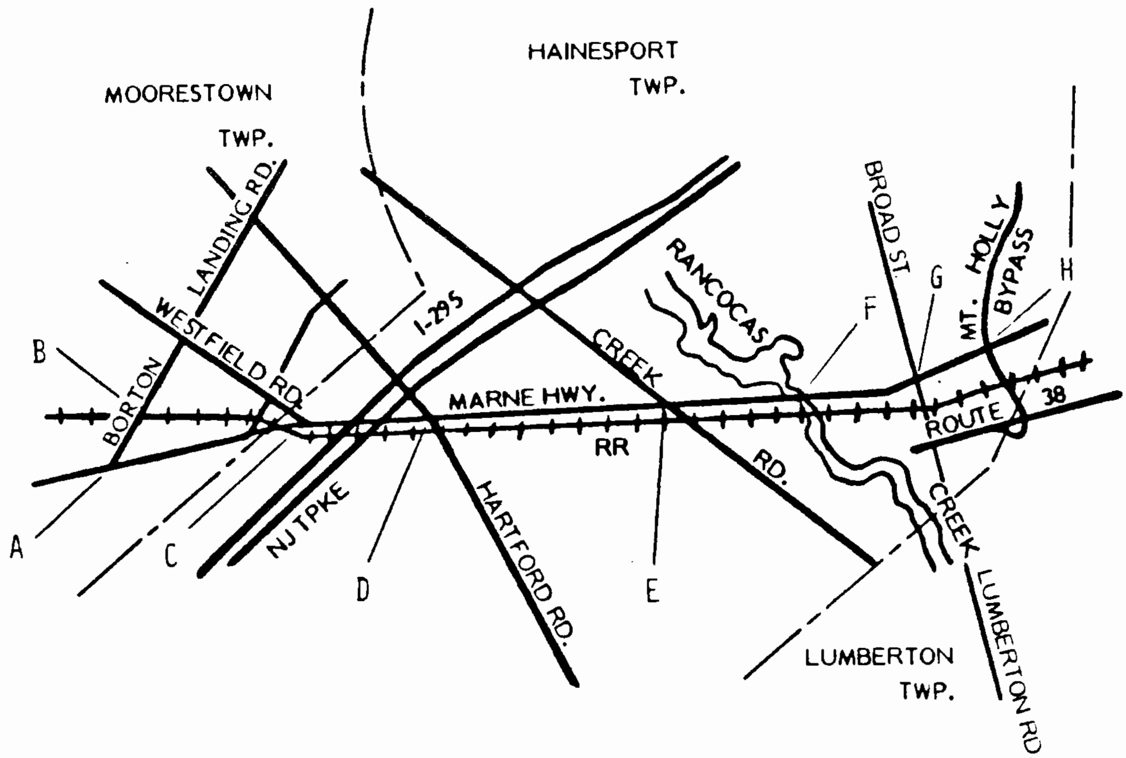
Increased use of public facilities and other nearby land uses has contributed to traffic congestion and safety problems at the intersection.

H Intersection of Mt.Holly By-pass and Marne Highway

This intersection of two county roads is a high accident location. Since there are few provisions for cross-overs on the highway, many u-turns impede traffic flow.

(Burlington County is investigating intersection and signalization improvements.)

Figure 4.6 MARNE HIGHWAY CORRIDOR IN MT. LAUREL AND HAINESPORT



RECOMMENDED IMPROVEMENTS

A Widen eastbound Main Street by about 14 feet to provide a third approach lane.

B Widen southbound Borton Landing Road to maintain roadway width for left turn lanes into RCA.

C Modify the Westfield Road approach by reconnecting to Marne Highway at 90 degrees.

D Cut-back vegetation and other minor obstructions. Relocate utility pole and improve southbound right turning radius (since signalization is programmed, sight distance restrictions are not as critical and existing building can remain).

@E Provide left turn lane for eastbound Marne Highway traffic; signalize intersection, if warranted.

Construct concrete median so that turns from Marne Highway are channeled toward the respective roads or consolidate Rancocas Boulevard into Creek Road (several hundred feet before intersection) and modify Creek approach so that it intersects Marne Highway at 90 degrees (long term solution).

Investigate reconstructing the Conrail underpass south of Marne Highway.

F Reconstruct the two-lane bridge with a shoulder on one side and a pedestrian walkway (as currently programmed).

G Signalize the intersection of Marne Highway, Broad Street, and Lumberton Road.

H Perform accident analysis and signal timing study.

@ Partly slated for short-range and partially for long-range completion. See chapter six for details.

PROBLEM AREA 7: HAINESPORT-MT. LAUREL ROAD

This two-lane road connects the western part of Mt. Laurel Township to the center of Hainesport. The corridor is generally rural with some surrounding parcels of land slated for future development.

Traffic volumes along the road range from nearly 3,000 to more than 5,000 vehicles per day.

Future Growth and Transportation Issues

The rural nature of this corridor and surrounding area may be associated with significant development and growth over the next 20 years. Traffic volumes are projected to increase by about 2% or 3% per year. This will increase the daily traffic to the 5,000-10,000 range by the year 2000.

Traffic problems along the route, summarized below, are mostly safety-related.

A At Moorestown - Mt. Laurel Road

The roadways have one lane by direction and a flashing ligth signals the approaching intersection. Hainesport Road is controlled by a stop sign.

A hillcrest north of the intersection, which affects sight distances causing failures to yield right-of-way at the flashing signal make this one of the highest accident locations in the township.

School buses from a nearby school frequently travel through the intersection that has poor alignment on Moorestown Road.

B At Ark Road

This is a five-legged intersection, controlled by stop signs.

A building between Phillips and Ark Roads near the property line causes serious sight distance problems for drivers approaching the intersection.

C At Masonville-Fostertown Road

Masonville-Fostertown Road bisects Hainesport-Mt. Laurel Road at an angle, which causes sight distance problems and limits the capacity of the intersection.

Development in Lumberton (including about 1000 units at Bobby's Run) uses the intersection to reach NJ 38.

The intersection is controlled by flashing signals and stop signs.

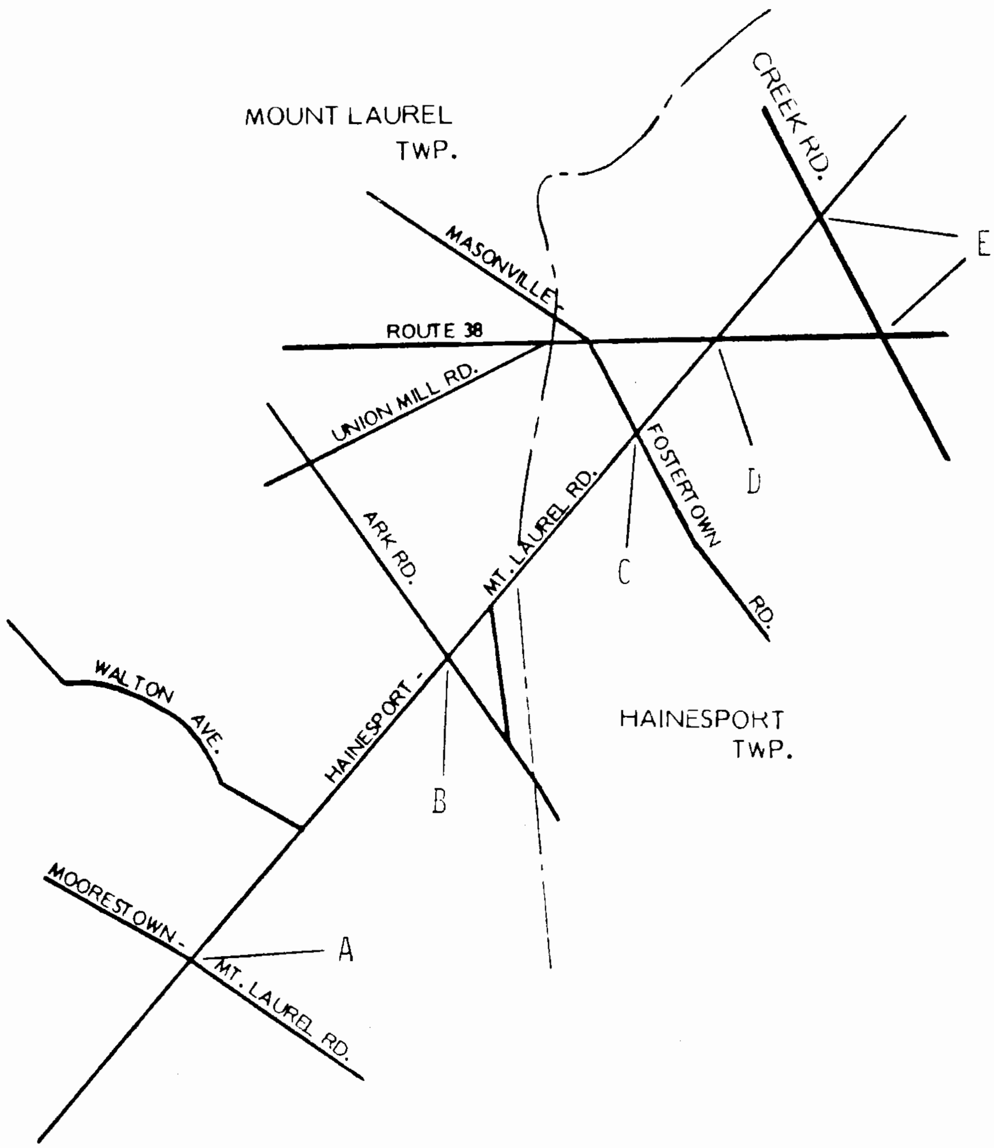
D At Route 38

Paving and shoulders are deteriorated at the intersection.

E At Creek Road

Sight distance problems exist at the intersection (and at the intersection of Route 38 and Creek Road) because of obstructions from plants and shrubs.

Figure 4.7   HAINESPORT-MT. LAUREL ROAD



RECOMMENDED IMPROVEMENTS

A Reduce and enforce speed limit at intersection, continue to evaluate need for full signalization.

B Construct new roadway between Phillips and Ark Roads to remove Phillips Road approach from the existing intersection.

C Investigate the need to realign intersection so that approaches bisect at right angles; study the need for signalization.

D Repave roadway surface; improve shoulders at the intersection.

E Cut-back or remove existing shrubbery and re-landscape.

The following improvements (not shown on map) are located outside of the corridor and would divert traffic from Hainesport - Mt. Laurel Road.

* Widen (to 4 lanes) Union Mill Road from Elbo Lane to Route 38.

* Complete the paving of Walton Road; realign roadway from Union Mill to Hainesport Road.

* Widen (to 4 lanes) Hartford Road from Route 38 to Medford Township.

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* Long-range improvement to be completed after 1990.

PROBLEM AREA 8: MOUNT HOLLY

Settled by Quakers in the seventeenth century, Mount Holly contains many outstanding examples of the architecture of the period, typically constructed near property lines. It is also the county seat for Burlington County. As such, administration and court house buildings are a dominant land use in the central area. The population of the township has decreased from 12,713 in 1970 to 10,800 in 1980.

Mount Holly occupies 2.8 square miles of land in the center of the county. Co. 537 is the principal travel route connecting the center of town to points east and west. Co. 541 provides the linkage to points north and south. Co. 541 (Spur) bypasses Mount Holly on the western side.

Future Growth and Transportation Issues

Because the township is generally developed with only limited amounts of land available for new development, modest levels of traffic growth are estimated for the next twenty years (10%-15%).

Traffic problems within the subarea are outlined below:

A Intersection of King Street and Washington Street

> The intersection is located in the older section of town with buildings close to the roadway and narrow sidewalks.
>
> Southwest corner has abandoned gas station, providing some right-of-way.
>
> A NJ Transit Bus route, truck traffic, pedestrian signals, and poor sight distance contribute to congestion.

B Intersection of Rancocas Road and King Street

> On the northeast corner of the intersection the traffic controller is located in the sight triangle causing problems for southbound King Street traffic turning right.
>
> The northwest corner (gas station) and the southeast corner (lumber yard) provide opportunities for right-of-way acquisition.
>
> King Street has a jog at the intersection.
>
> Signals are mounted on mast arms and pedestrian signals are provided.
>
> Although there are left turn lanes, no left turn signal advances are provided.

C Rancocas Road and High Street

High Street is two lanes by direction with parking permitted along the roadway.

One approach on Rancocas Road is about twice as wide as the other and the approaches are not aligned at the intersection.

Vacant property on the northeast corner provides opportunity to improve this heavily travelled area.

D Washington Street and High Street

This is the busiest intersection in town with the predominant movement from east to west.

Buildings are close to the intersection with little available right-of-way.

Because it is a shopping area, there are considerable pedestrian movements.

Signal equipment is old, but post mounts are in character with the older area.

E Mill Street and Pine Street

This is a "T" intersection with both Mill Street approaches consisting of two lanes by direction. One approach has a designated left and the other has a designated right turn lane. Pine Street has two lanes with a designated left.

No advanced green and no inter-connection with signals at Washington and High Street are provided.

