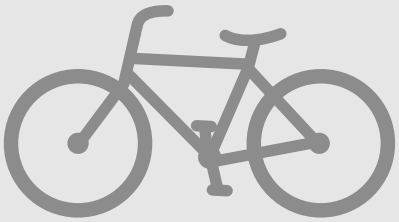
INCREASING INTERMODAL ACCESS TO TRANSIT

PHASE II

Delaware Valley Regional Planning Commission

JUNE 2005

INCREASING INTERMODAL ACCESS *TO TRANSIT*

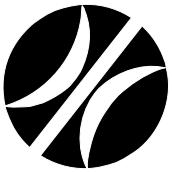


PHASE II

Delaware Valley Regional Planning Commission

JUNE 2005

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency that provides continuing, comprehensive, and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.



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

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) The Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The preparation of this report was funded through federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and the Pennsylvania Department of Transportation. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views of policies of the funding agencies.

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EXECUTIVE SUMMARY

Phase II of the Intermodal Access to Transit study assessed road and sidewalk facilities within pedestrian (one quarter mile) and bicycle (one mile) buffers surrounding three stations identified in Phase I: Ardmore Junction, Avandale Park and Ride, and Lindenwold Station. These were chosen for analysis using Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) software. The PLOS/BLOS software incorporates a range of facility attributes including width of cartway, buffering, traffic volume and pavement condition in generating a score from "A" to "F".

Scores for pedestrian safety and access to stations were better than bicycle access. The absence of road buffers along sidewalks, visible striping at intersections, and appropriate bicycle racks at stations all degrade the non-motorized travel environment. Field views verified that in many cases where pedestrian amenities were acceptable, conditions facing a bicyclist sharing the road to access a station were unacceptable. Specific comments follow:

- **Ardmore Junction**

Access to this station is facilitated by the presence of a SEPTA grade separated busway connecting neighborhoods to the north and south of the station. Haverford Road was found to be unfriendly to pedestrian and bicycle traffic and would benefit from buffering and striping. Bicycle racks at the station would facilitate access and accommodate the demand demonstrated by the multiple bicycles locked to guardrails and guidelines around the station.

- **Avandale Park and Ride**

Avandale is safely accessible by either non-motorized mode, particularly the residential developments adjacent to the station. Two aspects of concern are striping along the roads and through the Park and Ride lot. The second is access for future developments not directly connected to the facility, particularly any pedestrian access crossing County Highway 536 Spur.

- **Lindenwold Station**

Lindenwold scored poorly as pedestrian or bicycle accessible. The very large parking facility, narrow shoulders without buffers, and high automobile speeds all contributed to a challenging non-motorized environment. It was noted that the size of the lot might create its own dangers during peak arrival and departure times for pedestrians walking from their automobiles to the station. The maintenance of bike racks, buffering of sidewalks, and reduced vehicular speeds would all be positive steps in enhancing access.

As a pilot for more in depth non-motorized analysis, the PLOS/BLOS method appeared to be validated by field views. The next step is the further gathering of data in support of BLOS and PLOS software and the additional assessment of station access around the region. It is recommended that this data be added to other station level data in the Regional Transit Database currently being completed at the DVRPC.

