

**PUBLIC TRANSPORTATION
DEVELOPMENT STUDY**

for the

GREATER NEWARK AREA

December 1990

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EXECUTIVE SUMMARY

This document constitutes the final report of the Public Transportation Development Study for the Greater Newark area. With the goal of guaranteeing the future of Newark as a residential and educational community, a set of short and long term strategies was developed to reduce downtown and commuter traffic volumes by increasing public transit ridership.

Based on a thorough analysis of the current situation and the anticipated situation in the year 2010, the following recommendations were made:

- Short term:
 - = Schedule buses at constant headways
 - = Re-route AM/PM UNICITY buses from residential to employment areas
 - = Improve information to potential riders
 - = Provide opportunity for advance ticket purchases
 - = Improve transit appearance
 - = Provide exclusive transit right-of-ways
 - = Open University Shuttle to general public
 - = Encourage use of Park 'n Ride lots
 - = Encourage car and vanpooling
 - = Increase downtown parking rates
 - = Implement signage program

- = Implement staggered work hours

- Long term:
 - = Establish Transportation Management Associations
 - = Expand service area of public transportation
 - = Construct a timed transfer center
 - = Design for exclusive transit right-of-ways
 - = Maintain continuous attention for land use and development

These strategies and improvements are in most cases not a ready to implement solution; certainly for long term improvements separate feasibility studies will be necessary. This document, then, should be regarded as a guideline for future improvement of public transportation in the Greater Newark area.

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1. INTRODUCTION

1.1 Overview

The City of Newark is a rapidly growing community in northern New Castle County. While the Greater Newark Area was once mainly an agricultural region, residential development has increased dramatically after World War II and shaped Newark into the residential and educational community it is today. Despite the arrival of major industries such as Chrysler and DuPont, Newark still retains much of that character.

However, development has not come without its toll. Many of Newark's residents commute daily to nearby business centers such as Wilmington and, to a lesser extent, Philadelphia, mainly by private transportation. This resulted in increased traffic volumes on in and outbound Newark roads. Increasing enrollment at the University of Delaware, located in the heart of Newark, has caused a surge local traffic, often resulting in congestion and pollution. Lastly, Newark's location in the northeast corridor subjects the city to heavy through traffic, notably to and from southern Delaware, eastern Maryland and south-eastern Pennsylvania.

The development of transportation facilities, however, has not kept pace with this rapid expansion; the capacity of major roads is no longer adequate and the current public transportation systems are not used to their maximum benefit.

The Newark Area Transportation Study, published in March 1989, and the Year 2010 Transportation Plan, adopted in 1988, addressed these problems, but both concentrated on improvements for private transportation, and despite the improvements that were suggested, a substandard Level of Service was still predicted on a substantial part on the Greater Newark Area's roadway system. It was thus realized that the development and improvement of a public transportation system is instrumental in order to guarantee the future of Newark as a residential and educational center.

Specific objectives to be attained are the following:

1. Reduction of downtown private automobile traffic
2. Reduction of commuter traffic
3. Increase transit ridership

This Public Transportation Development Study will suggest short and long term improvements for the current transit system and make long term strategies for the implementation of new transit elements in the Greater Newark Area. The recommendations are, in most cases, not ready to implement and each will require a separate feasibility study. Rather, this document provides guidelines for the development of an improved transit system. Some recommendations may be regarded as a substitute for those in the Newark Area Transportation Study.

1.2 Study Area

The study area is bounded by the State of Pennsylvania on the North, a line from Milford Crossroads to Ogletown on the East, Pulaski Highway on the South and the State of Maryland on the west (see figure 1-1).

1.3 Project Approach

This project follows rather closely the methodology that was used in the Newark Area Transportation Study. The Public Transportation Development Study consisted of two phases, phase 1 concentrating on short term improvements and phase 2 concentrating on long term recommendations. The project involved nine tasks:

PHASE 1:

1. Review of previous studies
2. Inventory of current situation
3. Development of deficiency criteria and standards
4. Identification of deficiencies
5. Development of short term improvements

PHASE 2:

6. Forecasting of Year 2010 conditions
7. Development of Year 2010 Measures of Effectiveness
8. Identification of Year 2010 deficiencies
9. Development of long term improvements and

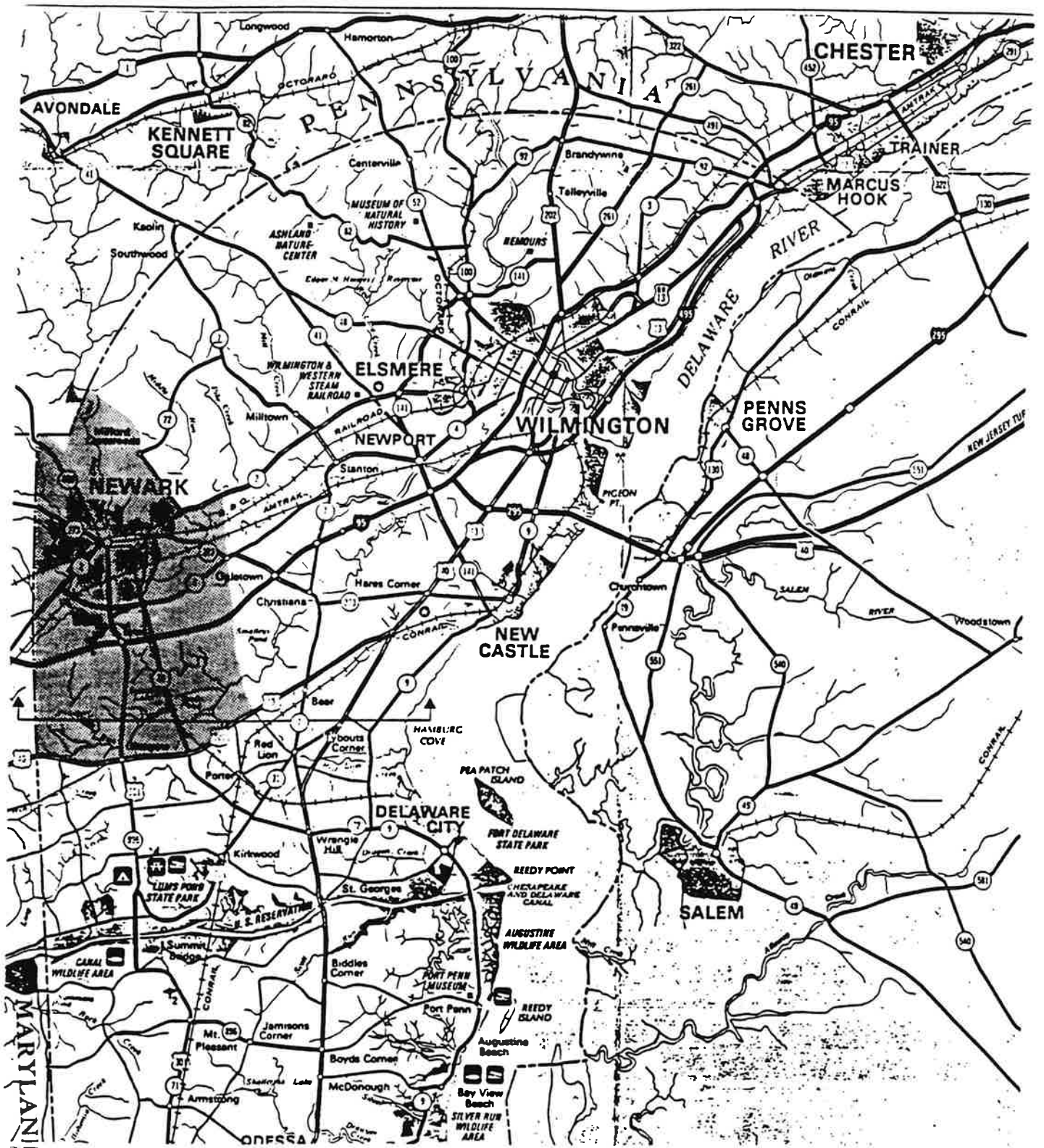


Figure 1-1
Study Area

recommendations

Each step will be discussed in detail in this report.