F Mt. Holly Bypass and Rancocas Road

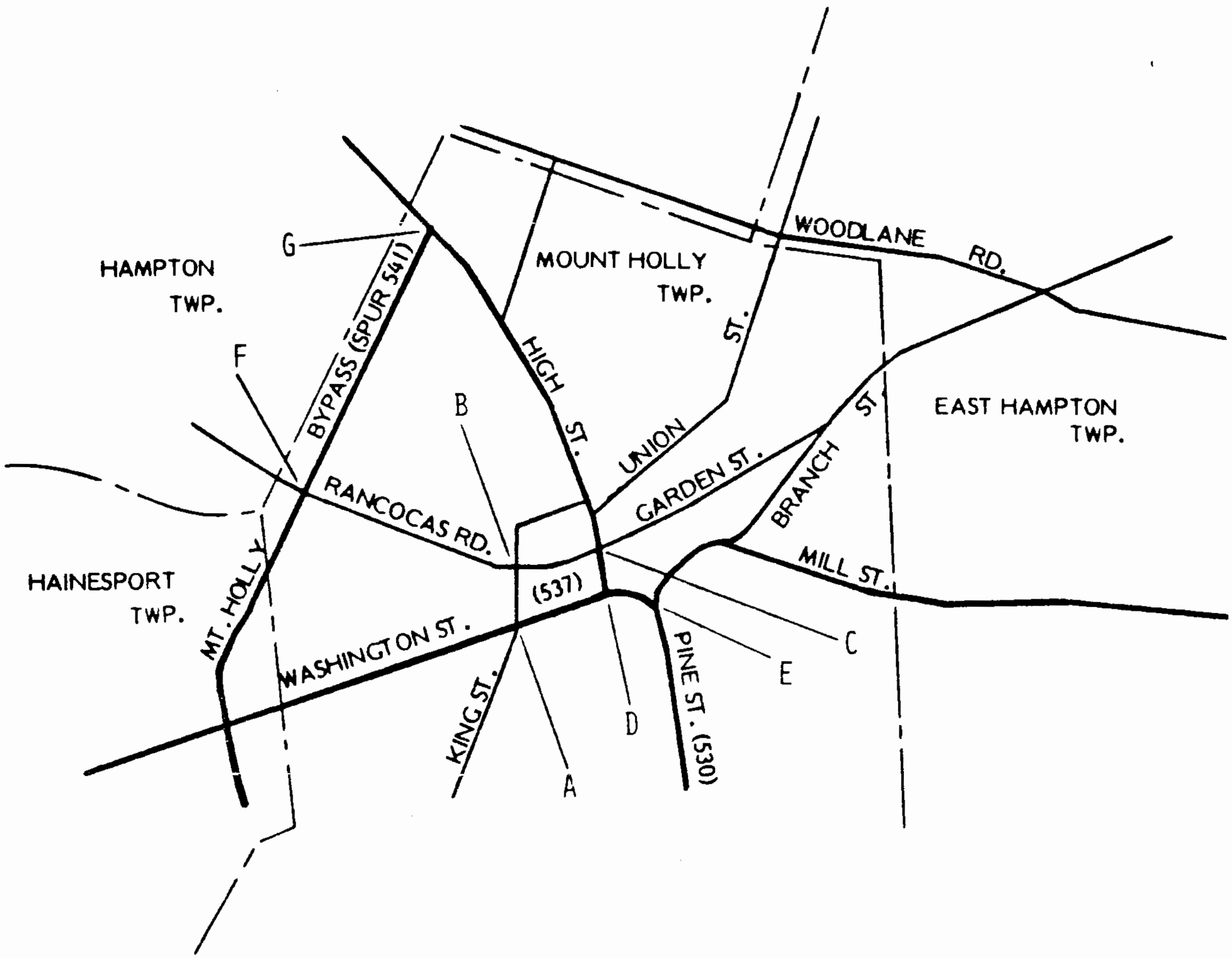
This intersection in the western part of town has good geometry.

Three approach lanes on Rancocas Road are not designated.

G Mt. Holly Bypass and High Street

The intersection is at the southern end of intense strip development. Many accidents have been caused by movements in and out of driveways from the nearby stores.

Figure 4.8 MOUNT HOLLY



RECOMMENDED IMPROVEMENTS

A Acquire right-of-way from abandoned gas station on southwest corner to provide a channelized right turn lane.

B Acquire a small amount of right-of-way, cut-back curbs and relocate sidewalks on northwest and southeast corners to provide improved right turn lanes for both northbound and southbound approaches on King Street. Restripe the intersection for maximum efficiency.

*C Acquire right-of-way on northeast corner to improve alignment by channelizing the westbound approach for an exclusive left and a straight/right (replace off-street parking at another location). Create left-turn pockets on High Street in both directions to move exclusive of opposing traffic. Remove on-street parking in the immediate vicinity. Modify signals.

D To be improved next year as "TOPICS" project.

E Perform signal timing study to optimize signal and to consider interconnection with traffic light at Washington and High Streets. (Request change-order for TOPICS project in the area)

F Perform signal timing study to optimize light and assess need for full actuation.$

G Within limits of current project on Route 541 for dualization, widening, and general upgrading.$

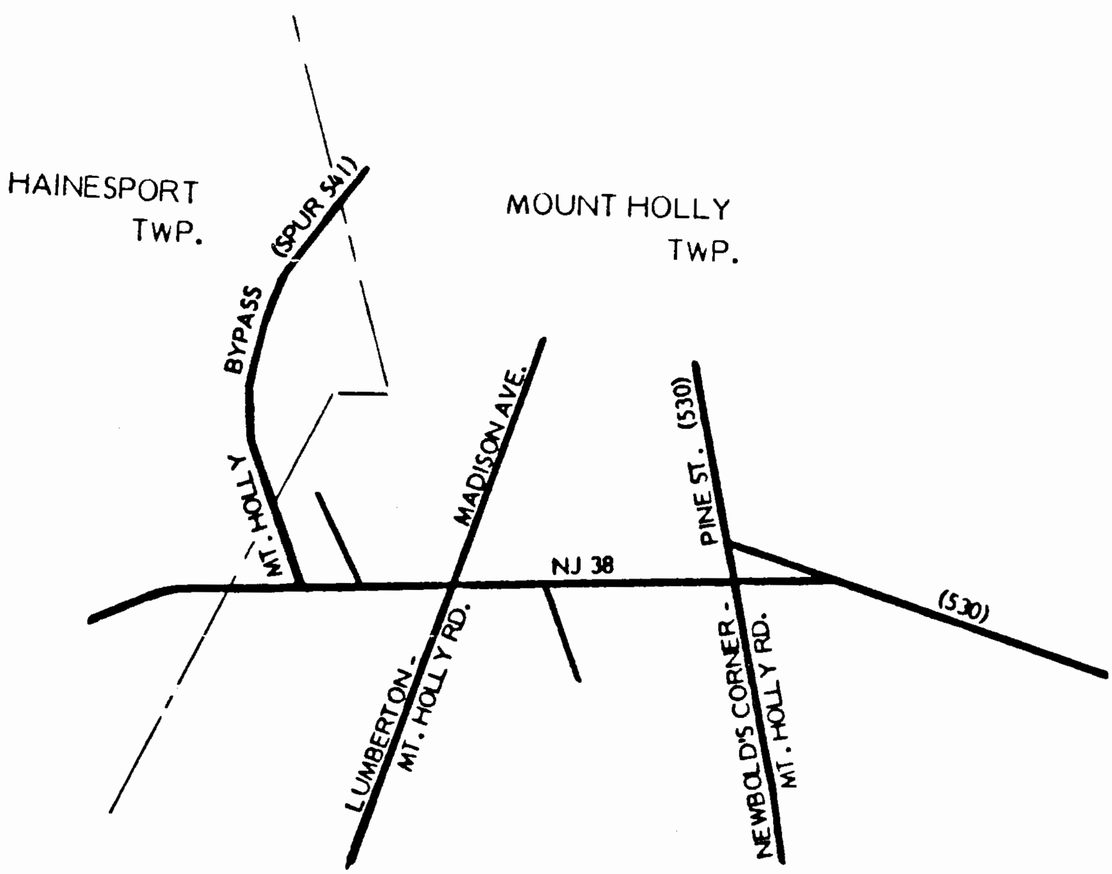
$ DVRPC is currently involved in these efforts.

* Long-range improvement to be completed after 1990.

PROBLEM AREA 9: NJ 38, MT. HOLLY BYPASS TO PINE STREET

This portion of NJ 38 is located near the boundary between Mt. Holly and Lumberton townships in the eastern part of the study area. Recognized as an important transportation facility with traffic problems, a NJ 38 widening program, was initiated by NJ DOT to improve the facility. Included in the program which contains geometric changes, installation of turning lanes, and signal improvements, are three important intersections shown on the schematic. Traffic problems for this road segment will be fully addressed as part of a 6.7 mile project extending from the New Jersey Turnpike to Pemberton Road. The project is scheduled in the Transportation Improvement Program for construction during the FY85-89 time period.

Figure 4.9 NJ 38, MT. HOLLY BYPASS TO PINE STREET



PROBLEM AREA 10: LUMBERTON

Lumberton Township is located in the central section of the county and the eastern part of the study corridor. The southern branch of the Rancocas Creek lends scenic beauty to this township of about 13.3 square miles of land. The 1980 population of Lumberton was 5,236 people, nearly 35 % growth since 1970.

The township is generally residential in the northern part with agriculture uses and undeveloped land in the southern portion. Various township ordinances are used to manage development and maintain the character of the area.

Future Growth and Transportation Issues

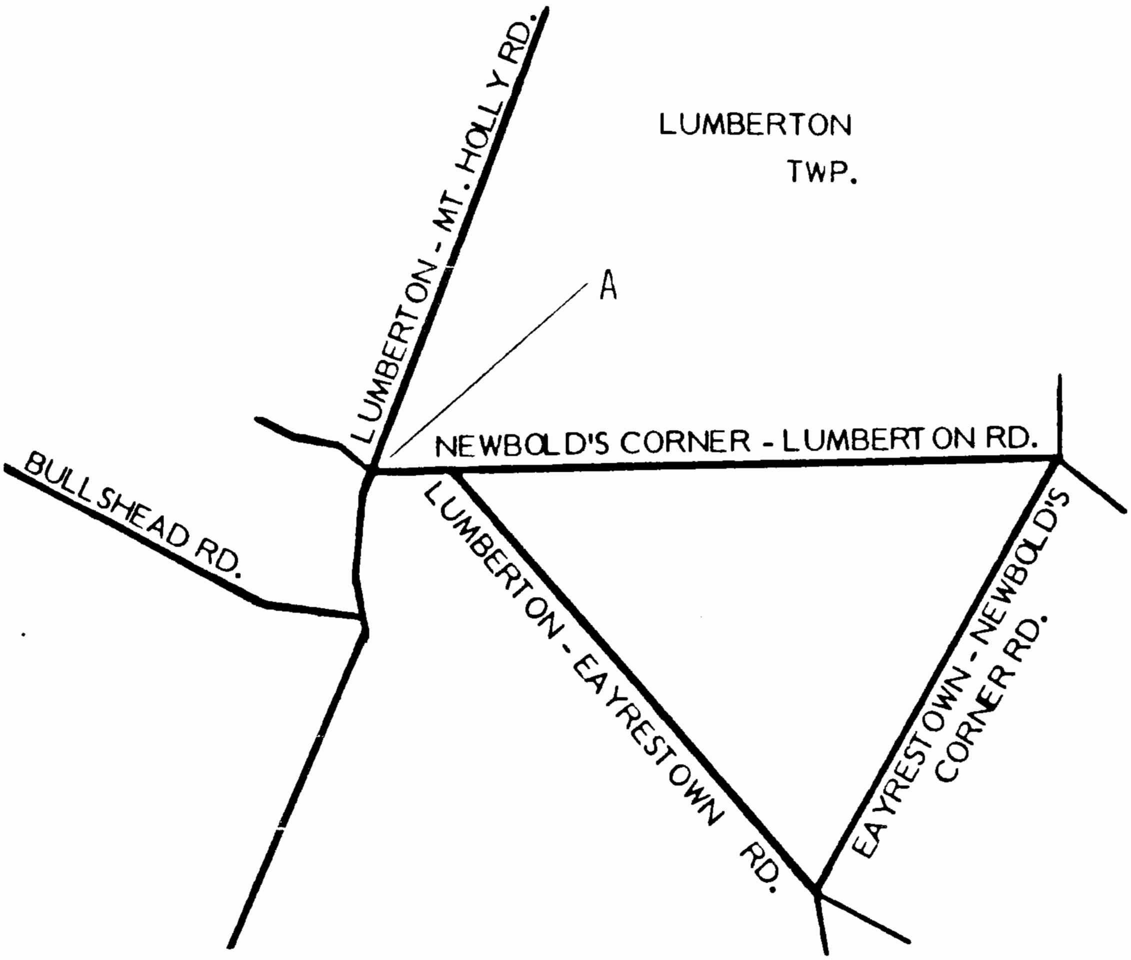
Pressure to develop parcels of land in the township will continue over the next 20 years. This may cause traffic in the town's center to increase by 20%-40% over the period. On some local streets near the new development, traffic is projected to increase by 50%-100%. Township policy on new subdivisions and other development issues will play an important role on mitigating or aggrevating this projection.