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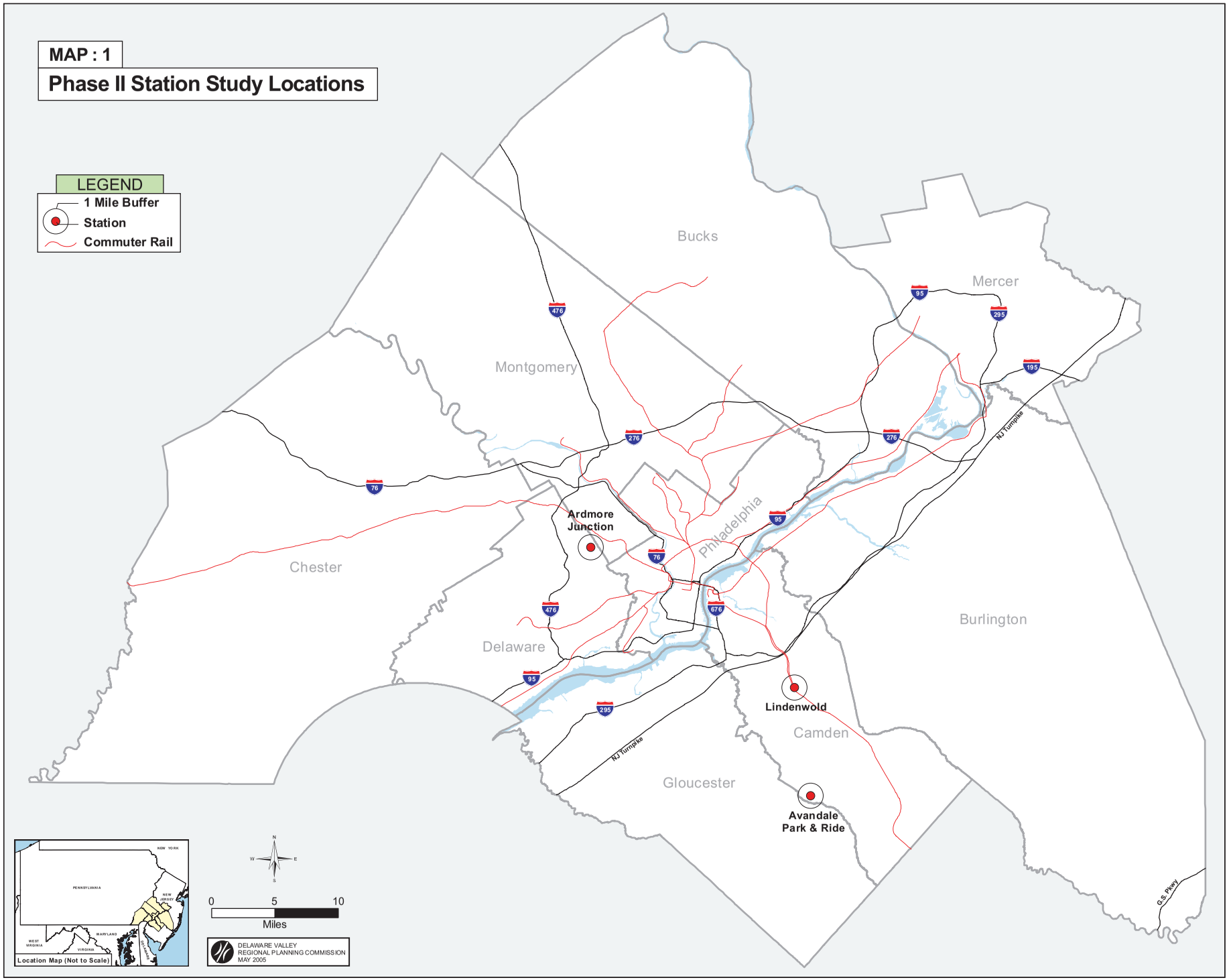
I. INTRODUCTION

This report is Phase II in the assessment of non-motorized access to transit facilities, focusing on commuter rail stations and a bus transit park and ride. Phase I identified a "doughnut" patterning of residential land uses around stations, where the population was outside the ideal quarter-mile buffer defined in the pedestrian literature. This suggested that access to transit stations need to be examined for qualities of safety and acceptable travel conditions for pedestrians and bicycles *through* the buffer zone traditionally identified as the area where the population accessing the transit station resides.

To accomplish this, the statistically calibrated Pedestrian Level of Service (PLOS) and the Bicycle Level of Service (BLOS) models are used in this study. The software, developed by Bruce W. Landis in collaboration with Tampa and Miami MPOs, and Florida DOT, provide a statistically reliable method of evaluating the pedestrian and bicycle conditions of the shared roadway environment. Using field data and observations, displayed in either tabular or GIS formats, this software can reliably characterize road facilities in an area.

The essential questions posed in Phase II of this study is: To what extent are stations accessible to pedestrian and bicycle traffic, and how can this information provide guide future decisions? There is a lack of information describing substantive differences relating to the assigned letter score based on the PLOS and BLOS software: what distinguishes a "B" from a "C"? The fairly simple procedure of collecting field data entering into a PLOS or BLOS, produces a letter score designating a level of service, but does not identify capital related deficiencies which could be corrected. Finally there is the question of how pedestrian and bicycle access to a transit hub differs.