2. REVIEW OF PREVIOUS STUDIES ---

Several publications were reviewed to provide background information for the Public Transportation Development Study and to provide an in-depth assessment of the issues that are involved. The materials that were reviewed are the following:

1. Comprehensive Development Plan II. City of Newark, Delaware, 1987.
2. DART Strategic Development Plan, Technical Memorandum: Analysis of DART Service, Abrams, Cherwany & Associates, 1988.
3. Expanded Metroform Area Study - Final Report, Vanasse Hangen Brustlin, Inc., 1988
4. Newark Area Transportation Study - Final Report, Vanasse Hangen Brustlin, Inc., 1989.

3. INVENTORY OF CURRENT SITUATION

The inventory of the current situation was divided into three categories: travel facilities, travel characteristics, and socio-economic factors. Each category was analyzed separately. At the same time, standards and deficiency criteria, by which the current situation is assessed, were developed.

3.1 Travel Facilities

Two categories of travel facilities were researched: the roadway network and the system of public transportation.

3.1.1 Roadway Network

The roadway network was evaluated on three standards: average daily traffic volumes, average travel speed, and level of service. Data were primarily obtained from the Newark Area Transportation Study and annual traffic summaries published by the Delaware Department of Transportation.

Figure 3-1 presents the average daily traffic volumes for the major roads in the study area for 1985. These volumes are certainly high; roads leading to the Wilmington area (Kirkwood Highway and Christiana Parkway) both carry volumes in excess of 30,000 vehicles per day. Traffic volumes in the

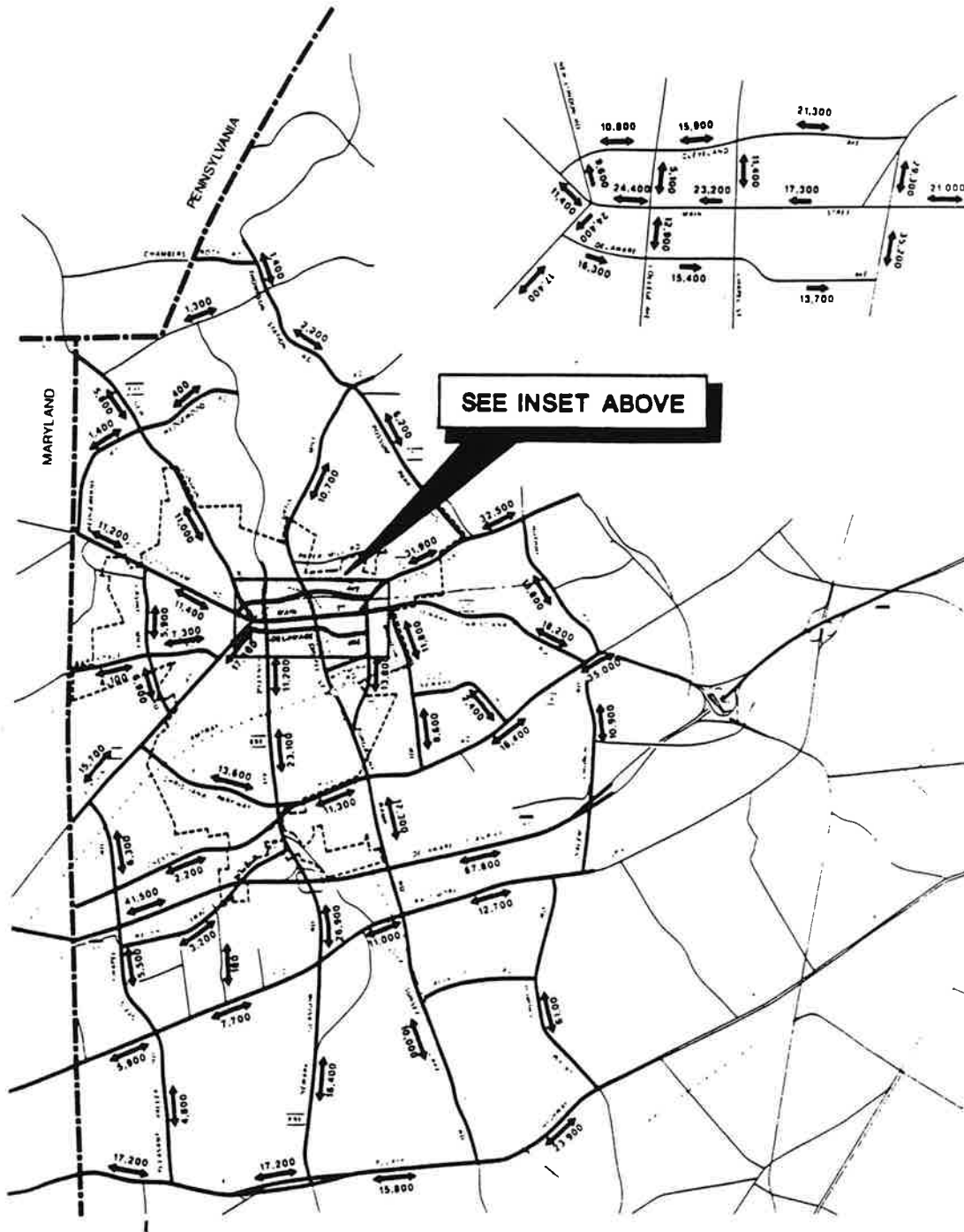


Figure 3-1

Current Average Daily
Traffic Volumes

Central Business District, ranging from 13,700 vehicles per day on Delaware Avenue to 21,300 vehicles per day on Cleveland Avenue are very high due to the fact that traffic reaching Newark from the North and East has no convenient bypass around the downtown area. The large number of students that use their automobile to go to class also contributes to the high CBD traffic volumes. This problem is well illustrated if one considers that the University of Delaware has about 7,500 parking spaces in the CBD, that are filled every day.

Figure 3-2 presents the average travel speeds during the evening peak hour on selected roads in the study area. Speeds are generally low in the CBD and on the roads east and south of the study area. This low travel speed significantly reduces the operating speed of public transit, which shares the right-of-way with private transportation.

Figure 3-3 marks those roads that are currently performing at Levels of Service D, E, or F. These sections constitute about 35 percent of the state maintenance route system in the study area. Again, transit operations are significantly affected.

3.1.2 Public Transportation

Public Transportation in the study area is provided by three



Figure 3-2
 Current Average Travel Speeds



Figure 3-3
Current Level of Service

systems: the Delaware Administration for Regional Transit (DART), the UNICITY Bus System and the University of Delaware Shuttle. Their respective routes in the study area are presented in figure 3-4.

DART provides regional public transportation to Newark on three routes, one of which is an express service that operates only during the rush hours and is especially geared towards commuters. Weekday buses operate at an average headway of 20 minutes during rush hours and 60 minute headway during off-peak hours; headways are generally not constant. Operating speed is relatively high at about 13 mph, yet a trip to Wilmington, a distance of about 7.5 miles, takes (without transfer) about 57 minutes. This is certainly not competitive compared with 17 minutes it would take by automobile. Consequently, ridership is low; in 1985 the three routes to Newark ranked among the lowest in ridership per vehicle mile among all DART routes. A brief summary of DART performance is given in table 3-1.