A traffic problem in the center of town is outlined below.

Intersection of Lumberton Road and Newbolds Corner-Lumberton Road:

> The non-signalized intersection is the most heavily used in the center of town and located in the historic district.
>
> Though there is a municipally-owned parking lot on one corner, buildings that were constructed near the property line provide little right-of-way acquisition opportunity on the other three corners.
>
> The intersection approach from the west has little traffic.
>
> There is a small curve on Newbolds Corner Road, travelling west toward the intersection.
>
> Traffic growth is anticipated because residents from several new subdivisions, including a few hundred homes on the north side of Newbolds Corner Road, will travel through the intersection.

Figure 4.10 LUMBERTON



RECOMMENDED IMPROVEMENTS

A Realign westbound Newbolds Corner Road approach, including minor widening to add a right turn lane for north bound traffic.

Investigate the need for a traffic signal.

The following improvement (not shown on map) is located outside of the area and would divert traffic from the center of town.

* Construct a bypass facility around the Village of Lumberton

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* Long-range improvement to be completed after 1990.

GROWTH MANAGEMENT TECHNIQUES

The following guidelines were outlined in a report, "Growth Management and Transportation", Urban Consortium (1982). They are provided as alternative approaches to manage the impacts of both residential and non-residential development.

Through the use of growth management tools, a variety of essential public services and facilities, as well as amenities can be provided. Included are services and facilities that otherwise could not be offered without raising taxes, or allowing other facilities to deteriorate and services to be curtailed. To finance these improvements, local governments have instituted growth management programs through which fees, exactions, and taxes are collected that range from $100 to several thousand dollars per development unit.

Many jurisdictions require developers to provide not only streets, sidewalks, street lights, and other on-site improvements, but also off-site improvements at intersections and along streets adjacent to the development.

Growth management tools can also be used to encourage development in areas that previously have been bypassed by development, but that already have adequate transportation services and facilities. Jurisdictions can also use growth management tools to assure that development will not take place before necessary public improvements are in place.

Benefits are also realized through the use of site planning and design techniques such as cluster zoning. The National Association of Home Builders estimates that up to $1,000 a unit can be saved on land-clearance, street paving, and storm sewers when housing is clustered or concentrated on a portion of a site and lot sizes are reduced. The Real Estate Research Corporation reports that the cost of providing roads and utilities is about 55% lower in high-density developments than in low-density developments.

Special Assessments: Special assessments are levied on properties to collect some or all of the revenue required to finance public improvements that benefit the properties and that are necessitated by its development. Such assesssments are collected for improvements that directly benefit particular properties as opposed to improvements that benefit the public or community as a whole.

Exactions: Exactions are fees levied by government as a condition of development approval and may be imposed at various points in the development process. They may take the form of land and facilities, often referred to as dedications, or money. Exactions are passed from developers to the government.

Local governments often use exactions for on-site improvements including parks and roads and the provision of improvements such as sidewalks, streets, street lighting, and traffic signals. Fee in-lieu-of facilities or land are often used for off-site improvements.

The conditions of an exaction may be stated in specific terms in a state law, or local zoning ordinances or subdivision regulations. Frequently, however, such conditions are determined through negotiations between the developer and local officials.

Impact Taxes and Fees: Impact taxes and fees are collected by local governments to finance some or all of the improvements necessitated by a development's effect on existing services and facilities. Local governments use impact taxes and fees as alternatives and supplements to special assessments and exactions.

Impact taxes and fees provide local governments with greater latitude in financing public improvements required by new development and finance off-site projects such as intersection improvements, new streets, and traffic signals, as well as transit services, and transit and highway operating and maintenance costs, which seldom can be financed with exactions. Impact fee and tax rates generally are specified in local ordinances and legislation. These rates are usually based on a charge for a given unit, such as a residential unit, or a square foot of commercial or office space. An impact tax or fee may entail a fixed charge for each unit or a variable charge based, for instance, on the type of use and the amount of traffic such use is will generate.

In addition, impact taxes or fees can be applied in conjunction with small-scale developments that may not have an immediate impact on existing services and facilities but will incrementally affect other developments.

Adequate Facilities Ordinances: An adequate public facilities ordinance is a relatively simple growth management tool, often included as part of a jurisdiction's subdivision permits or review requirements. In terms of transportation services, an adequate public facilities ordinance might require as a condition of site-plan, zoning, or subdivision approval that:

- o The existing off-site road systems can adequately accommodate additional traffic generated by the development.
- o The on-site road systems can adequately serve the development and provide access for private cars, deliveries, transit, and emergency vehicles.
- o Public transportation services can adequately serve the residents of the development in terms of the frequency of public transportation serving the development, the proximity of transit stops, and other criteria.

An adequate public facilities ordinance may define the terms "adequacy" and "accommodate" with standards such as Level-of-Service measures of highway and road service capacity. The definition of these terms may also be left to the discretion of the jurisdiction planning commission, review board, technical staff, or elected officials.

An adequate public facilities ordinance can be used to encourage development of land previously by-passed by development and as an assurance that private development will not occur before a jurisdiction is able to provide public improvements.

Staging and Phasing Plans: Growth staging and phasing plans go one step beyond most adequate public facilities ordinances by identifying the levels of future development that can be served adequately by programmed levels of future capital improvements.

Point-Permit Developer Incentive Plans: Point-permit systems offer an incentive to developers to pay for public improvements. The incentive is development approval from the jurisdiction.

For example, developers receive points for providing on- and off-site public improvements such as bicycle paths, street lights, intersection improvements, and sidewalks. A community may require a developer to earn a minimum number of points before development approval is granted, or developers may compete with one another with approval going to the developer or developers earning the most points.

Development Agreements: Development agreements are new land use planning mechanisms that permit developers and local officials to identify and agree to the conditions and rules under which development may proceed. Development agreements can, for example, specify the on- and off-site improvements that a developer agrees to make, or specify that the local government agrees not to change any planning or zoning laws or policies affecting the development.

Development agreements can eliminate any uncertainty a developer might have as to whether a local enity will attempt to impose additional requirements at later stages in the development process. Conversely, development agreements can provide the local entity with a guarantee of the developer's intention to fulfill the terms of the agreement.

CHAPTER V

TRANSIT POTENTIAL OF CORRIDOR

OVERVIEW

Construction of a proposed rail rapid transit line between Camden and Mount Laurel has been continually deferred since it was conceived more than ten years ago. Funds have been lacking and doubts existed that the line would draw sufficient passengers to justify its expense. This part of the corridor analysis is intended to re-examine that issue for the long term and to examine the potential application of other less costly systems.

The analysis described in this chapter has, therefore, the purpose of determining the most appropriate transit mode to meet the travel demand within the corridor and to the Camden and Philadelphia central business districts (CBDs). The principal product of this analysis is the ridership on systems employing various technologies, which are estimated for the year 2000. The population projections employed are based on trends but tend to emphasize new growth in zones adjacent to urbanized areas. Several alternative growth scenarios are examined to see what effect these might have on the need for transit. Finally, costs associated with each alternative are estimated.

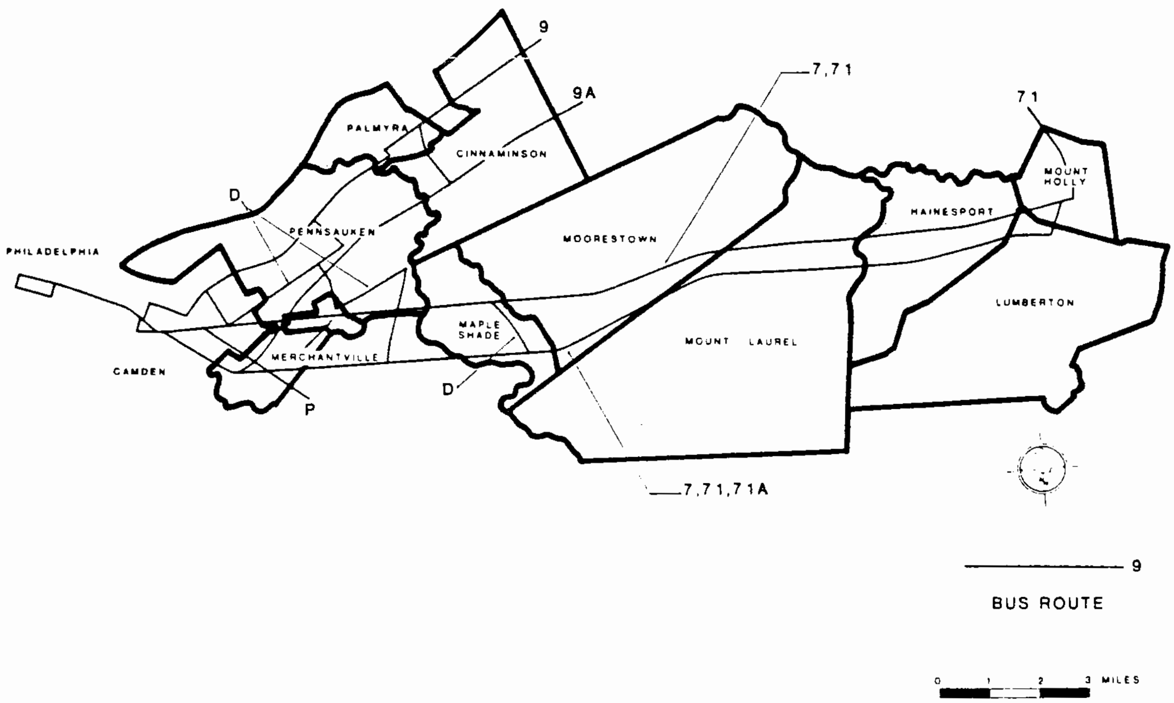
The reader should keep in mind that the techniques employed here are "sketch planning" methods which provide rough calculations of ridership. The results can indicate which system is superior in attracting riders and in what approximate numbers. However, if a system appears to be promising, more precise estimates of ridership, costs and revenue must be made.

The method of analysis is based upon an approach developed by the Urban Mass Transportation Administration, but is modified and adapted to this region. The basic approach is to determine the "impedance" of each of several modes a tripmaker can choose from in traveling between two points. The impedance is a weighted combination of time and cost of making the trip. The relationship between the impedances yields the percent of tripmakers who will choose each of the modes. A description of the methods is found in Appendix A.

ALTERNATIVES

Four systems were analyzed ranging from a continuation of the current combination of express and local buses to construction of a rail rapid transit system similar to the PATCO Lindenwold Line. Two intermediate alternatives are also analyzed which are less costly than PATCO but offer greater service than the current bus service does. They are described and mapped in Figures 5.1 through 5.4.

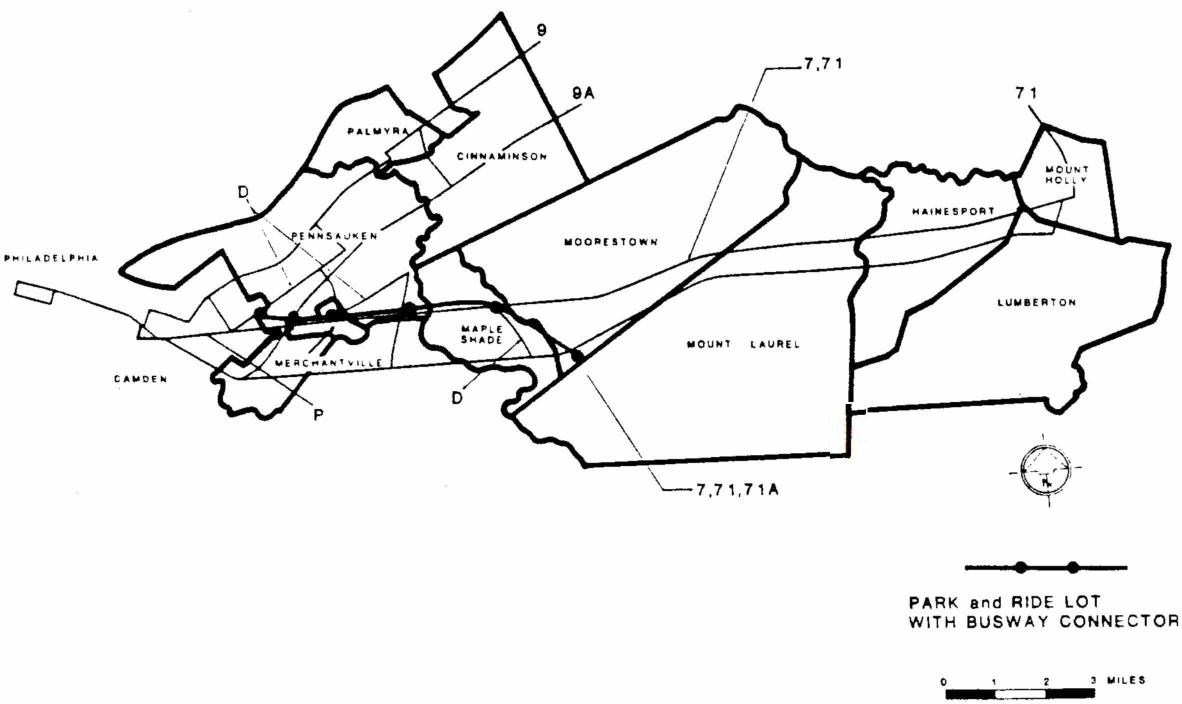
Figure 5.1 EXISTING EXPRESS AND LOCAL BUS: ALTERNATIVE 1



Alternative 1 description:

The central part of the corridor is served by the existing routes 7 (Moorestown-Philadelphia), 71 (Mount Holly-Philadelphia), and 71A (Larchmont-Philadelphia Express). These lines are located on Federal, Maple, and Marne Highway (County 537) or on Kaighn Avenue (NJ 38). Line D between Maple Shade and Philadelphia, following a zigzag route, also serves the corridor. In the northern part of the corridor, Routes 9A and 9 offer service between Cinnaminson and Philadelphia. Lastly, Route P on Marlton Pike offers service to a portion of Pennsauken. This alternative assumes the continuation of these services with the same characteristics to the year 2000.