The three stations recommended for study in Phase II are identified on Map 1: Ardmore Junction, located along the Southeastern Pennsylvania Transit Authority's (SEPTA) Route 100 Norristown High Speed Line in Haverford Township, Delaware County, Pennsylvania; Avandale Park and Ride, serving New Jersey Transit (NJT) local and commuter buses in Winslow Township, Camden County, New Jersey; and Lindenwold station at the terminus of the Delaware River Port Authority's PATCO High Speed Line, and along New Jersey Transit's Atlantic City Line commuter rail in Lindenwold Borough, Camden County, New Jersey. These stations represent a range of settings, modes, agencies and services whose findings may be applied to other locations or contexts.


MAP : 1
Phase II Station Study Locations
LEGEND
1 Mile Buffer
Station
Commuter Rail
Bucks
Mercer
Montgomery
Chester
Delaware
Philadelphia
Burlington
Camden
Gloucester
Ardmore Junction
Lindenwold
Avandale Park & Ride
NJ Turnpike
G.S. Pkwy
0 5 10
Miles
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MAY 2005
Location Map (Not to Scale)

Method of Analysis

The method for analyzing station accessibility in Phase II requires the collection of field data and its analysis using customized software which determines level of service for bicycles and pedestrians. Phase I of the study compiled and analyzed demographic data to recommend three stations for more in depth study in Phase II. Information collected in the field includes road cartway and shoulder widths, sidewalk and buffer widths, and amenities that enhance station access by pedestrians and bicyclists. While some road information is available from PennDOT and NJDOT, the local and collector roads are not included in the databases of this information kept by the agencies. The method of analysis used in Phase II involves calculating Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) of the sidewalk and road facilities feeding into the transit hubs.

PLOS is a measure that quantifies pedestrian perception of safety and comfort and BLOS is a measure of bicyclist safety and comfort. The measure assigns an A through F score to a facility based on the road environment, with 'A' being the safest and most comfortable roadway segments, and 'F' being the most hazardous and uncomfortable for pedestrians and bicyclists. The measure uses an algorithm or mathematical relationship between variables to compute a measure of how well roadways accommodate pedestrian and bicycle travel. The terms of the calibrated model were developed and refined through extensive variables transformation testing and regression developed through the Florida Department of Transportation. The resulting score is not level of service in the highway sense, where the length of time delay at a point, typically an intersection, establishes an objective score.

Table 1. Level of Service Categories for PLOS and BLOS

Level of Service	Model Score
A	<1.5
B	>1.5 and <2.5
C	>2.5 and <3.5
D	>3.5 and <4.5
E	>4.5 and <5.5
F	>5.5

Table 1 shows the level of service and the accompanying model scores derived from the spreadsheet algorithms. Scores of 'A,' indicate the highest level of safety and comfort with scores of 'F,' indicative of minimal safety and comfort. Unlike highway level of service the differences between letter grades have ordinal distinctions, with the letter grades indicating only that a "B" is better than a "C". Even when field measures were used in conjunction with field views, the degree of difference between letter grades was difficult to determine.

More detailed information on PLOS algorithms of the founding perceptual and calibration research, can be found in the Transportation Research Board paper #01-

0511 by Bruce W. Landis, et al., titled “Modeling the Roadside Walking Environment: A Pedestrian Level of Service” from 2001, also available online at: http://www.dot.state.fl.us/planning/systems/sm/los/pdfs/pedlos.pdf. The BLOS method from which the PLOS was derived is also described in technical detail in the 1997 report Transportation Research Record 1578, authored by Bruce W. Landis, and titled “Real-Time Human Perceptions: Toward a Bicycle Level of Service.” The spreadsheet software for the bicycle is currently in its second version with a background of over 20,000 miles of evaluated streets across North America including use by the city of Philadelphia Department of Planning.

The data needed to calculate PLOS and BLOS are:

- Annual average daily traffic volume on roads
- Percent of heavy vehicles
- Number of through travel lanes
- Lane configuration
- Posted speed limit
- Width of outside travel lane
- Width of paved shoulder
- Width of bicycle lane
- Percentage of segment occupied by on-street parking
- Percentage of road segment with sidewalks
- Pavement condition
- Buffer width between curb and sidewalk
- Width of sidewalk
- Spacing of street trees

Field work conducted for Phase II of this study gathered the above data for roadway widths, on-street parking, buffer width, and sidewalk width. The number of through travel lanes on all local roads was assumed to be two and confirmed this through field views. Lane configuration information, speed limits, and traffic volume information on major roads not visited during the field surveys were obtained from secondary sources, such as state Department of Transportation or by assuming continuity with other known proximate facilities.