The UNICITY Bus System provides limited service within the Greater Newark Area and was implemented in 1980 after DART suspended its local service within Newark because of low ridership (30-40 riders per day). UNICITY currently operates a total of three lines, two of which are early morning and late afternoon commuter lines, while a third route is operated throughout the day. This midday loop provides

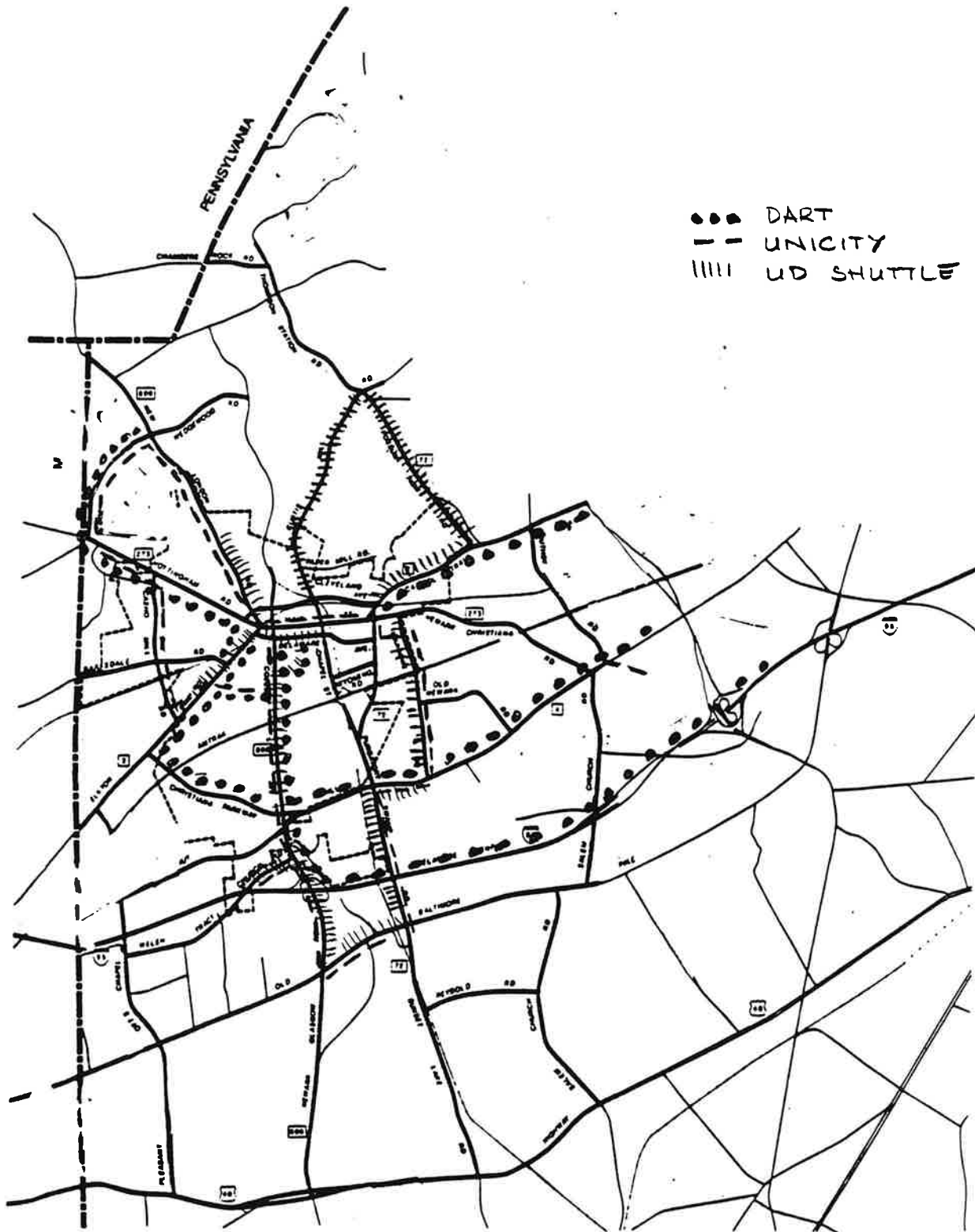


Figure 3-4

Public Transportation
Service Area

	Route	Dist. [mi]	Operating Speed [mph]	Total passengers /v.m.	rank
1	Philadelphia Pike	13.1	13.1	2.43	9
2	Concord Pike	20.6	13.7	1.74	16
3W	South Broom Street	7.3	7.3	3.20	5
3E	Vandever Avenue			4.61	2
4W	West 4th Street	16.5	9.9	3.73	3
4E	Gov. Printz Blvd.			2.20	11
5	* Maryland Avenue	20.1	13.4	1.86	14
6	* Kirkwood Highway	20.4	12.3	2.24	10
7	Faulkland Road	15.4	11.9	1.94	13
8	Woodlawn Avenue	5.7	8.6	3.67	4
9	Union Street	12.5	12.5	0.45	23
10	Delaware Avenue	6.2	7.7	4.92	1
11	Washington Street	5.8	7.7	2.53	8
12	Baynard Boulevard	6.2	8.4	2.83	6
13	Naamans Road Express	20.0	25.0	1.63	18
14	Kennett Pike	16.7	13.0	1.64	17
15	New Castle Avenue	13.4	13.4	2.16	12
16	* Newark Express	36.6	20.3	1.36	21
18	Milltown Road	17.2	14.7	1.47	19
19	Pike Creek Valley	24.1	16.8	1.20	22
20	Lancaster Pike	21.0	12.6	2.77	7
21	Foulk Road	13.8	13.8	1.82	15
22	DuPont Avenue	22.2	16.6	1.44	20

* indicates bus service to Newark

Source: DART Strategic Development Plan

Table 3-1

Summary of DART Performance

service to primarily residential areas; headways are in excess of two hours. UNICITY service is offered free of charge through cooperation between the University of Delaware (who operates the system) and the City of Newark Planning Department (who administers the service). Funding is primarily provided by the Delaware Transportation Authority. Ridership showed promising figures shortly after UNICITY's introduction (300-400 riders per day), but has declined to a current average of about 100 riders per day.

The University of Delaware Shuttle is also operated by the University. During the day a total of six routes are operated, which serve all University dormitories, classroom buildings on North, Central and South campus and some apartment complexes that have students as their primary tenants. Only members of the University community are allowed to use the Shuttle system. Ridership is high, with average daily ridership per route ranging from about 100 to over 900. It is interesting to note that those routes which operate at a constant headway generally have the highest ridership, even though their schedule does not always follow class schedules. A brief summary of UNICITY and University of Delaware Shuttle statistics is presented in table 3-2.

3.2 Travel Characteristics

Two components were considered in the study of travel

	Headway	Average Daily Volume
--	---------	-------------------------

UD Shuttle:

Loop 1	NC	276
Loop 2	NC	121
Loop 3	NC	224
Bus A	C	550
Bus B	C	917
Bus C	C	435

UNICITY:

N-1	C	92
N-2	N/A	16
N-3	NC	19

Source: UD Transit

Table 3-2

Operating Statistics
for UNICITY and UD Shuttle

characteristics. These were area travel patterns and the transit rider profile.

3.2.1 Travel Patterns

Figure 3-5 presents the major traffic flows in and out of the study area as well as the percentage of through trips of those volumes. As can be seen, traffic volumes are very high. Through trips constitute a major part of the total volume, with a percentage as high as 76 percent for trips oriented to Maryland. Trips oriented towards the rest of New Castle County, however, have a more local character, as is evidenced by the percentage of through trips ranging from 18 to 49. This prompts the suggestion that a majority of those trips are commuter trips, which are a potential target for public transportation.

Within the study area an origin-destination survey was carried out for the Newark Area Transportation Study. Results showed that the majority of trips originated in and were destined for New Castle County locations. In addition, 60 percent of all trips were work related. Again, this points to potential for public transportation.