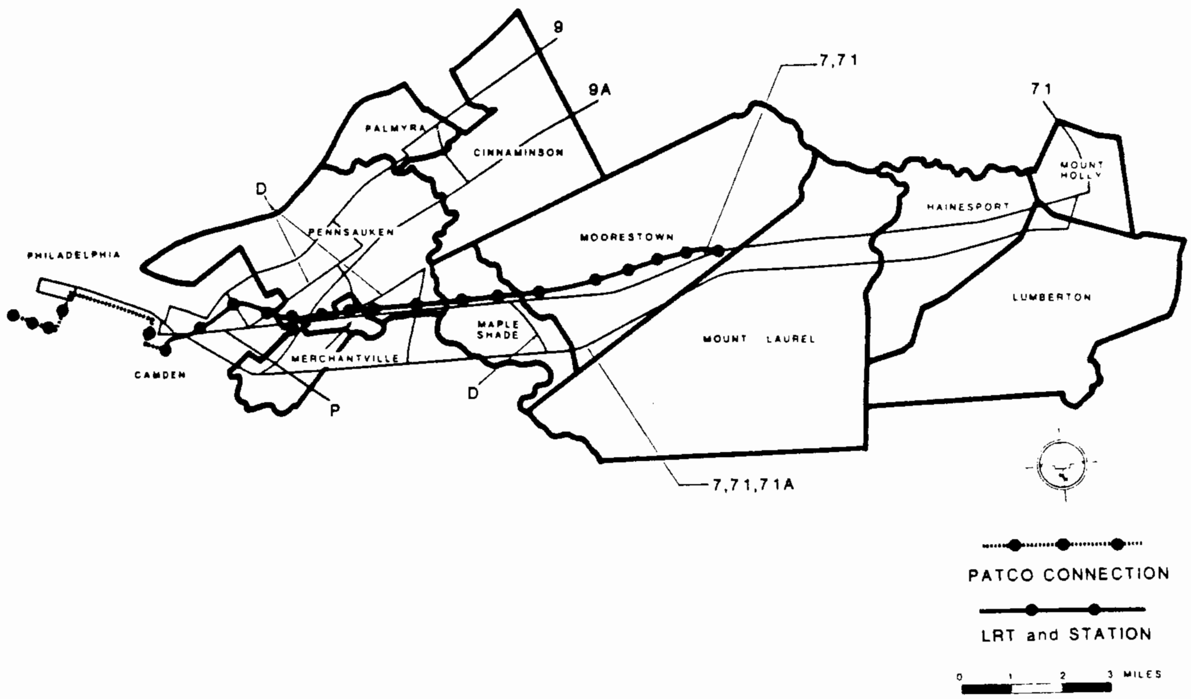
Figure 5.2 BUS RAPID TRANSIT ON CAMDEN-MAPLE SHADE BUSWAY: ALTERNATIVE 2



Alternative 2 description:

In this alternative, an exclusive busway will be constructed on the right-of-way of the Conrail Line between Westfield Avenue in Camden and Route 73 in Maple Shade, at which point buses are assumed to travel on an exclusive right-of-way to Moorestown Mall. The busway will be one lane in each direction and will employ pre-emptive signals at grade crossings. Some buses in the central part of the corridor serving points east of Route 73 may be routed on the busway making only a few stops and achieving much faster running speeds than are currently possible. Park-and-ride lots will be constructed at the sites of proposed rail rapid stations at Westfield Avenue, Crescent Blvd, Merchantville, East Pennsauken, Maple Shade and Moorestown Mall.

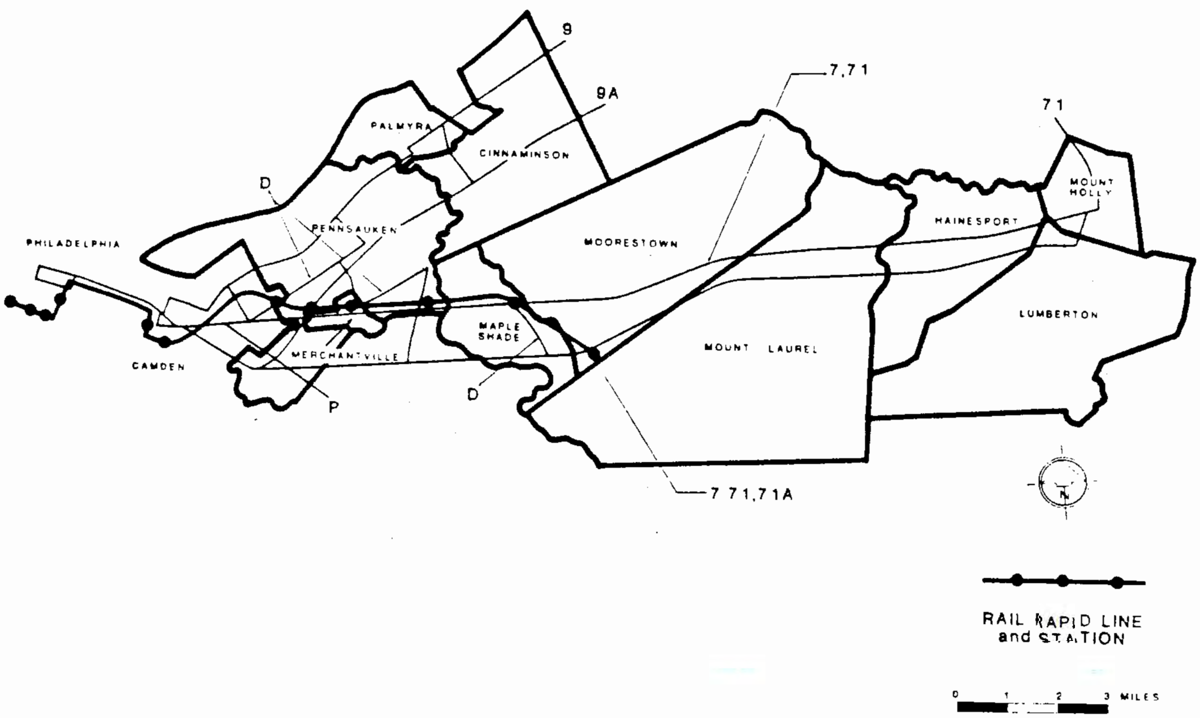
Figure 5.3 LIGHT RAIL TRANSIT - CAMDEN TO MOORESTOWN: ALTERNATIVE 3



Alternative 3 description:

This alternative is designed to provide a less expensive mode than a PATCO-type service but with similar amenities. Light rail cars will be used on a rebuilt trackbed on the Conrail right-of-way between Borton's Landing Road in Moorestown and the Camden Transportation Terminal. In Camden, Philadelphia-bound passengers will transfer to the Lindenwold Line for the remainder of their trip to 16th and Locust streets. Stations will be spaced at intervals of about one half mile and will provide parking to commuters approaching the stations by automobile. Large capacity, articulated cars will be similar to those recently put into service in San Diego and Cleveland.

Figure 5.4 RAIL RAPID TRANSIT - PHILA TO MOORESTOWN MALL: ALTERNATIVE 4



Alternative 4 description:

The last alternative represents the fastest and largest capacity mode--and the most expensive to build. The line would follow the previously determined right-of-way along the Conrail tracks just east of the Camden Transportation Terminal to Maple Shade where it would turn southeastward on a new right-of-way to a terminus at the Moorestown Mall. Intermediate stations would be located at the same points as in the 1975 PATCO plan at Westfield Avenue, Crescent Boulevard, Merchantville, East Pennsauken, and Maple Shade. Park-and-ride lots would be located at each station. Service would continue into Philadelphia with no change of vehicles required.

FINDINGS

Mode Choice

Figure 5.5 presents the results of the analysis for home-based work trips between the study area and the Camden and Philadelphia central business districts (CBDs).

Figure 5.5 PERCENT OF STUDY AREA WORK TRIPS* BY MODE

	Alt 1 Express & Local Bus	Alt 2 Bus Rapid Transit	Alt 3 Light Rail Transit	Alt 4 Rail Rapid Transit
Riding subject alternative	-	29	32	41
Riding existing bus system	15	0	11	10
Using an automobile	85	71	57	49

* Home-based work trips between the study area and the Camden/Philadelphia CBDs

Fifteen percent of home-based work trips will be made on the existing bus system if it were to be operating in the year 2000. Eighty-five percent will drive.

Under Alternative 2, auto driving to work in the CBDs is reduced to 71%. The light rail system of Alternative 3 will attract 32% of the work trips and further reduce auto travel to 57%. The greatest shift, however, is expected to be achieved with construction of a rail rapid system similar to PATCO. Under this alternative, auto use drops to 49% with 41% using the rail system. (In comparison, 48% of the home-based work trips are made on the Lindenwold Line in a similar area surrounding that line, according to the 1980 Census.)

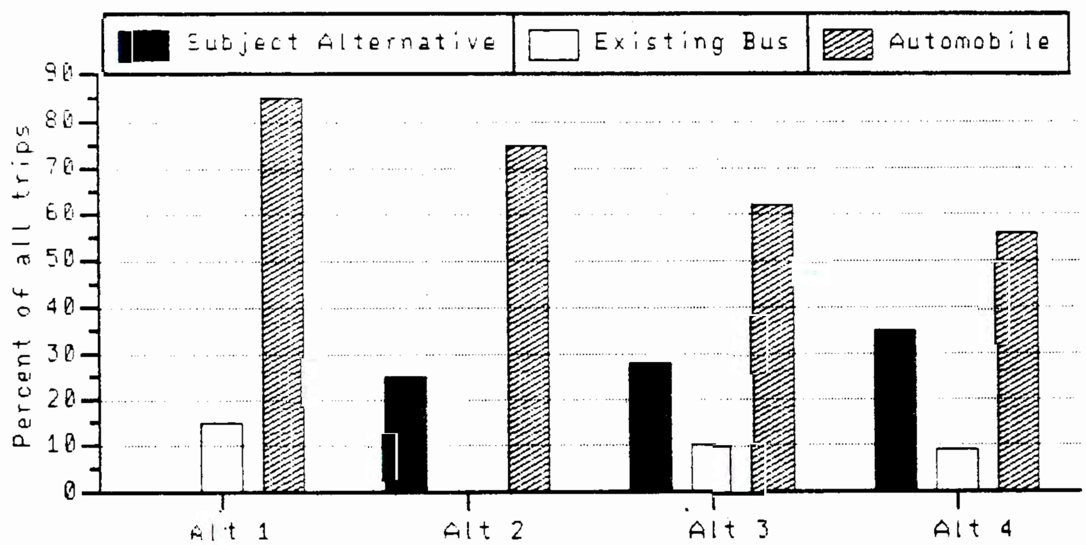
Figure 5.6 shows the percent of total trips by mode within the study area. Figure 5.7 represents these data graphically. The percent of trips made on transit are less in this table than in Figure 5.5, because people have a greater tendency to use transit for work trips. Headways are longer and the non-routine nature of these trips makes using a scheduled service less likely.

Figure 5.6 PERCENT OF STUDY AREA TOTAL TRIPS* BY MODE

	Alt 1 Express & Local Bus	Alt 2 Bus Rapid Transit	Alt 3 Light Rail Transit	Alt 4 Rail Rapid Transit
Riding subject alternative	-	25	28	35
Riding existing bus system	15	0	10	9
Using an automobile	85	75	62	56

* All trips between the study area and the Camden and Philadelphia CBDs.

Figure 5.7 MODE CHOICE OF ALL TRIPS BETWEEN THE BURLINGTON COUNTY CORRIDOR AND THE CAMDEN/PHILADELPHIA CBDs



Ridership Estimation

The first step of the transit modeling effort estimated transit ridership from all zones in the corridor to the Philadelphia and Camden Central Business Districts because these trips are the largest single contributor to the line's ridership. After the trips implied by the percentages in Figure 5.6 are factored upward to account for trips made within the study area to locations other than the Philadelphia and Camden Central Business Disrticts, they result in the trips shown in Figure 5.8. The table shows the daily trips made on each alternative and the mode formerly used. Total transit trips are listed and are the sum of trips on the alternative and those remaining on the present bus system. In the do-nothing alternative (1), 11,200 trips will be made by bus. With the proposed modes initiated, total transit trips range from 14,700 with the bus rapid transit to 21,500 with the rail rapid transit.