On major roads, average annual daily traffic (AADT) volume data was obtained from secondary sources, or if unavailable, assumed constant at 12,000 vehicles per day. AADTs on local roads were held constant at 500 vehicles per day, though in the case of the SEPTA busway, a count of 50 buses per day was used. Data on the spacing of street trees was held constant at zero, as none of the surveyed streets featured any consistent significant trees plantings in the buffer areas between the sidewalk and the curb.

The method itself is simple. The first step is to inventory the roads surrounding the stations. For the PLOS, this is a one quarter mile buffer around the station, and for the BLOS a mile wide buffer was described for assessment. Field work was done using a measuring wheel to assess the widths of the required parts. The data collected for the

spreadsheet analysis required measurement of cartway, shoulder, buffer and sidewalk widths in a quarter mile area surrounding the respective transit station. These sample measures are then use to describe the road segments in question.

The second step is to enter the road segment data into one of the LOS spreadsheets and receive a letter score. Other data collected during the field views includes the percent of usable street parking available, descriptions of bicycle amenities, and qualitative notes regarding conditions for pedestrians and bicyclists. The collected data is merged with whatever preexistent data has been supplied by the DOTs. The assigned letter grade is used to characterize the road on a map. The numerical score ranges from A through F, but what these mean in any practical sense was never described in the literature. The nature of the scores will be reflected on in discussion of the station area scores and their contextual environments.

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II. STATION STUDY AREAS

ARDMORE JUNCTION

Ardmore Junction is a station on the Route 100 Norristown High Speed Line with connections to SEPTA's 103 bus. There are scheduled pick ups and drop offs at Ardmore Junction by employee shuttles for two assisted living centers. The 103 bus runs along a former trolley right of way converted to a dedicated bus-way connecting Ardmore and its adjacent shopping district at the north end, crossing Haverford Road, passing Merwood Park, and merging into the street traffic where Darby and Eagle roads meet in the heart of Havertown. Paved, grade separated, and well lighted, nearly any time of the day or night people can be found riding bikes, walking their dogs, or exercising along the bus-way. The approximate mile and a half strip of road has become a local amenity for safe movement through and between the local neighborhoods.

The Ardmore Junction platform is high above street level, accessible through two stairways on the north and south sides of the tracks. The north stairway ascends from the SEPTA parking lot along Haverford Road to the outbound platform. The parking lot is accessible by vehicle via a curb cuts along West Hathaway Lane. During the weekday morning when the field survey was done, the parking lot was completely full (146 slots), with some cars parked in non-designated parking spaces.

Pedestrian amenities in the station area include a SEPTA provided crossing under the rail overpass using the bus-way, though this bus-way crossing requires passing in front of automobile traffic on Hathaway Lane on both sides of the underpass. The West Hathaway Lane underpass separating the north and south station areas is quite narrow, and poses a safety hazard to pedestrians, though it is frequently used by pedestrians sharing the narrow tunnel with automobiles rather than crossing to the bus-way.

There are no buffer areas separating the parking lot or sidewalk from the street on the north side of the station area. On the south side of the station area, there is no sidewalk along West Hathaway Lane, although the SEPTA bus-way is frequented by pedestrians. There is no bicycle rack or bicycle storage facility at Ardmore Junction. However, there were two bicycles, along with four bicycle locks attached to guard rails and hand rails at the both the north and south sides of the station area. At other times many more bicycles can be found locked to every imaginable freestanding object surround the station. Regardless of the accessibility of the station for the surrounding community, there is no designated place to lock up one's bicycle, except to railings or telephone pole guidelines.

Pedestrian Level of Service

Table 2 shows the Pedestrian Level of Service (PLOS) scores calculated for the roads within a quarter-mile radius of the station.

Table 2. Pedestrian Level of Service Within One-Quarter Mile of Ardmore Junction Station.