Figure 3-6 shows the distribution of hourly traffic volumes on several intersections in the study area. It can be seen that, with the exception of the CBD, peak conditions exist

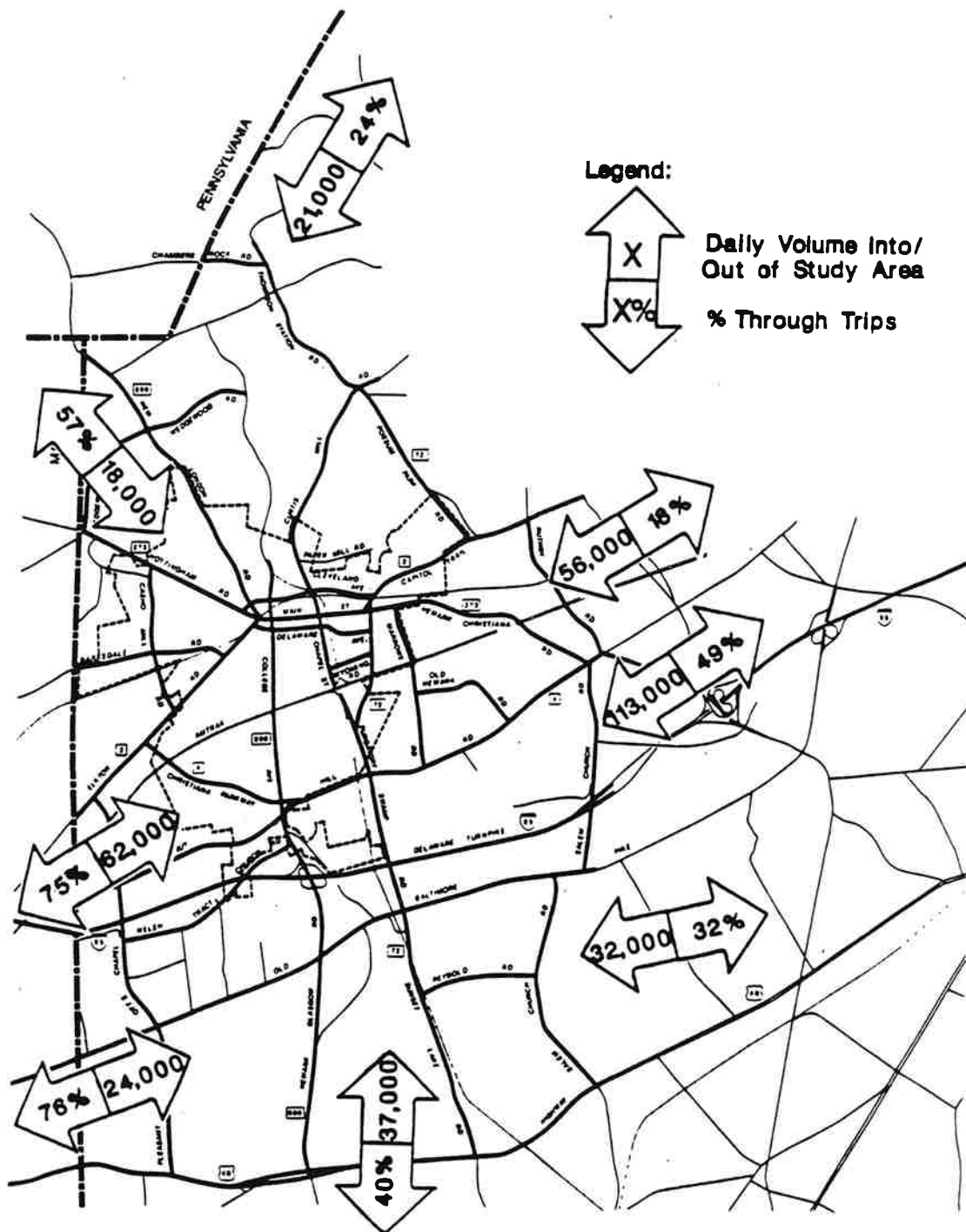


Figure 3-5
Regional Traffic Patterns

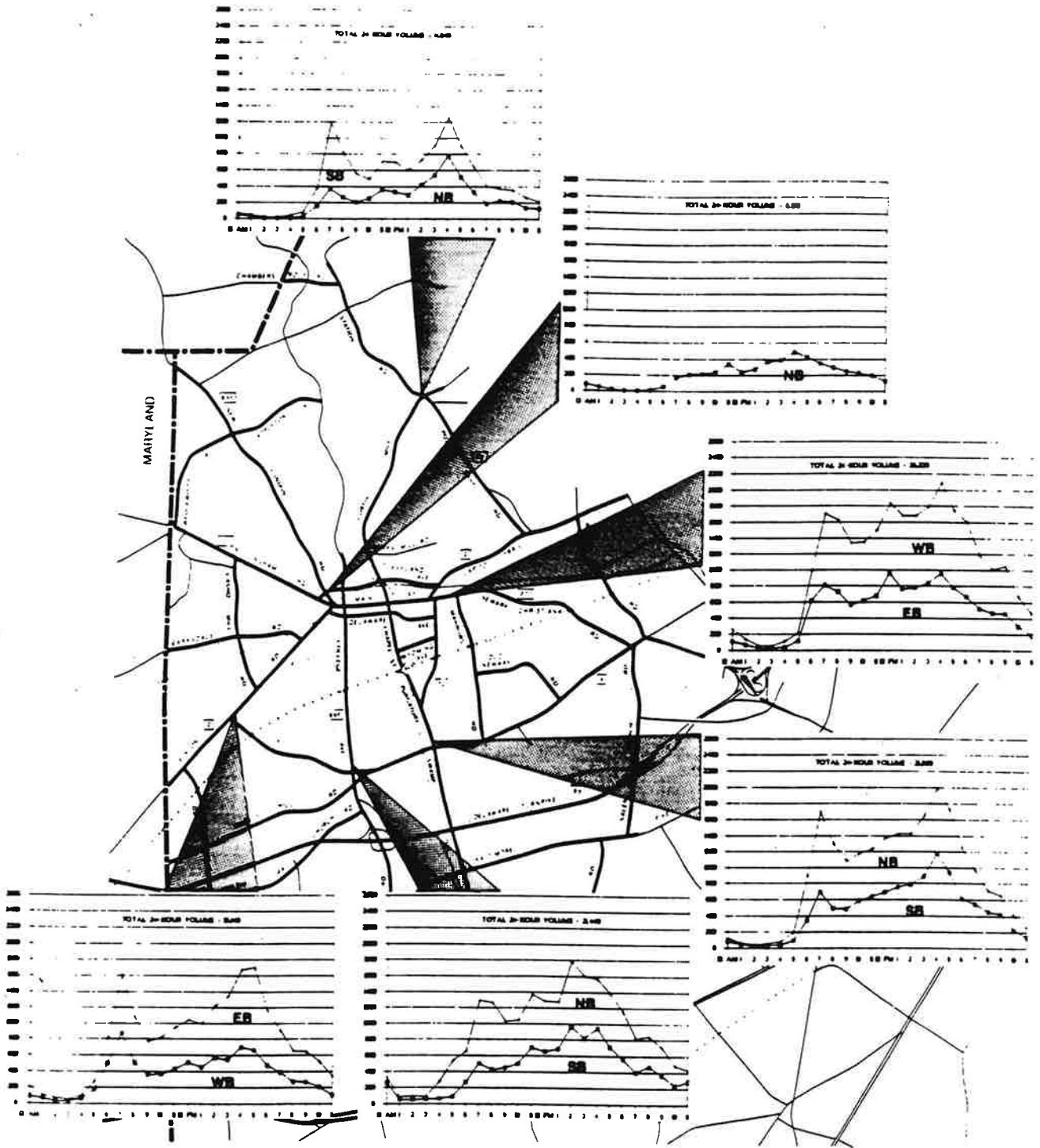


Figure 3-6
 Distribution of
 Hourly Peak Volumes

during the morning and afternoon peak hours. This result, too, indicates a substantial volume of commuter traffic on the study area's roads.

3.2.2 Profile of Transit Riders

The three providers of public transportation in the study area all cater to a different public.

A survey, carried out for the DART Strategic Development Plan, revealed that 80 percent of the trips taken by DART riders are work related; further evidence of "commuter use" is that the majority of DART riders use the service 5 days per week. The survey also indicated that almost 50 percent of the riders had one or more cars available for their particular trip. This proportion of "choice riders" compares favorably with percentages for other transit agencies in the country and it is certainly an indication that DART service can be exploited to attract commuters. It should be noted, however, that the above statistics are compounded for the entire DART service area. Results for the lines that serve Newark (5, 6 and 16) are likely to be less impressive.