Note, in Figure 5.8, the progression in the number of trips formerly made by automobile, from 3,500 with the bus rapid transit, to 8,700 with light rail transit and 10,300 with rail rapid transit. Also note that trips will continue to be made on the existing bus system in the case of Alternatives 3 and 4. These "higher" alternatives leave many riders on the buses, indicating the mode's inferiority in serving local trips. The data in this table are graphically presented in Figure 5.9.

The performance of these modes may vary under different assumptions. For example, the bus network existing today may not be the optimum one to serve the pattern of population in 2000. An improvement in light rail transit ridership will occur if the transfer to the PATCO line could be eliminated for Philadelphia-bound passengers.

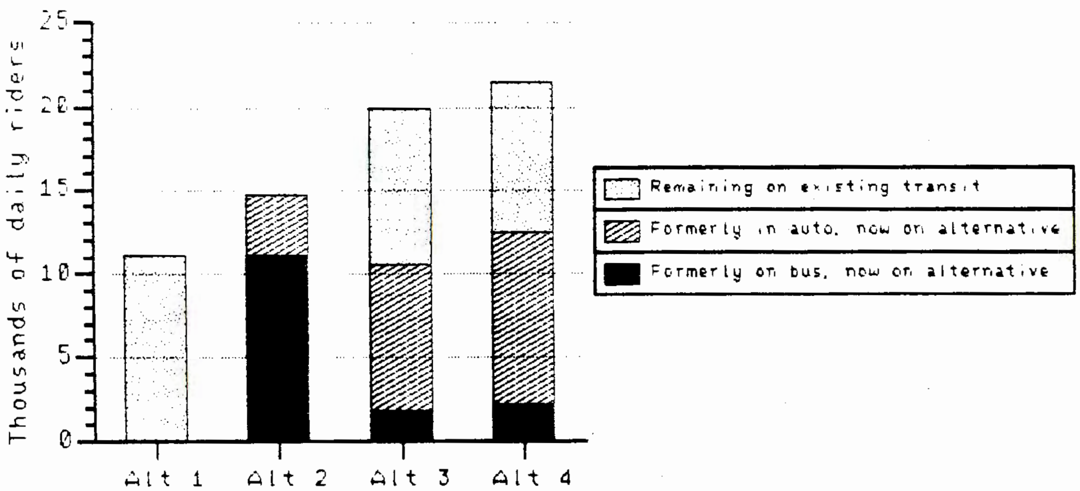
It should also be kept in mind that the three "build" alternatives are not assumed to be on the same alignment. The light rail transit passes through Moorestown, for example, to take advantage of the relatively dense development which will yield a large walk-to ridership. The rail rapid transit turns southward to the Moorestown Mall which provides easy access from high-speed highways and the attractor of the shopping center.

In summary, Figures 5.8 and 5.9 demonstrate that the total transit ridership generated within the corridor in the year 2000 will increase 31% with construction of a busway, 78% with construction of a light rail transit system and 92% with construction of a rail rapid transit system.

Figure 5.8 TRANSIT RIDERSHIP SUMMARY - YEAR 2000

	Alt 1 Express & Local Bus	Alt 2 Bus Rapid Transit	Alt 3 Light Rail Transit	Alt 4 Rail Rapid Transit
Formerly used existing transit	0	11200	1900	2200
Formerly used automobile	0	3500	8700	10300
(Sub-total on alternative)	(0)	(14700)	(10600)	(12500)
Remaining on existing transit	11200	0	9300	9000
TOTAL TRANSIT TRIPS	11200	14700	19900	21500
Increase over alternative 1	-	31%	78%	92%

Figure 5.9 TRIPS ON EACH ALTERNATIVE - YEAR 2000



Growth Scenarios

The preceding information was developed for a base case scenario, (existing trends continue into the future). Additional growth scenarios were developed to examine the impact of other development patterns on the results. The following statistics demonstrate the sensitivity of the results to possible changes in the magnitude and geographic distribution of population and employment growth.

Figure 5.10 presents the results of the ridership analysis for the four growth scenarios considered. (The figures for Alternatives 3 and 4 are only for the subject mode with large numbers of trips still being made on the existing bus system.) The data is also graphed in Figure 5.11.

Scenario 1 is defined as the base case which is previously discussed. Scenario 2 shows the impact of reorienting growth to zones where the percentage of transit use is highest in the base case. This action has very little impact on transit ridership for alternatives 2, 3 and 4 inasmuch as (a) growth in the corridor is small and (b) the savings in auto approach time is only a small portion of the total time and cost impedance of a trip to the CBDs. In the case of Alternative 1, somewhat more riders are able to walk to transit facilities and this is reflected in the relatively greater increase for this alternative.

The results for Scenario 3 show the impact of doubling the growth and locating it in transit-oriented zones. Ridership on the alternatives which employ auto access increases over the base case by about ten percent. For Alternative 1, Scenario 3 is about 25% higher than the base case. Again, the transit-orientation means that significantly more riders can walk to the bus.

The first three scenarios predict ridership in the year 2000 and assume that the service has recently been established. Little time has been permitted for settlement patterns to be affected which will alter the tripmaking destinations of the residents of the corridor. In time, more residents will choose job locations in the CBDs of Camden and Philadelphia because of the superior access offered by the new transit facilities. Also, more CBD workers will find housing in the corridor.

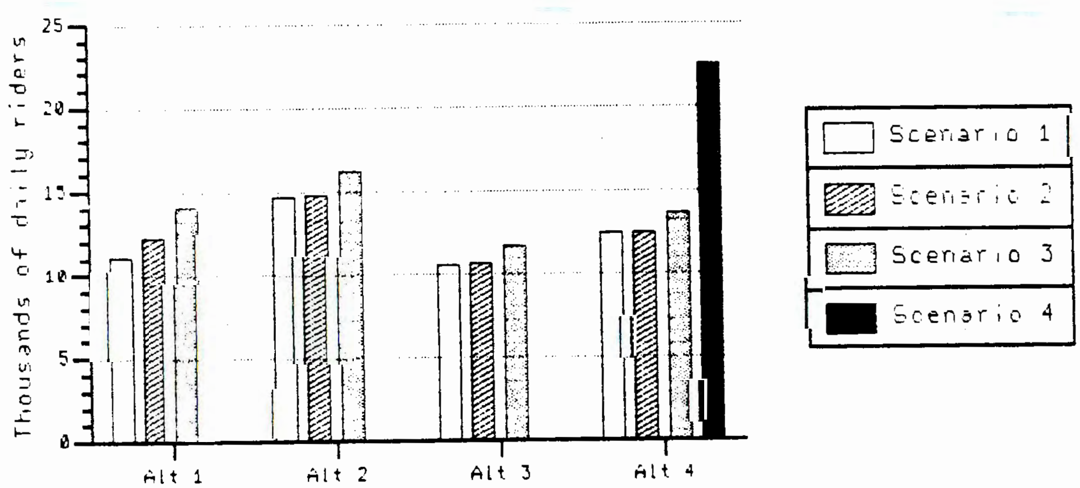
Scenario 4 assumes that ultimately the same rate of trip-making to the CBDs will prevail in the corridor as exists in a similar corridor in which the PATCO Lindenwold Line is located. In 1980, 12 years after the initiation of service on the Lindenwold Line, the rate in the Lindenwold corridor was 74 work trips to the CBDs per 1000 population. The ridership rate in the Burlington Corridor was only 40. The table shows the ridership on the rail rapid alternative if the rate of 74 were applied.

Figure 5.10 DAILY TRANSIT TRIPS (2000) BY VARIOUS GROWTH SCENARIOS

Scenario:		Alt 1 Express & Local Bus	Alt 2 Bus Rapid Transit	Alt 3 Light Rail Transit	Alt 4 Rail Rapid Transit
1	Base case------------------->	11200	14700	10600	12500
2	Base case but residences transit-oriented------>	12300	14800	10700	12500
3	Double growth and transit-oriented------>	14100	16200	11700	13700
4	Trip making redistributed with CBD focus-------->	-	-	-	22500

NOTE: Scenario 4 applied only to the rail rapid transit alternative as a maximum ridership potential in the corridor.

Figure 5.11 TRIPS ON EACH ALTERNATIVE BY GROWTH SCENARIO



COSTS

The discussion of costs is designed to provide only a preliminary estimate of the anticipated public investment and operating expenses associated with the alternatives. Appendix B provides a detailed description of the cost model and assumptions used in the analysis.

Figure 5.12 presents results of an analysis of operation and maintenance costs (O&M). The estimate is based upon local experience wherever possible. Variations in fare collection methods, reliability of equipment, labor agreements and ridership will all impact operations and maintenance costs and may create wide variances from the rates shown in the table.

The cost per passenger trip is $1.19 for the busway with park-and-ride (Alternative 2), $2.45 for light rail transit (Alternative 3), and $2.10 for rail rapid transit (Alternative 4). The cost of the light rail trip includes the cost of providing extra service via PATCO during peak hours. By comparison, the cost of the existing express and local bus service is estimated under the same assumptions to be $1.27 per passenger trip.

Under Alternatives 3 and 4 there will remain passengers on the bus system. The reduced patronage will cause the cost per passenger trip to increase to $1.33 and $1.34.

Capital costs are even more difficult to estimate without a designed system. Particularly variable are civil engineering items such as grading and elevated structures and land acquisition costs. The quality of vehicles, stations and landscaping can vary greatly according to the wishes of the community and the availability of funding. This is particularly true of the light rail system, where the costs of recently built systems have been very different. These costs do not include right-of-way; however, these costs can be expected to be modest because much of the right-of-way is in public ownership.

Figure 5.13 presents a summary of anticipated capital expenditures. The capital cost of the new alternatives range from $50 million for the busway system, to $216 million for the light rail, and $303 million for the rail rapid system. These costs amount to $1.59, $7.92 and $8.69 per trip, respectively.

If the capital cost of the remaining bus service is added to that of the alternative, a per passenger trip cost for the entire transit system (within the study area) can be calculated. These range from $0.72 for the existing bus system, to $1.59 for the busway, $4.56 for the light rail system and $5.36 for the rail rapid system.

Figure 5.12 OPERATION AND MAINTENANCE COST OF ALTERNATIVES
(2000 ridership and 1984 dollars)

	Alt 1 Express & Local Bus	Alt 2 Bus Rapid Transit	Alt 3 Light Rail Transit	Alt 4 Rail Rapid Transit
ANNUAL COST IN MILLIONS				
Cost of alternative	$4.3	$5.2	$7.8	$7.9
Cost of remaining buses	-	-	$3.7	$3.6
Total transit system	$4.3	$5.2	$11.5	$11.5
PER PASSENGER TRIP				
Cost of alternative	$1.27	$1.19	$2.45	$2.10
Cost of remaining buses	-	-	$1.33	$1.34
Total transit system	$1.27	$1.19	$1.93	$1.78

Figure 5.13 CAPITAL COST OF ALTERNATIVES
(2000 ridership and 1984 dollars)

	Alt 1 Express & Local Bus	Alt 2 Bus Rapid Transit	Alt 3 Light Rail Transit	Alt 4 Rail Rapid Transit
TOTAL COST IN MILLIONS				
Cost of alternative	$17	$50	$216	$303
Cost of remaining buses	-	-	$14	$13
Total transit system	$17	$50	$230	$316
ANNUALIZED COST IN MILLIONS				
Cost of alternative	$2.4	$7.0	$25.2	$32.6
Cost of remaining buses	-	-	$ 2.0	$ 2.0
Total transit system	$2.4	$7.0	$27.2	$34.6
PER PASSENGER TRIP				
Cost of alternative	$0.72	$1.59	$7.92	$8.69
Cost of remaining buses	-	-	$0.73	$0.73
Total transit system	$0.72	$1.59	$4.56	$5.36

CONCLUSIONS

The following observations and conclusions can be made based upon the analysis described in this chapter.

Express and Local Bus

- o Use of the system which exists today will increase modestly by the year 2000, even without modifications.
- o Use of the present system may be increased if routes are modified to better serve the location of the population in 2000.

Bus Rapid Transit

- o A busway serving park-and-ride lots is the least expensive new alternative considered, with a annualized capital cost per trip of about $1.50, compared with $8. or more for rail alternatives.
- o Construction of a busway will ensure preservation of a right-of-way if a rail system becomes feasible in the future.
- o The bus rapid transit system proposed here is more effective than rail alternatives in terms of capital costs per automobile trip eliminated.
- o Because of the comparatively lower capital costs involved, a busway may have more likelihood of attracting the necessary public funds for construction.

Light Rail Transit

- o Few light rail transit (LRT) systems carry as few passengers as the 10,600 predicted to use the proposed system. The Newark City Subway, one of the smallest LRT systems in the country, carries about 10,000 a day.
- o A light rail system is expensive at about $220 million in capital costs or $8. per trip.
- o Many more trips shift from auto to transit with light rail when compared to a bus rapid transit system.
- o The necessity for a transfer in Camden in the case of the light rail alternative may be a significant deterrent. For the line to achieve the ridership estimated in this report, the transfer would need to be made easily. If interest persists in the light rail alternative, a further study might be made of the feasibility of eliminating the transfer by operating light rail cars along with PATCO trains to 16th and Locust.