Road Name	From	To	PLOS Score	Level of Service
Haverford Rd	Haverford Ct	Park Ter.	3.36	C
SEPTA Busway	Eagle Rd	County Line Rd	0.0	A
Sunnybrook Ln	West Hathaway Ln	Golfview Rd	3.03	C
Pine Valley Ln	West Hathaway Ln	Sunnybrook Ln	3.03	C
Golfview Rd	Overbrook Ter	Ardmore Ave	3.3	C
Overbrook Ter	Golfview Rd	West Hathaway Ln	1.97	B
West Hathaway Ln	Haverford Rd	Merwood Ln	3.3	C
East Hathaway Ln	St. Denis Ln	Merwood Ln	2.09	B
St. Denis Ln	East Hathaway Ln	Cherry Ln	2.02	B
Cherry Ln	Merwood Ln	Wynnefield Dr	2.02	B
Linden Dr	Merwood Park	Wynnefield Dr	2.09	B
Poplar Rd	Cherry Ln	Eagle Rd	1.86	B
Rosewood Ln	Linden Dr	Wynnfield Dr	2.25	B
Wynnfield Dr	Eagle Rd	Merwood Park	1.5	A
Lorraine Ave	Haverford Rd	Belmont Ave	1.91	B
Rosemont Ave	Lorraine Ave	Park Ter	1.95	B
Belmont Ave	Willow Ave	Malvern Rd	1.95	B
Humphreys Rd	Belmont Ave	Oak View Rd	1.67	B
Haverford Ct	Haverford Rd	(No Outlet)	3.16	C
Georges Ln	Haverford Rd	Belmont Ave	2.09	B
Malvern Rd	Belmont Ave	Haverford Rd	1.85	B
Woodcrest Ave	Belmont Ave	Haverford Rd	1.89	B
Patton Dr	Belmont Ave	(No Outlet)	1.95	B

Two segments of road, the SEPTA Route 103 busway and Wynnefield Drive between Eagle Road and Merwood Park, received a PLOS score of 'A.' Most road segments received a PLOS score of 'B.' It is interesting to note that Haverford Road seemed less safe that the other segments designated with a "C". While Sunnybrook, Pine Valley and Golfview roads had the same grade, the assumed AADTs used in the spreadsheet may have skewed the results. It is also worth considering that vehicular volumes during peak hours (7:30 to 9:00 am, 4:30 to 6:30 pm) may create hazardous walking or bicycling environments which are relatively safe during the other times of day.

Map 2 displays PLOS results for the roads within a quarter-mile radius of the station. The quarter-mile area is characterized by a fairly dense residential neighborhood, with numerous local roads, many of which feed into a large park. The presence of Merwood Park is significant because it limits east-west automobile through traffic. Haverford Road is the only arterial road within one-quarter mile of the station. It features four lanes of through traffic, with four foot sidewalks and no buffers on either side, receiving PLOS grade "C".


Haverford Township
HAVERFORD RD
GOLFVIEW RD
MALVERN RD
GEORGES LN
HAVERFORD CT
WOODCREST AVE
PATTON DR
POINT READING RD
OAK VIEW RD
HUMPHREYS RD
BELMONT AVE
LORRAINE AVE
OLCOTT AVE
BRYN MAWR AVE
WILLOW AVE
ROSEMONT AVE
SUNNYBROOK LN
PINE VALLEY LN
OVERBROOK TER
WEST HATHAWAY LN
EAST HATHAWAY LN
SAINT DENNIS LN
CHERRY LN
WYNNEFIELD DR
LINDEN DR
POPLAR RD
EAGLE RD
PARK TER
WYNNEWOOD DR
KENILWORTH RD
WHITEMARSH RD
MERWOOD LN
Ardmore Junction Train Station
Pedestrian LOS
A
B
C
D
E
F
MAP 2
Pedestrian Level Of Service Within One-Quarter Mile of Ardmore Juntion Station
0
250
Feet
N
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MAY 2005