UNICITY riders have a more "traditional" character in that the majority of riders is a senior citizen; probably with the exception of the two commuter routes, the service is mostly used for social trips during midday periods.

The University of Delaware Shuttle, of course, caters to students, who use the service primarily to travel from their dormitory or apartment to class.

3.3 Socio-Economic Factors

Population and auto ownership typically have the highest effects on the number of trips that are generated in a given area. In 1985 a total of 100,868 persons were living in the study area; the most populated areas are the southern and southeastern regions of the study area (see figure 3-7). Auto ownership is distributed accordingly, with the highest number of car registrations in the southern region of the study area. High population and auto ownership are also found in the region bordering the study area on the South and Southeast, which in turn is responsible for a high rate of trip generation.

The major employers in the study area are the University of Delaware (4076 employees), Chrysler (4280 employees), DuPont and the industries along Ogletown road (route 273 corridor). In addition, employment is provided by the many smaller businesses located in shopping centers and office parks throughout the area. The majority of Newark's residents work in Newark (56 percent) or New Castle County (34.2 percent). This indicates a strong potential market for public transportation.

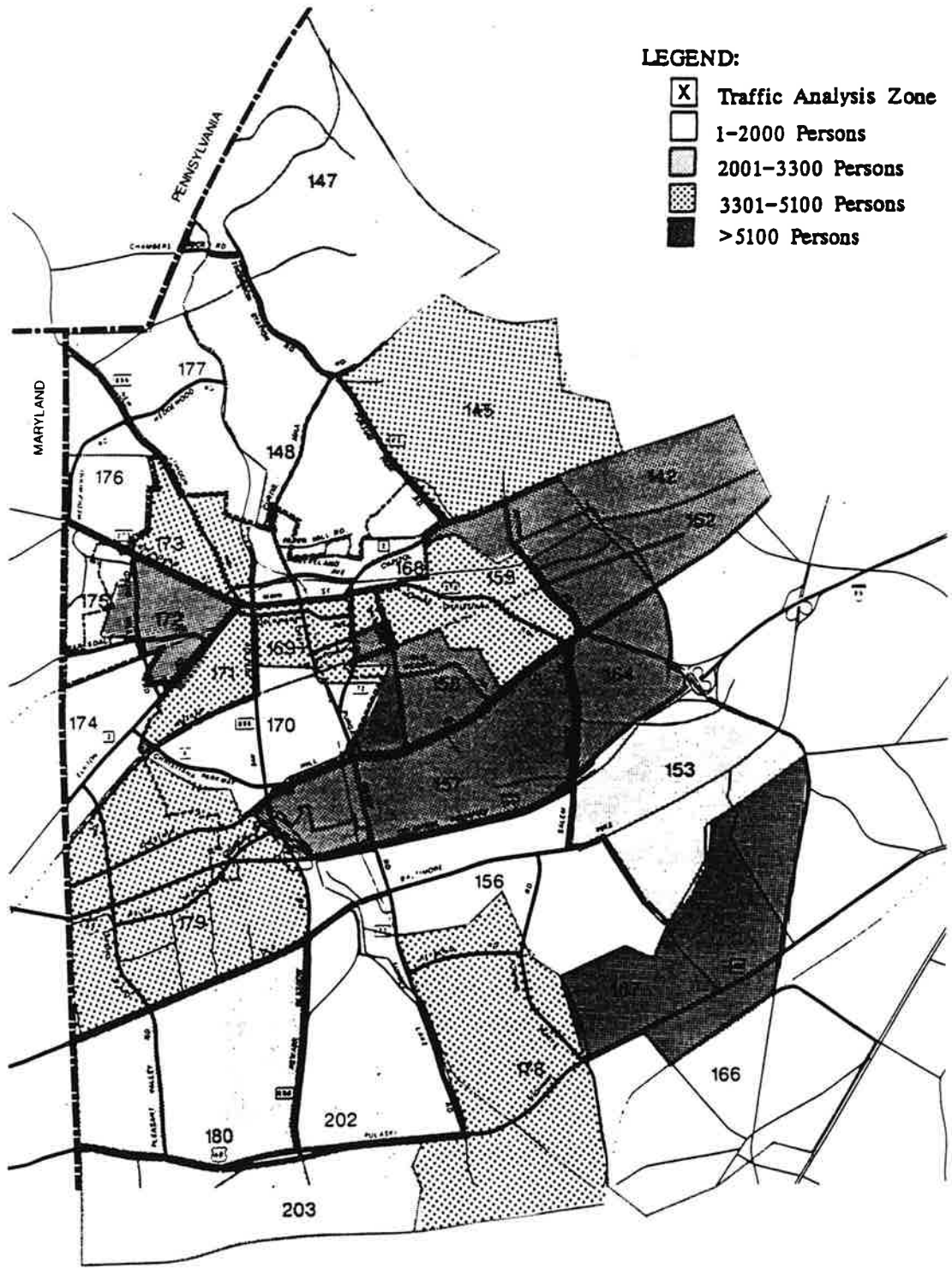


Figure 3-7
Population

With regard to environmental concerns, the area North of Newark is especially sensitive. Carpenter State Park is located here; plans for construction of new roads through this area have experienced fierce opposition from local residents. Together with the increasingly important issue of wetlands preservation, this suggests that great emphasis should be placed on public transportation.

4. PROBLEMS IN THE CURRENT SITUATION ---

From the analysis of the inventory in the previous chapter, a number of deficiencies can be identified. With respect to roadway facilities the following problems exist:

- Low travel and low transit operating speeds are prevalent on a substantial part of the roadway network in the study area.
- A majority of the roadways in the study area are performing at a Level of Service "D" or below.
- Travel patterns in the area show peak demand.
- Low vehicle occupancy rates.

With respect to transit operations, the following problems exist:

- Very low ridership on DART services and only marginal ridership on UNICITY services.
- Highly populated areas in the southern and eastern regions of the study area are not served at all or served inadequately by public transportation.

Some general problems, that the inventory did not specifically reveal, but that are clear from observations are:

- Poor transit scheduling:

The only bus services that operate on constant headways are some routes of the University Shuttle; all other routes are operated with irregular intervals or extremely long headways.

- Poor transit information:

All time tables that are published by the area transit operators were found difficult to comprehend, thus discouraging the use of public transportation. Moreover, the University Shuttle and UNICITY systems lack a clear route indication on their vehicles.

- Poor transit supporting facilities:

Waiting facilities for passengers are absolutely minimal. Currently, small passenger shelters are available at only two bus stops in Newark. The lack of shelters at Park 'n Ride lots is certainly a major problem. Furthermore, there is little opportunity to purchase tokens or monthly tickets in advance.

- Poor transit marketing:

Little effort is made to promote or advertise the use of public transportation.

5. SHORT TERM RECOMMENDATIONS ---

Based on the deficiencies identified in the previous chapter, a number of short term improvement alternatives were developed. These alternatives can be grouped into two categories: transit related improvements and non-transit related improvements. Each category will be discussed separately; improvements are listed in order of priority.

5.1 Transit Related Recommendations

Eight strategies were developed as short term transit related improvements. The objectives of these strategies are primarily to encourage the use of public transportation. The recommendations are, in order of priority:

- Schedule buses at constant headways:

Buses should be scheduled so that headways are easy to remember by potential riders. The objective is to schedule bus arrivals and departures at constant intervals at the same time into each hour; this means that there must be an integer number of buses per hour (for example at 5, 10, 15, 20, or 30 minutes headway).

Constant headway scheduling will eliminate much of the confusion that currently exists and thus increase user convenience. As was mentioned in section 3.1.2, this

strategy has proved successful in the University of Delaware Shuttle operation.