Rail Rapid Transit

- A rail rapid system is very expensive at about $300 million, and total costs per trip are almost $9.

- Rail rapid transit offers the greatest potential for reducing auto travel in the corridor and for speeding the trips made on public transit.

- No rail rapid transit line operates today with as few passengers as the 12,500 predicted for such a line in the corridor. Staten Island Rapid Transit carries about 17,000 trips a day. Such a line requires large subsidies.

- A rail rapid transit line is likely to eventually draw heavily from ridership on the Lindenwold Line. Much of the growth of ridership on the Burlington Line will come at the expense of the Lindenwold Line.

- A rail rapid transit system has the greatest potential for shaping urban development, as demonstrated by the Lindenwold Line. The benefits of this effect are not fully reflected in this analysis.

CHAPTER VI

CONCLUSIONS

This chapter summarizes the study findings, recommendations and implementation costs. The role of agencies responsible for implementation is outlined, including their role in the programming process. Private-public partnerships in the planning and development of transportation improvement projects, and public participation are discussed. The chapter ends with a description of continuing planning efforts that should be advanced.

SUMMARY OF FINDINGS

Corridor Growth

The corridor has experienced slight (about 2%) population growth from 1970 to 1980 (to approximately 134,000 persons). This overall population increase (about 3,000 persons) consisted of a decrease within four municipalities and a population increase in the remaining six municipalities.

Maple Shade and Mt. Laurel received about two-thirds of the 1970 to 1980 increase in corridor dwelling units, raising their combined share of 1980 dwelling units (about 40,000 for the corridor) to 30%.

Population is projected to increase to about 150,000 persons between 1980 and the year 2000, averaging less than 1% growth per year.

Since household size in the corridor is expected to continue to decrease and the population is projected to increase moderately, nearly 12,000 additional dwelling units will be required in the corridor by the year 2000.

Three of the municipal land use plans (Hainesport, Lumberton, and Moorestown townships) are based on "build-out" or the achievement of maximum growth consistent with full development at planned densities.

Maple Shade, Merchantville, Mount Holly, Palmyra, and Pennsauken are mostly developed and have land use plan concepts oriented toward restoration, preservation and revitalization of community resources.

Traffic

The number of 1980 daily trips produced in the municipalities ranged from 115,800 in Pennsauken Township to a low of 8,100 by Hainesport residents for a corridor total of 402,000 trips per day.

The municipalities with the highest percentage of trips where both origins and destinations were within their own boundaries, including Lumberton and Mt. Holly, are those which are situated farthest from the cities of Philadelphia and Camden.

Existing traffic volumes tend to be highest in the western and central portions of the corridor and are projected to remain the highest in the future.

Overall travel growth from 1980 to the year 2000 in terms of vehicle-miles of travel and trips made in the corridor are projected to increase by 20 to 25 %.

Projected travel growth (as a percentage) tends to be greatest in the southeastern portion of the corridor. The smallest percentage increases are projected for older urban areas.

Maple Shade and Mt. Laurel are projected to capture about 43% of the corridor's trip growth from 1980 to 2000.

Since the amount of traffic volume growth on many highways and roads in the corridor will probably exceed the additional capacity added to the system, overall congestion levels are expected to increase.

Ten transportation problem areas containing existing and future deficiences have been identified.

Transit Potential

Light rail or rail rapid transit services offer the greatest potential for reducing auto travel in the corridor. However, such services are estimated to generate only between 10,000 to 13,000 trips daily in the year 2000. Some of this ridership would be diverted from the existing Lindenwold Line or other bus routes.

The busway alternative is estimated to increase transit ridership in the corridor by 3500 trips daily in the year 2000.

The impact of various growth scenarios on transit ridership in the corridor varies considerably. A "transit-oriented" scenario results in a minor increase in transit ridership over the base case. A CBD-focused scenario increased by nearly 75% the number of trips on the rapid rail alternative. However, even this optimistic scenario produces only 22,500 trips in the rail rapid transit alternative in the year 2000.

The cost of implementing one of the rail alternatives is estimated between $200 and $300 million. The cost of implementing the busway is estimated at about $50 million.

The capital cost per trip for rail is high ($8-$9) and does not justify either alternative. Also, operating cost per trip, the unit most often used in judging existing transit services, ranges from $2.10 to $2.45 for rail. The corresponding total and operating costs per trip for the busway alternative are $1.59 and $1.19, respectively.

SUMMARY OF RECOMMENDATIONS AND COSTS

Highways

Figure 6.1 presents a summary of the short-range transportation improvements that are described in Chapter IV. For each of the ten problem areas that were defined, the table indicates the specific improvement locations, a listing of proposed improvements, and the lead parties in the implementation process, which is discussed in the section on "Implementation". As shown in the table, short-range improvements have been recommended at more than 40 locations in the corridor. These improvements are needed by the end of 1990.

Figure 6.2 indicates a series of traffic studies that also should be accomplished over the short-range. These traffic studies should recommend a set of traffic improvements, most of which will be scheduled for completion in the long-range.

Figure 6.3 shows a summary of the long-range transportation improvements that are recommended by this study. System improvements at ten locations have been proposed. Upon completion of the studies listed in Figure 6.2 and other local, county and state efforts, the recommendations should be updated.

Cost summaries by problem area, prepared for planning purposes, are presented in the three tables. The costs, developed with information gathered at the field investigations, provide an order of magnitude estimate of funds required to complete the short-range improvements, traffic studies, and the limited number of long-range improvements that have been proposed. It should be noted that several projects have already been initiated during the course of this study.

As shown in Figure 6.1, about $26.1 million (the cost of right-of-way acquistion is not included) is required to implement the short-range improvement recommendations. This sum includes $23 million to improve N.J. 38 (problem area 9). About $250,000 is required to perform the eight studies that are proposed in Figure 6.2. These studies range in complexity from an analysis of a single intersection to a sub-area evaluation of an industrial zone. More than $9.5 million plus right-of-way (R.O.W.) acquistion costs will be required to implement the long-range improvements listed in Figure 6.3.

These total costs for short- and long-range improvements do not represent the total highway needs in the corridor, for several reasons:

1) Potentially expensive or complex traffic improvements have been recommended for future study and their anticipated improvement costs have not been allocated to either the short- or long-range.

2) The costs address only improvements required in the ten problem areas identified in the report.

3) Costs associated with the periodic operation and maintenance of streets and roads in the corridor are not included.

Figure 6.1

SUMMARY OF SHORT RANGE TRAFFIC IMPROVEMENT RECOMMENDATIONS
AND AGENCY RESPONSIBILITY

PROBLEM AREA 1: NJ 73 (Lead municipalities: Palmyra, Cinnaminson, Maple Shade) (Total Cost: $300,000)

LOCATION	RECOMMENDATION	AGENCY
A. High Street to Fork Landing Road	Stripe shoulder, erect median barrier	N.J. DOT
B. Fork Landing Road	Designate Old Fork Landing Road as one way westbound, replace missing signs, stripe curb lane	N.J. DOT, Cinnaminson
D. Remington Avenue	Replace street sign	Cinnaminson
E. Hylton Road	Improve turn signal, erect "no turn on red" signs on eastbound approach	Cinnaminson
F. Vicinity North Broad Street	Paint roadway markings and bridge abutments, prohibit turns onto North Broad Street, indicate access to Broad Street via Spring Garden Street, widen shoulder	N.J. DOT
G. 73 North of Souder Street to Toll Plaza	Widen to four lanes	N.J. DOT

PROBLEM AREA 2: Maple Shade (Lead municipality: Maple Shade) (Total Cost: $450,000 + R.O.W.)

LOCATION	RECOMMENDATION	AGENCY
B. N.J. 73 and Fellowship Road	Add signal and interconnect to signal at "Village of Deerfield" entrance	N.J. DOT, Burlington County
C. Fellowship Road and Mill Road	Restrict parking near intersection	Burlington County, Maple Shade
D. N.J. 73 and Maple Avenue	Signalize (if warranted), install signs, reconstruct pavement, install medians	N.J. DOT, Burlington County
E. North Fork Landing Road and Rail Road Crossing	Improve road surface and rail-road tracks	Maple Shade
F. N.J. 73 and Stiles Avenue	Improve and interconnect signals	N.J. DOT, Burlington County

PROBLEM AREA 3: Western Mount Laurel (Lead municipality: Mount Laurel) (Total Cost: $200,000 + R.O.W.)

LOCATION	RECOMMENDATION	AGENCY
A. Church Street and Ramblewood Parkway	Signalize intersection (authorized 7/83)	Burlington County, Mount Laurel

Figure 6.1 (Cont')

SUMMARY OF SHORT RANGE TRAFFIC IMPROVEMENT RECOMMENDATIONS AND AGENCY RESPONSIBILITY

LOCATION	RECOMMENDATION	AGENCY
B. Springdale Road and Church Road	Lengthen two-lane approach of northbound Springdale to Church Road, relocate utilities and guardrail	Burlington County, Mount Laurel
D. Fellowship Road and East Park Drive, West Park Drive, Eastgate Lane	Signalize (if warranted), resurface at Eastgate Lane, relocate signing at East Park Drive, stagger work hours for industrial and office park	Burlington County, Mount Laurel
E. Church Road and Waverly Avenue	Improve signs redesignate lanes, remove vegetation and move utility poles	Burlington County, Mount Laurel

PROBLEM AREA 4: N.J. 38 (Lead Municipality: Moorestown) (Total Cost: $350,000 + R.O.W.)

LOCATION	RECOMMENDATION	AGENCY
A. Kings Highway and Lenola Road	Widen approaches, improve signals, redesignate lanes, improve curve radius, relocate utilities	Burlington County, Moorestown
B. N.J. 30 and Lenola Road	revise signal timing and interconnect, modernize signal faces	N.J. DOT, Burlington County
C. N.J. 38 and Nixon Drive	redesignate lanes	N.J. DOT, Moorestown
D. N.J. 38 and Pleasant Valley Road	revise signal phasing, lengthen Route 38 left-turn slot	N.J. DOT, Burlington County
E. N.J. 38 and Church Street and Fellowship Road	Redesignate lanes, improve geometrics	N.J. DOT, Burlington County
F. N.J. 38 and Mount Laurel Road	Redesignate lane, increase capacity for turning movements	N.J. DOT, Burlington County
G. Mount Laurel Road and Main Street	signalize (if warranted)	Burlington County, Moorestown
H. Church Street and Hooten Road	Signalize (if warranted) redesignate lanes, move shrubbery	Burlington County

PROBLEM AREA 6: Marne Highway (Lead Municipalities: Moorestown, Mount Laurel, Hainesport) (Total Cost: $1,200,000 + R.O.W)

LOCATION	RECOMMENDATION	AGENCY
A. Borton Landing Road and Marne Highway	Widen intersection approaches	Burlington County
B. Borton Landing Road and Conrail	Widen roadway, redesignate lanes	Burlington County
C. Westfield Road and Marne Highway	Modify intersection geometrics	Burlington County
D. Hartford Road and Marne Highway	Improve turn radius, relocate utility poles, remove shrubs	Burlington County
E. Creek Road and Marne Highway	Signalize (if warranted), provide left-turn lane, construct medians	Burlington County

Figure 6.1 (Cont')

SUMMARY OF SHORT RANGE TRAFFIC IMPROVEMENT RECOMMENDATIONS AND AGENCY RESPONSIBILITY

LOCATION	RECOMMENDATION	AGENCY
F. Marne Highway Over Rancocas Creek	Reconstruct bridge	Burlington County
G. Broad Street, Lumberton Road and Marne Highway	Signalize	Burlington County Hainesport
H. Mount Holly By-Pass and Marne Highway	Revise signal timing, perform accident analysis	Burlington County

PROBLEM AREA 7: Hainesport-Mount Laurel Road (Lead Municipality: Hainesport)
(Total Cost: $100,000 + R.O.W.)

LOCATION	RECOMMENDATION	AGENCY
A. Morrestown-Mount Laurel Road	Reduce and enforce speed limit, fully signalize (if warranted)	Burlington County
D. Route 38 and Hainesport-Mt. Laurel Road	Repave roadway and improve shoulders at intersection	N.J. DOT, Burlington County
E. Creek Road and Hainesport-Mt. Laurel Road	Remove shrubbery and re-landscape	Burlington County

PROBLEM AREA 8: Mount Holly (Lead municipality: Mount Holly
(Total Cost: $400,000 + R.O.W.)

LOCATION	RECOMMENDATION	AGENCY
A. King Street and Washington Street	Acquired right-of-way to increase capacity	Burlington County
B. Rancocas Road and King Street	Acquire right-of-way to increase capacity, restripe	Burlington County
D. Washington Street and High Street	"TOPICS" project including the up-grading of traffic signals	Burlington County
E. Mill Street and Pine Street	Revise signal timing and interconnect	Burlington County
F. Mount Holly By-pass and Rancocas Road	Revise signal timing	Burlington County
G. Mount Holly By-Pass and High Street	Widen approaches and improve geometrics	Burlington County

PROBLEM AREA 9: N.J. 38, Mount Holly By-Pass to Pine Street
(Lead Municipality: Mount Holly)
(Total Cost: $23,000,000)

LOCATION	RECOMMENDATION	AGENCY
N.J. 38, Mount Holly BY-Pass to Pine Street	Currently addressed by N.J. DOT from N.J. Turnpike to Lumberton Road	N.J. DOT, Burlington County

PROBLEM AREA 10: Lumberton (Lead municipality: Lumberton)
(Total Cost: $100,000 + R.O.W.)