- Re-route A.M./P.M. UNICITY Routes from residential areas to employment sites:

The two UNICITY AM/PM lines should be re-routed so that transit service is provided between residential areas and employment sites. Residential areas that deserve special attention are the developments in the northwestern region of the study area; employment sites that deserve special consideration are the route 273 corridor and the office park developments along South College Avenue. Providing transit service along these corridors will substantially reduce commuter traffic through the Central Business District.

- Improve information to potential riders:

Time tables should be redesigned so that they can easily be understood by the general public. At the least, they should contain a complete map of the area and fare zones, a clear indication of the particular route and a neatly arranged listing of departure times. In addition, when appropriate, a separate section on policies, black-out dates and information telephone numbers should be provided.

Bus stops should be clearly recognizable; information similar to that in the timetables should be provided as

well. The availability of a passenger shelter greatly increases the potential for public information.

In addition, routes and destinations should be marked unambiguously on all buses.

- Provide more opportunities to purchase tokens or passes in advance:

Area stores should be allowed to sell tokens, or weekly or monthly passes directly to the public. This will decrease the significance of the "exact change" obstacle and thus increase user convenience. In particular, post offices and newsstands should be considered as selling points. In many European countries, advance token purchases at facilities such as post offices constitute a large percentage of the total purchase of transit tickets; the extra administrative costs are considered well worth the effort.

- Improve the appearance of transit vehicles and facilities:

Well-maintained vehicles are a key to public acceptance of public transportation. A well-maintained vehicle is aesthetically more appealing, increases the sense of safety for riders, and, if desired, will attract more "side-panel advertising." In the same manner, supporting facilities such as passenger shelters should be provided.

- Provide exclusive right-of-ways for transit vehicles:
By providing exclusive right-of-ways transit operating speed can be increased, thus making public transit more competitive with private transportation. As a short term strategy, it is rather restricted in its application, since the already overburdened roadway system allows for limited allocation of space to transit operations.

- Open the University Shuttle to the general public:
At the time UNICITY service was started, it was considered to open the University Shuttle to the general public. It was found, however, that insurance costs would soar, and the plan was rejected. Since the University Shuttle covers, however, the most extensive area in the study area, this suggestion ought to be reconsidered.

- Encourage the use of Park 'n Ride lots:
By providing Park 'n Ride lots the access/egress time to and from public transportation facilities can be reduced significantly. In addition, it provides a means for residents of areas that would not be served by public transportation otherwise to utilize transit. The main problem is to provide enough incentive for drivers to change transportation modes once they are already in their car.

5.2 Non-Transit Related Recommendations

Four strategies were developed as short term non-transit related recommendations. The objectives of these strategies are primarily to reduce traffic volumes. The recommendations are, in order of priority:

- Provide incentives to area employers to encourage car and vanpooling:

By allowing tax breaks, land development privileges and similar incentives to area employers as a reward for initiating traffic mitigation programs, traffic volumes may be decreased. The University has an extensive employee development programs and is therefore a prime candidate to take the lead in a carpooling program. (It is somewhat discouraging, though, that the University Traffic Department has ended its program of selling low-priced carpool parking permits in 1988). Other important candidates are DuPont and the industries along the route 273 corridor.

- Increase downtown parking rates:

Increasing downtown parking rates will discourage many students to use their car to go to class and encourage them to walk, bike or take the University Shuttle instead. This will reduce downtown off-peak traffic volumes. To prevent Main Street retailers from losing business, the current system of parking validation should be continued.

- Implement an extensive signage program to divert traffic from the CBD:

By means of a signage program through traffic can be diverted from the CBD. Especially traffic entering the area from the South and West can be diverted to the Christiana Parkway. A limited program has been implemented.

- Provide incentives to area employers to implement staggered work hours:

Implementation of staggered work hours will reduce the peak volumes that are currently experienced in the study area by spreading the commuter burden over a larger time period. However, staggering work hours is a strategy that must be approached with caution, because it may hurt transit operations. Employees can not be expected to wait for a bus during the time they gain by leaving early, and transit operators can not always be expected to provide short enough headways to minimize the employee's waiting time. Clearly, a trade-off exists in this strategy.

6. FORECAST OF YEAR 2010 CONDITIONS ---

Many transportation planning projects that have been carried out recently in the New Castle County adopt a twenty-year planning horizon; in general, conditions for the year 2010 are forecasted. The Public Transportation Development Study also adopts this horizon year.

Determination on year 2010 conditions relied on several components. First, forecasts from the DelDOT E+C 67 model were considered. This model gives an estimate for traffic volumes in the year 2010. Next, several documents were reviewed to assess future land development, economic development and transit planning.

6.1 DelDOT Model and Traffic Volumes

Figure 6-1 presents the anticipated average daily traffic volumes as generated by the E+C 67 DelDOT computer model. The base road network assumes that some roadway improvements, such as widening of sections of the Christiana Parkway and South College Avenue, as well as new alignments, such as the Glasgow bypass, connecting routes 301 and 896, are in place by the year 2010. Compared with volumes presented in figure 3-1, it can be seen that there will be significant increases in traffic volume on a substantial part of the area's roadways, ranging from 26 to 153 percent. Consequently,

despite the improvements in the road network, almost 40 percent of the area roads is expected to perform below Level of Service "C" in the year 2010, as is illustrated in figure 6-2.

6.2 Other Developments

From review of the documents listed in chapter 2, several major future developments were identified.

Probably the most important development that will take place is the growth of the Metroform area, located just east of the study area. Already Metroform has experienced rapid growth in the past decade, and projections are that growth will continue at a similar rate. Eventually, land use in the area will be dominated by commercial and retail enterprises. This means that a significant volume of commuter traffic will be generated outside the area; it is anticipated that, by the year 2010, 60 percent of all trips within Metroform will originate elsewhere. Certainly, the Greater Newark Area will be the origin for a substantial part of those trips.

The major asset of the Metroform area is its excellent roadway accessibility (Interstate 95, Kirkwood Highway, U.S. Route 4), although current capacity may not be sufficient for year 2010 volumes. The AMTRAK and Chessie System rail lines run through Metroform, but at this moment they are neither exploited for passenger transport to the area, nor do plans

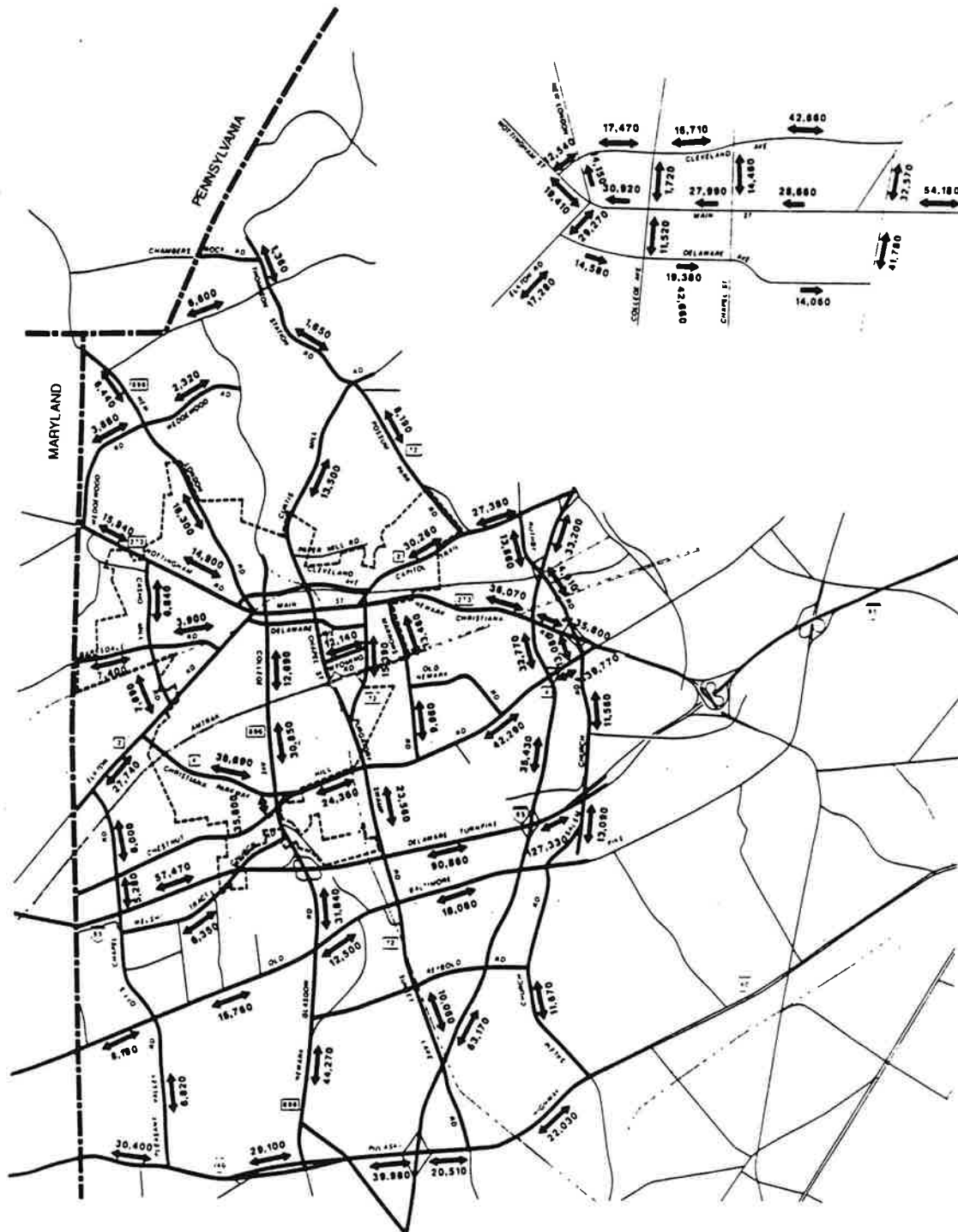


Figure 6-1
 Year 2010 Average
 Daily Traffic

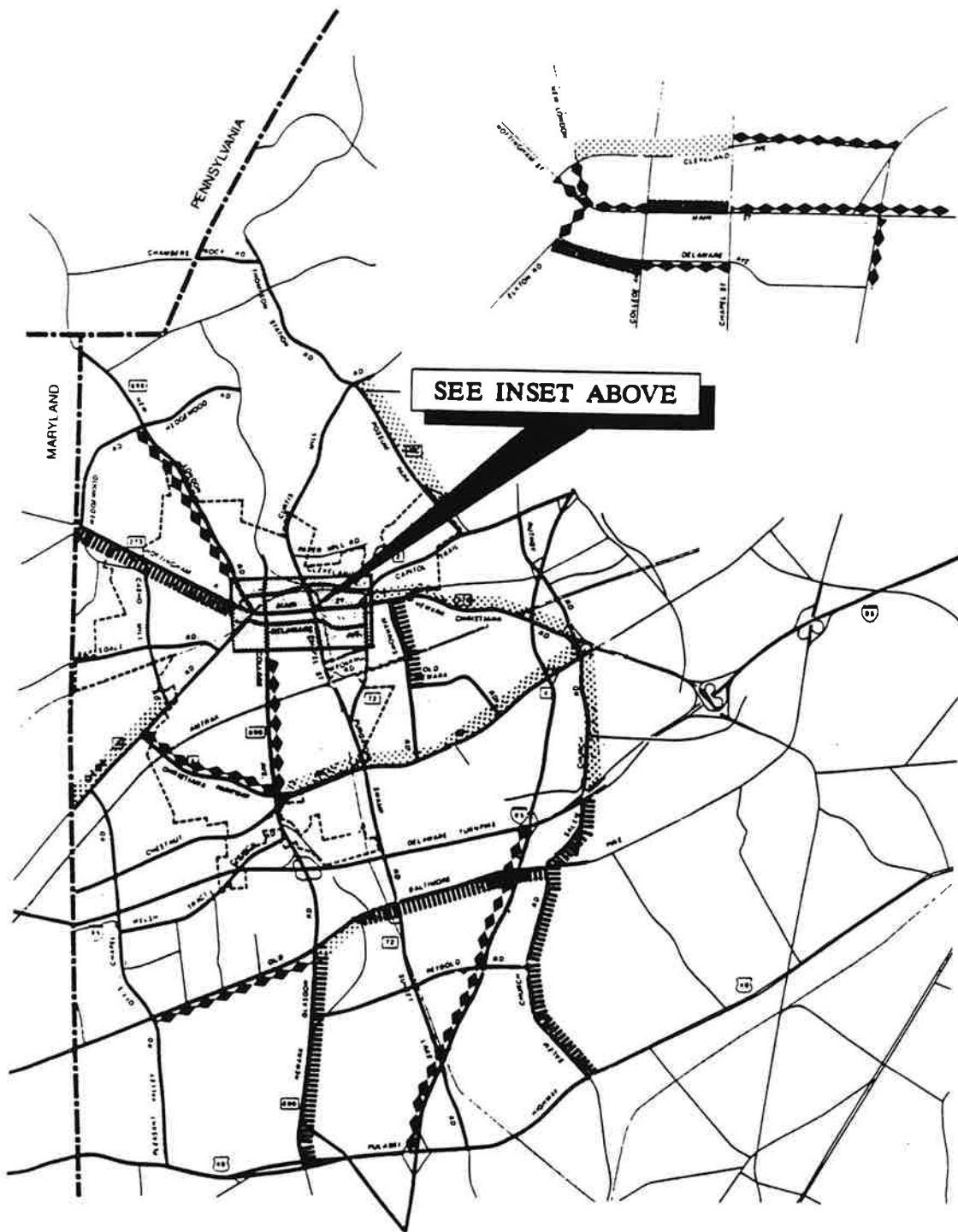


Figure 6-2

Year 2010
Level of Service

LEGEND:

- Level of Service D
- ||||| Level of Service E
- ◆◆◆ Level of Service F

exists to start rail service in the future.

The next factor that must be considered is the expected increase in population, especially in the southern and southeastern regions of the study area. Already highly populated, it is anticipated that there will be a 40 percent population increase in these regions by the year 2010. The remainder of the area will experience growth at a slower pace. Enrollment at the University of Delaware is expected to remain at its present level of about 20,000 students.

With respect to future DART service, two factors are important. First, between 1992 and 1995 the implementation of a pulse system, operating from the Christiana Mall, southeast of the study area, is projected. A pulse system resembles the airline industry's hub-and-spoke system; several routes would arrive at a terminal at a scheduled time, wait anywhere in between 5 and 10 minutes, and then all leave at the same time. The 5-10 minute waiting time would allow for passenger transfer between routes. The Christiana Mall location was chosen because it is on the border of the Metroform area. The importance of the latter area was described above. Only one new route is expected to serve the Newark area; it will mainly provide service to employment sites.

After 1995, no new DART routes are anticipated, but the frequency of service is planned to increase. The DART

strategic development plan boasts that by that time, the bus network will provide both extensive coverage and a high service level.

At this time, future plans for the UNICITY and University Shuttle systems are not known, and it does not seem likely that there will be major changes in their operations. Over the last few years, however, the option of constructing a high capacity parking garage on the university campus has been discussed frequently. No agreement has been reached yet, but there is a definite possibility that such a facility will be in place by the year 2010. It is reasonable to assume that this will have a negative impact on downtown traffic volumes.

7. PROBLEMS IN YEAR 2010 CONDITIONS ---

From the analysis of the year 2010 situation, and based on the standards that were developed earlier, a number of deficiencies can be identified for the year 2010.

Primarily, a tremendous increase in traffic volumes is expected throughout the area; as a result, low levels of service will still be prevalent on a majority of the area roadways. This was illustrated in figure 6-2. Directly related are the expectations of low travel speeds and, pertinent to transit systems, low operating speeds.