LOCATION	RECOMMENDATION	AGENCY
Lumberton-Mount Holly Road and Newbold's Corner-Lumberton Road	Widen and realign, signalize (if warranted)	Burlington County

Figure 6.2

SUMMARY OF TRAFFIC IMPROVEMENT STUDIES
AND AGENCY RESPONSIBILITY

LOCATION	RECOMMENDATION	AGENCY
PROBLEM AREA 3: Western Mount Laurel (Lead municipality: Mount Laurel) (Total Cost: $30,000)		
A. Church Street and Ramblewood Parkway	Investigate circulation and a need for a deceleration lane	Burlington County, Mount Laurel
B. Springdale Road and Church Road	Study feasibility of connecting Springdale and Church Roads	Burlington County, Mount Laurel
PROBLEM AREA 4: N.J. 38 (Lead Municipality: Moorestown) (Total Cost: $50,000)		
D. N.J. 38 and Pleasant Valley Road	Continue to investigate the widening of Pleasant Valley Road	N.J. DOT
E. N.J. 38 and Church Street and Fellowship Road	Perform traffic study with delay analysis	N.J. DOT, Burlington County
I. N.J. 38 and Marter Avenue	Study impact of future development	N.J. DOT, Burlington County
PROBLEM AREA 5: Northwestern Moorestown Industrial Park (Total Cost: $100,000)		
A. Northwestern Moorestown Industrial Zone	Study alternatives to improve highway access to industrial zone	N.J. DOT, Burlington County, Moorestown
PROBLEM AREA 6: Marne Highway (Lead Municipalities: Moorestown, Mount Laurel, Hainesport) (Total Cost: $25,000)		
E. Creek Road and Marne Highway	Investigate reconstructing conrail underpass	Burlington County
PROBLEM AREA 10: Lumberton (Lead municipality: Lumberton) (Total Cost: $50,000)		
Lumberton-Mount Holly Road and Newbold's Corner-Lumberton Road	Study a bypass facility around the Village of Lumberton	N.J. DOT, Burlington County, Lumberton

Figure 6.3

SUMMARY OF LONG RANGE TRAFFIC IMPROVEMENT
RECOMMENDATIONS AND AGENCY RESPONSIBILITY

LOCATION	RECOMMENDATION	AGENCY
PROBLEM AREA 1: N.J. 73 (Lead Municipality: Moorestown) (Total Cost: $600,000)		
C. U.S. 130 Interchange	Replace bridge deck	N.J. DOT
PROBLEM AREA 2: Maple Shade (Lead municipality: Maple Shade (Total Cost: $60,000 + R.O.W.)		
A. Mill Road and South Fork Landing Road	Realign intersection geometrics	Burlington County
PROBLEM AREA 3: Western Mount Laurel (Lead municipality: Mount Laurel (Total Cost: $500,000 + R.O.W.)		
C. N.J. 73 and Church Road	Consolidate Church Road approaches, improve shoulders, cutback curbs	N.J. DOT, Burlington County
PROBLEM AREA 6: Marne Highway (Lead Municipalities: Moorestown, Mount Laurel, Hainesport) (Total Cost: $950,000 + R.O.W.)		
E. Creek Road and Marne Highway	Modify intersection geometrics, consolidate approaches	Burlington County

LOCATION	RECOMMENDATION	AGENCY
PROBLEM AREA 7: Hainesport-Mount Laurel Road (Lead Municipality: Hainesport) (Total Cost: $7,200,000 + R.O.W.)		
B. Hainesport-Mount Laurel and Ark	Construct new roadway to remove Phillips Road from intersection	Burlington County
C. Masonville-Fostertown Road	Signalize (if warranted) realign intersection	Burlington County
Union Mill Road	Widen to four lanes	Burlington County, Hainesport
Walton Road	Finish paving realign	Burlington County, Hainesport
Hartford Road	Widen to four lanes	Burlington County, Hainesport
PROBLEM AREA 8: Mount Holly (Lead municipality: Mount Holly (Total Cost: $250,000 + R.O.W.)		
C. Rancocas Road and High Street	Modify signals, realign and redesignate lanes	Burlington County

Transit

Based on the evaluation of existing and future travel demand in the corridor and a brief analysis of capital and operating costs, a recommendation of a light rail or rapid rail extension into Burlington County does not appear to be justified. Projected ridership in the year 2000 on either of these lines would be under 23,000 trips per day under the most optimistic conditions and would probably be in the 10,000-13,000 trip range on a daily basis. Furthermore, some of this ridership would be diverted from the existing PATCO system in which a significant public investment has already been made. Given the estimated cost of between $200 and $300 million to purchase vehicles and construct a light or rapid rail extension, the cost-effectiveness of these transportation service alternatives is low.

However, because of the uncertainty about the future, it may be appropriate to re-examine these alternatives after 1990 census data is available. A re-orientation and strengthening of travel patterns from the corridor toward the Camden and Philadelphia central business districts could increase the justification for a new rail facility and the need for re-evaluation.

Acting alone, it is not likely that the municipalities in the corridor can direct their growth and development in a way that would enhance the potential of either rail alternative. Rather, major regional efforts (with the cooperation of local governments) to strengthen central business districts and to encourage employment to locate in these areas would be a step in the direction of supporting rail transit. Other factors could also cause a significant increase in the anticipated rail ridership. For example, a shifting of travel modes from automobile to transit might result from an extensive fuel shortage, thereby increasing the need for transit development.

Therefore, it is recommended that planning for the corridor maintain the assumption that a new rail service is a long-range possibility, although small, (more than 15 years). Inorder to keep this option open, at least one right-of-way should be reserved for the facility and growth and development should be discouraged from sprawling over the corridor. This strategy has the added benefits of conserving land, saving energy and reducing infrastructure requirements.

It is also recommended that an exclusive busway for the corridor be studied in more detail. Such a system would divert from automobile to transit about 35% of the trips estimated on the rail rapid alternative; the cost of constructing and operating the busway is approximately 15% of the rapid rail line. It appears that the busway alternative becomes most feasible if automobile access (provision of parking) is maximized.

The new study might examine the possibility of staging the implementation of the corridor busway. Park-and-ride facilities might be built first, served by frequent, reliable and comfortable express bus service. Over time, ridership on the bus line would increase and the construction of the second phase (the busway) would be justified.

Growth Management

The Burlington Corridor has experienced only modest growth (over the past 10 years) and projections for the next 15 years indicate that growth of population and employment will continue at about the same rate. However, certain areas within the corridor are growing at much faster rates and new industrial, commercial, and residential development is occurring at various locations. Much of the new growth and development is occurring in the southern and eastern portions of the corridor. Also, growth of other areas in the corridor, such as the northwestern industrial zone in Moorestown Township (which will impact Cinnaminson Township), may experience significant new growth.

The growth of residential, industrial, and commercial areas in the Burlington corridor may cause additional traffic congestion in the vicinity of the development which may spill over onto the roads in more established areas. Recognizing that it will be difficult to construct major new transportation facilities, the municipalities in the corridor are presented with a choice. Are the benefits from growth worth the costs on existing communities?

Since this report has only addressed transportation issues, a comprehensive answer to this question cannot be offered here. The response should be based on an evaluation of community values, housing supply, educational facilities, other public services, environmental features, and so on. However, from a transportation perspective only, a balanced approach is proposed. Growth should be encouraged to locate in those areas which have, or will have the infrastructure to accommodate it, and only if spill-over impacts can be absorbed by neighboring communities.

Since decisions about growth are often made at the local level (e.g. a municipality wants an industrial park) and major infrastructure decisions are often made at the state or federal level (e.g. a new highway will not be constructed), there may be conflicts among plans for a given area. Over time, the parties respond to the actions of each other and may modify their plans. However, there is often a time lag before adjustments are made and counter-productive activities occur.

This imbalance in the planning process suggests a more significant role for an intermediary to review land use decisions from a larger perspective. County government is in a unique position to fill this function and to provide a balancing force. Local aspirations must be translated into corridor-level and county-level plans that are internally consistent and then communicated to state-level decision-makers for appropriate and supporting actions.

One way to increase the amount of development that could be accommodated by the transportation system would be to change local zoning on a county or regional basis to encourage cluster housing and industrial uses along existing and potential transit lines. While most trips in the corridor begin or end at home, the other end is usually a non-residential activity. Since these schools, factories, stores, and offices are dispersed, they can be approached only by automobile. If they are clustered together, they can begin to support bus lines or other transit services. This is especially true for employment opportunities, but it applies to shopping, schools and other destinations as well. The effect may be more significant than that from raising residential densities; furthermore, this approach may be more realistic.

A variety of growth management tools including impact fees and taxes, assessments, exactions, growth staging, adequate public facilities ordinances, and developer incentives are available to municipalities that want to manage growth. Before using these tools, local officials must examine carefully their cost-effectiveness with respect to their communities.

The money received from developers after application of one of these growth management tools can be placed in an escrow account for transportation improvements. These funds would then be used for overall transportation system improvements in this area.

A special seminar should be conducted for local and county planners to introduce them to growth management tools and to initiate discussion of a corridor-level strategy.

IMPLEMENTATION

Implementation of the study recommendations is the most important phase in the planning process since it results in the construction of new and improved facilities and better transportation service. Successful implementation, however, requires coordination and depends on many considerations and decisions by a number of individuals and groups.

Agency Responsibilities

To implement the recommended transportation improvements and those that will result from studies proposed in this report, agencies at the local, county, regional, and state levels must do their part in the the planning, capital programming, design and construction process.

Municipalities

For implementation to proceed, the municipalities in the study corridor must concur with the proposed improvements in the report. After concurrence on the scope of the proposed improvements, each municipality, with the assistance of Burlington or Camden counties, must follow-through in the implementation of the traffic improvements. Assistance in implementation, which includes local financing, engineering, land acquisition, and construction should also be sought from appropriate developers and businesses. The townships may want to suggest that escrow accounts be established by new developers and the business community to fund some of the needed improvements.

Counties

Burlington and Camden Counties' function is to develop projects and priorities for capital programming by the county and region. In addition, the process requires that the counties coordinate with the municipalities, DVRPC, and NJ DOT. Because of funding constraints, high priority must be assigned to the proposed improvements in the corridor to enable them to be advanced in Fiscal Year 1985. The counties must rank the improvements near the top of their transportation improvement program lists to assure full consideration of the projects for programming and county, state or federal funding.

Delaware Valley Regional Planning Commission (DVRPC)

DVRPC's primary responsibilities toward implementing the transportation improvements are to evaluate the technical merits of projects, establish priorities, and program projects. Prior to programming, the Commission staff must evaluate projects based on criteria established by NJ DOT and U.S. DOT. In addition, the recommended improvements may be potential candidates for special state programs.

New Jersey Department of Transportation (NJ DOT)

NJ DOT's responsibility is to support local, county, and regional initiatives by programming transportation improvements at the state level. After programming, it is charged with the tasks of engineering, acquiring any needed land, obtaining federal and state funds, and constructing the improvements under state jurisdiction. Local acceptance and cooperation will assist NJ DOT in implementing the Corridor improvements.

New Jersey Transit (NJT)

Public transportation recommendations for the State of New Jersey are primarily the responsibility of NJ Transit. Working cooperatively with governments and the residential and business communities in the corridor, the southern division of NJ Transit must seek to provide improved transit service. Several issues concerning new local, express, and shuttle bus services raised during the study should be addressed.

Delaware River Port Authority (DRPA)

DRPA operates four bridges between New Jersey and Pennsylvania and the PATCO High Speed Line in Southern New Jersey. Since some highway improvements in the corridor will affect bridge traffic, and some transit improvements in the corridor are operated by DRPA or linked to their existing line, the Port Authority should participate in transportation improvement decisions. Their responsibility is to work cooperatively with the agencies discussed in this section to identify and implement transportation improvements that will benefit the corridor and the region.

Private-Public Partnership (Creative Financing)

The benefits from constructing transportation projects in the corridor will accrue to employers, developers, and others who use the improvements, or who benefit by increased activity. It is in the interest of these firms and groups to participate in the planning and financing of the projects if the benefits to each exceed their share of the costs, particularly, if governments or transportation operators would not implement the improvements without this private support. It is in the interest of governments and transportation operators to develop and support improvements that have identifiable benefits to businesses and developers, especially when public funds are scarce and the transportation improvements would benefit the region.

Private-public partnerships and creative financing arrangments should be developed and built upon this economic principle. It is most effectively accomplished by including the public and private sectors from the early stages of planning to the final implementation stages of programmed projects. The formation of special transportation task forces for specific problem areas are recommended to stimulste active participation of the interested parties. The task forces provide a forum to discuss issues, establish goals, undertake studies, define alternatives, make recommendations, and design implementation strategies.

Strong leadership is an important element of the successful task force. Working in a cooperative environment, the leadership role may be filled by representatives from the private or public sector. The principal functions of the leadership role include developing momentum for action, increasing participation from the local community, and guiding the overall planning process.

Funding Priorities and Programming

Funding priorities are set annually as part of the budgetary process of each government as it appropriates funds to implement particular transportation programs and projects. This report and other studies addressing issues related to the corridor can be used in this budgetary process by setting guidelines for the development objectives of the area and the range of needed improvements.

In general, the governments, due to financial resource constraints, will not be able to implement the entire package of needed transportation projects in a short time frame. Therefore, a strategy for achieving the transportation objectives of the corridor should include a priority ranking by the county governments. For some projects that may be funded exclusively from local resources, rankings are not required.

The annually updated regional Transportation Improvement Program (TIP) specifically lists projects to be undertaken in the next five-year period for New Jersey counties. The program is established with the local units of government and includes low cost improvements as well as more costly, large-scale improvements for each transportation mode. Of special importance is the "annual element" of the TIP which lists projects that are programmed to advance over the first year of the five-year period. The process of addressing, reviewing, and updating the TIP project listings each year provides a continuing opportunity to consider funding priorities for the immediate future and to build support for long-range plans.

Public Participation and Information

The recommendations in this report are designed to make the transportation system that is used by residents and businesses more acceptable and efficient at a low cost. As such, many of the projects have direct benefits to a public that walks, bicycles, drives, and uses public transit. Since many people are affected by the proposals, it is important to promote participation by affected interest groups.

Accordingly, public participation and information efforts should concentrate on three areas: public involvement in the task force structure and programming process; public meetings about proposed projects; and dissemination of information about activities in the corridor.

The citizen advisory committee, a public forum for discussion, should also be given a detailed presentation on the study findings and recommendations, after which the committee will provide input into the process of establishing regional priorities.

Continuing Planning

Transportation service in the corridor is related to many technological and socio-economic factors that are changing. For example, there are many possibilities for substituting telecommunication for personal travel. Special television systems may provide a means for business meetings, education, and the conveyance of papers. Also, the magnitude and type of future development or changes in travel behavior, because of special situations such as fuel shortages, are difficult to predict. Therefore, priorities may change in the context of new funding constraints and political forces.

The recommended improvements for the Burlington Corridor should be reviewed, along with other improvements for the region, in several years to confirm or modify these guidelines for decision makers. During the interim period efforts should be made to resolve outstanding issues. Small traffic studies to support, revise, and augment recommendations should be advanced.

APPENDIX A

TRANSIT POTENTIAL METHOD OF ANALYSIS

The following list of steps briefly describes the analysis. The approach is based upon the UMTA publication, "Transit Corridor Analysis: A Manual Sketch Planning Technique", issued in April 1979. Considerable modifications have been made to adapt the method to the region and corridor.

(1) Define a service area - In this case the service area includes all those municipalities within the corridor boundaries and adjacent census tracts which contribute to ridership. The service area was then divided into analysis zones of increasing size as the distance increases from the center of the corridor where the proposed improvements will be located. There are 53 such "origin" zones.

(2) Determine person trips between origin zones and three "destination" zones - The three zones are Philadelphia CBD west of Broad Street, Philadelphia CBD east of Broad Street, and the Camden CBD. Similarly, predict person-trips between these sets of zones for the year 2000. These trips are divided between home-based work trips and all other purposes.

(3) Determine the proportion of the population who can walk to a transit stop in each origin zone - In the case of existing bus lines, this is anyone residing within a quarter mile of the line and in the case of rail lines, or bus park-and-ride lots, anyone within a quarter mile radius of a station. This walk will average five minutes in length. The remaining population is assumed not to be served in the case of existing bus, or will approach by auto in the case of bus rapid and rail alternatives. Shuttle bus access is not considered because of its very light usage experienced on the PATCO Lindenwold Line.

(4) Determine an impedance for each transit mode and for the highway system from each production zone to each destination zone - These impedances will be reflective of the combination of walk and auto access to each transit line. The formula for these calculations is:

For highways:

Impedance = Network access time
+ Running time
+ Operating costs/6.0
+ Out-of-pocket costs/6.0
+ Egress walk time x 2.5

For transit (walk approach):

Impedance = Walk Time x 2.5
+ Line haul time
+ (Headway/2) x 2.5
+ Fare/6.0
+ Transfer penalty (if any)
+ Egress walk time x 2.5

For transit (auto approach):

Impedance = Network access time
+ Running time (auto) x 2.5
+ Operating costs/6.0
+ Out-of-pocket costs/6.0
+ Line haul time
+ (Headway/2) x 2.5
+ Fare/6.0
+ Transfer penalty (if any)
+ Egress walk time x 2.5

For zones where a combination of walk and auto approach market exists, an impedance is calculated for each.

Figure A.1 describes the assumptions used in calculating highway impedances and Figure A.2 provides similar data for the transit alternatives.

(5) Calculate the percent of trips in each zone using the subject alternative. This calculation is made by relating the impedance of the alternative to that of highway and any other transit system which may be competing for the zones' trips. This calculation is made in the following way in the case of home-based work trips:

$$\text{Percent Using Alternative} = \frac{(1/Ia)^2}{(1/Ia)^2 + (1/It)^2 + (1/Ih)^2}$$

Where:

Ia = Impedance of alternative
It = Impedance of competing transit system
Ih = Impedance of auto (highway system)

The percent on any competing transit system can be calculated by substituting "It" for "Ia" in the numerator.

Figure A.1 MODEL ASSUMPTIONS OF COMPETING AUTO TRAVEL

Operating costs (Out-of-pocket)	$0.12/mile
Avg parking costs - Camden	$0.75
Avg parking costs - Phila	$2.25
Egress time (1)	5 minutes
Suburban speed: outer zone (2)	35 mph
Suburban speed: inner zone	30 mph
Suburban taxi factor (3)	1.3
Tolls to Philadelphia (4)	$0.50
CBD speed	15 mph
CBD taxi factor (3)	1.4
Network access time (5)	5 minutes

(1) Time required to reach destination after parking car
(2) Outer zone Maple Shade and east
(3) Multiple of airline distance required to conform to street patterns
(4) Assumes use of commuter sticker
(5) Time required to reach arterial highway network after leaving residence

Figure A.2 MODEL ASSUMPTIONS OF TRANSIT ALTERNATIVES

	Express & Local Bus	Bus Rapid Transit	Light Rail Transit	Rail Rapid Transit
Walk time to line/station	5 min	5 min	5 min	5 min
Auto speed to station	-	30 mph	30 mph	30 mph
"Auto factor" (1)	-	2.5	2.5	2.5
Parking cost at station	-	$0.25	$0.25	$0.25
Speed: Outer zone to Camden	22 mph	20 mph	25 mph	40 mph
Speed: Outer zone to Phila	20 mph	15 mph	20 mph	30 mph
Speed: Inner zone to Camden	17 mph	20 mph	25 mph	40 mph
Speed: Inner zone to Phila	15 mph	15 mph	20 mph	30 mph
Headways (2)	Varies	Varies	6 min	6 min
Fares (3)	NJT	NJT	PATCO	PATCO
Egress Walk Time	5 min	5 min	5 min	5 min
Impedance of Transfer to PATCO (4)	-	-	20.0	-

(1) Auto approach distance is multiplied by this factor to reflect reluctance of tripmaker to change modes
(2) Headways of bus are unique to each zone according to which line serves it
(3) NJT = Based on NJT fares; PATCO = Based on PATCO fares
(4) Impedance factor to reflect inconvenience of transfer to PATCO necessary for Philadelphia-bound passengers.

The percent of other than home-based work trips is similarly calculated except that an exponent of 3 is used instead of 2, and headways are assumed to be two and a half times those experienced by work trip passengers. It should be noted that headways are used as a surrogate for the level of service rather than an actual wait time.

(6) Calculate total trips using a multiplier. Upon summing the trips made on the subject alternative between the origin and destination zones cited in (2) above, these sums are factored upward to obtain total trips and account for:

(a) trips originating in other zones
(b) trips destined to other zones
(c) trips between the study area zones

These factors are 2.5 for bus and 1.2 for new passengers on the bus-rapid, light rail and rail rapid transit.

(7) Examine different growth scenarios. After calculating total daily trips and peak hour trips for the base case, repeat the steps using different trip tables representing some other development scenarios. These include:

(a) All estimated trip growth for the corridor occurs only in those zones which are in the top half when listed by percent using transit, that is, a transit-oriented growth scenario.

(b) As above, except that growth between 1980 and 2000 will be twice the rate assumed in the base case.

(c) A scenario in which the trip-making patterns of the base case population become as oriented to the CBD as those which occur in the Lindenwold corridor today. That is, the number of trips per capita between the study area and the central business districts are equal to the rate in the Lindenwold Corridor. This scenario is used only to assess the impact on the rail rapid transit.

APPENDIX B

TRANSIT POTENTIAL COST MODEL

In order to compute operating cost and capital cost of rolling stock, operating assumptions about each alternative had to be made. Operating assumptions are then used to compute vehicle requirements, which in turn are used to compute vehicle capital cost.

Table B.1 OPERATING ASSUMPTIONS FOR ALL ALTERNATIVES

Hours of operation	
Peak periods	4 hours
Off-peak periods	14 hours
Night operation	6 hours
Headway	
Peak periods	According to demand
Off-peak periods	15 minutes
Night	40 minutes
Peak hour factor	20% of daily volume
Vehicles required/vehicle in operation (Total vehicle factor)	1.1

Table B.2 SPEED, ROUTE-MILES AND CYCLE TIME BY ALTERNATIVE

	Local/ Express Bus	Bus Rapid Transit	Light Rail Transit	Rail Rapid Transit
Speed (MPH)	18	20	25	30
Minutes/mile	3.33	3.00	2.40	2.00
Route-miles	12.6	12.6	14.9	12.6
Terminal time/running time	20%	20%	15%	10%
Cycle time (Minutes)	101	91	69	56
Peak hour riders	2240	2940	2120	2500
Vehicle trips/peak hour	45	59	25*	36
Vehicle miles/revenue miles (Vehicle-mile factor)	1.15	1.15	1.05	1.05

* Plus 30 trips on PATCO to accommodate transfers

Table B.3 CAPITAL COST ASSUMPTIONS

	Local/ Express Bus	Bus Rapid Transit	Light Rail Transit	Rail Rapid Transit
Vehicles				
Number of seats	50	50	85	70
Cost per vehicle (Millions)	$0.2	$0.2	$1.0	$0.8
Life of vehicle	15	15	40	40
Capital recovery factor	.1468	.1468	.1213	.1213
Route (Way, stations, facilities)				
New route miles		6.8	11.4	9.1
Route service miles	12.4	12.4	14.9	12.4
Cost per new route mile (Millions)		$4.5	$15.0	$30.0
Life of route		20	50	50
Capital recovery factor		.1339	.1210	.1210

The following relationships were used in calculating vehicle requirements:

1. (Peak hour volume) = (Peak hour factor) x (Daily ridership)

2. (Operating vehicles required) = ((Peak hour volume)/(Seating capacity)) x (Cycle time in hours)

3. (Total vehicles required) = (Total vehicle factor) x (Operating vehicles required)

The following relationships were used in calculating annual vehicle-miles.

4. (Total revenue miles) = (Vehicles per hour) x (Service period--peak, off-peak or night--in hours) x (Route miles)

5. (Total daily miles) = (Total revenue miles) x (Vehicle-mile factor)

6. (Total annual vehicle-miles) = (Total daily miles) x (Equivalent days per year--300)

Table B.4 CAPITAL COST OF ALTERNATIVES

	Local/ Express Bus	Bus Rapid Transit	Light Rail Transit	Rail Rapid Transit
Alternative:				
Number of vehicles	83	88	32 (1)	37
Vehicle costs (Millions)	$16.6	$17.6	$32 (2)	$29.6
Annualized vehicle cost (Millions)	$2.4	$2.9	$5.5	$3.6
Route cost (Millions)	-	$30.6	$17.1	$27.3
Annualized route cost (Millions)	-	$4.1	$20.7	$29.0
Total cost of alternatives (Millions)	$16.6	$50.2	$216.6	$302.6
Annualized cost of alternatives (Millions)	$2.4	$7.0	$25.2	$32.6
Capital cost per trip	0.72	1.59	7.92	8.69
Remaining bus system cost:				
Capital cost (Millions)			$13.8	$13.4
Annualized cost (Millions)			$2.0	$2.0
Total Cost of Transit Service:				
Capital Cost (Millions)	$16.6	$50.2	$230.4	$316.0
Annualized cost (Millions)	$2.4	$7.0	$27.2	$34.6
Capital cost per passenger trip	0.72	1.59	4.56	5.36

(1) Plus 17 Patco vehicles to accommodate transfers.
(2) Plus $13.6 million for additional Patco vehicles.

level planning activities. The Urban Mass Transit Administration and Federal Highway Administration were invited to provide guidance on federal policies and programs.

The following agencies and groups were invited to participate on the Advisory Committee.

State Department of Transportation (Sponsor)

County Governments

Municipal Governments

NJ TRANSIT

Regional Planning Commission

County Transportation Advisory Board

New Jersey Department of Environmental Protection

New Jersey Department of Community Affairs

Urban Mass Transit Administration

Federal Highway Administration

Burlington County Bridge Commission

Citizen Representative

Chamber of Commerce