In addition, large areas will still be without adequate transit service or without any service at all. This remains the case despite plans for expansion of DART service.

UNICITY and the University Shuttle do not seem to have any long term policy, nor is it likely that the University will discourage use of private transportation in the future, as is evidenced by repeated discussions on the construction of a large capacity parking garage. It is not known whether other area employers such as Chrysler, DuPont and the industries along the route 273 corridor have developed their own plans for traffic mitigation.

Large scale construction of new roadways is currently

hindered by fiscal and environmental constraints. The latter is especially important for the Delaware area which, due to its proximity to the coast, contains a substantial percentage of wetlands. These restraints will continue to affect future development.

8. YEAR 2010 MEASURES OF EFFECTIVENESS ---

In order to evaluate long term strategies, a set of Measures of Effectiveness (MOEs) had to be developed, on the basis of which these strategies could be prioritized. MOEs were divided into two groups: benefits and impacts.

8.1 Benefits

A total of three benefits was considered. These are:

- Expected increase in ridership:
The ultimate objective of implementation of the Public Transportation Development Study is to increase transit ridership. Expected increase in ridership should thus be the first MOE that is evaluated.
- Expected increase in transit operating speed:
Since the success of transit operations is dependent on roadway Level of Service, the appeal of transit to the public is closely related to this MOE.
- Average access and egress distance:
Access and egress distance significantly affect the total travel time for public transportation and hence user convenience. As MOE, therefore, they should be

considered.

8.2 Impacts

A total of four impacts was considered. These are:

- Capital and/or construction costs

- Operating costs

- Environmental impact:

Environmental issues play an important role in transportation planning and it is expected that their role will increase in significance. Therefore, environmental impact must be considered.

- Residential disruption:

Implementation of new bus services, especially in residential areas will have a significant effect and must be evaluated.

8.3 Evaluation Process

The benefits that are considered are generally difficult to assess. Mostly, they depend on the increase in ridership and the degree to which citizens can be brought to change their mode of travel. Impacts are less dependent on ridership and

are thus easier to determine.

In principle, the assessment benefits was based on the effect of implementation of similar projects carried out in areas comparable to Greater Newark, supplemented by "engineering judgement." The benefit of each alternative was rated on a scale from 1 to 5, where 1 represents no benefit, and 5 represents significant benefit. Impacts were based on order-of-magnitude estimates of capital/construction costs, present DART operating costs as reported in the DART Strategic Development Plan, and "engineering judgement." Again, impacts were rated on a scale from 1 to 5, where 1 represents no impact and 5 represents significant impact.

Weighting factors were assigned to each particular benefit and impact; a "fuzzy evaluation with linguistic expressions" technique was used to determine the overall rating. Based on this overall rating, alternatives were prioritized. The major advantage of the fuzzy technique is that it can account for uncertain benefits and impacts such as future ridership.

9. LONG TERM STRATEGIES

The long term strategies that were developed concentrated on increasing ridership by improving accessibility to public transportation as well as making transit more efficient for the citizens to use. The following strategies were developed:

1. Implement more new DART, UNICITY, and University Shuttle routes:

The planned expansion of service by DART does not adequately cover areas that will be developed in the near future. As has been mentioned before, especially the southern and southeastern regions of the study area deserve attention; providing adequate transit service here means reducing access and egress times, which is instrumental in encouraging the use of public transportation.

2. Design for exclusive bus right-of-ways in future road construction:

Exclusive bus lanes will eliminate bus operations from heavily congested traffic; as a result, operating speed will increase dramatically. In addition, priority for transit movements at intersections can be established by installing sensing devices on buses and roadways, which in

turn are connected to the traffic signal controller to yield to transit vehicles. The net result, of course, is a reduction in delay, which will stimulate ridership.

3. Establish Transportation Management Associations (TMAs):

The primary purpose of a TMA is to involve the private sector (i.e. area employers) in the planning process. In particular, the University of Delaware, Chrysler, DuPont and the industries along the route 273 corridor are prime candidates for such a program. With their involvement, the problem of traffic mitigation can be managed more efficiently; because of their direct contact with employees, TMAs are main candidates to initiate car and van pooling programs. Also, participants may be able to finance part of a transit operation serving their location. It remains the question how many resources each individual company is willing to allocate, but the establishment of the route 141 TMA in the Wilmington area is an encouraging sign.

4. Establish a Timed Transfer Center:

A timed transfer center would be the heart of a pulse system operated from the Newark area and primarily catering to commuters. The concept of a pulse system was described in section 6.2.

A suggested location is the area along the AMTRAK right-of-way, just south of College Square Shopping Center.

This location is central in the study area and is easily accessible, especially from the development areas in the southern and southeastern sections of the study area; the predicted Level of Service on route 72, the main access road is above standard "C". Therefore, no major roadway upgrading will be necessary. Moreover, it is an excellent location for the construction of a commuter rail station, with rapid rail service to Metroform, Wilmington and beyond. Despite plans of the University of Delaware to construct a technology research center in the same area, no major problems are foreseen with respect to, for instance, the construction of Park 'n Ride facilities. In principle, the center would be served by low capacity feeder lines, including UNICITY and the University Shuttle. A high capacity trunk line (rapid rail or express bus) would then provide fast service to the Wilmington area and beyond. The center would also allow for long distance transfers from for example AMTRAK or Greyhound service to the University's UNISTATE service to southern Delaware.

Although capital costs are high, the increased efficiency and visibility of public transportation will encourage its use.

Besides these strategies and improvements, continuous attention is required for:

- Marketing and pricing policy:

Public transportation should be aggressively advertised in news media and publications from the City of Newark. With regard to pricing, "congestion pricing" should be eliminated to reduce commuters' out-of-pocket cost, currently found to be a major obstacle for many potential riders. Discounts should be allowed for advance purchase multi-trip tickets.

- Land use and development:

Especially for the case of residential development, attention to public transportation should be given early in the planning process. This concern ranges from accounting for bus turning radii to allocating space for Park 'n Ride facilities. Zoning restrictions, for example limiting low density development, should be considered as well, but public opposition will be strong.

10. EVALUATION AND RECOMMENDATION

The strategies and improvements were rated and evaluated according to the methodology described in section 8.3. The results are presented in table 10-1.

As can be seen, based on the benefit/impact ratings, the establishment of TMAs should receive priority attention. Its low direct cost requirements, low environmental impact and relatively high benefit in terms of traffic mitigation are key factors.

The remaining suggested strategies received an equal overall rating. With respect to the construction and designation of exclusive bus right-of-ways, it should be noted that the success is largely dependent on actual future road construction. Therefore, this strategy should be approached with some caution, and not as the one and only solution to the problems of the study area.

In addition, individual ratings for benefits and impacts, were, to a large extent, based on subjective judgement. If a more substantiated method of assessing the Measures of Effectiveness becomes available, especially one to predict future transit ridership, all strategies might be re-evaluated to assess their overall benefit and impact.

MOE	Weight	ALTERNATIVE			
		1	2	3	4
BENEFITS					
Ridership increase	3	4	3	3	4
Improvement in operating speed	2	1	4	2	4
Reduction of access/egress time	2	4	2	2	3
IMPACTS					
Costs:					
- Capital	1	1	4	1	5
- Operating	2	5	2	1	5
Environmental impact	1	2	3	1	2
Residential disruption	1	3	3	1	2
OVERALL RATING		3	3	4	3

1. New transit routes
2. Exclusive bus lanes
3. TMA
4. Timed transfer center

TABLE 10-1
Evaluation of Long
Term Strategies

In order of priority then, the following strategies are recommended:

1. Encourage the establishment of Transportation Management Associations
2. Expand the service areas of the DART, UNICITY and University Shuttles
3. Study the feasibility of a timed transfer center
4. Design future roadways for designation of exclusive transit right-of-ways

In addition, continued attention should be given to marketing and pricing trends, as well as land use and development patterns.