Bicycle Level of Service

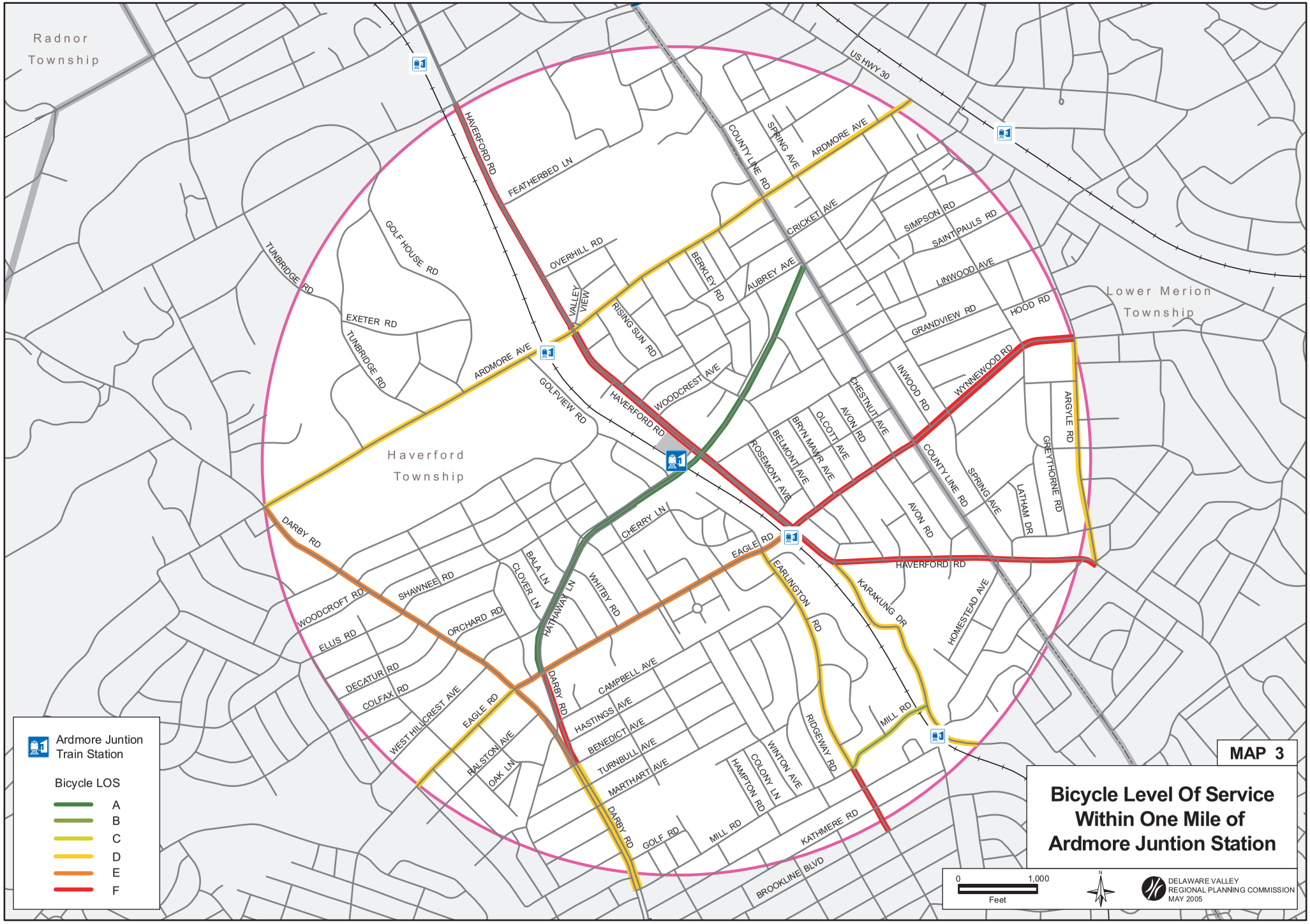
Table 3 shows BLOS data for the major roads within a one-mile radius of the station area.

Table 3. Bicycle Level of Service Within One Mile of Ardmore Junction Station.

Road Name	From	To	BLOS Score	Level of Service
Ardmore Ave	Darby Rd	US 30, Lancaster Ave	4.07	D
Argyle Rd	Wynnewood (Eagle) Rd	Haverford Rd	4.47	D
Darby Rd	Ardmore Ave	Eagle Rd	4.67	E
Darby Rd E	Eagle Rd	Benedict Ave	29.76	F
Darby Rd W	Eagle Rd	Benedict Ave	4.62	E
Darby Rd	Benedict Ave	Mill Rd	4.44	D
Eagle Rd	Buffer S	Darby Rd	4.36	D
Eagle Rd	Darby Rd	Haverford Rd	4.71	E
Wynnewood (Eagle) Rd	Haverford Rd	Argyle Rd	7.89	F
Earlington Rd	Eagle Rd	Mill Rd	4.35	D
Earlington Rd	Mill Rd	Buffer	7.13	F
Haverford Rd	College Ave (buffer)	Argyle Rd (buffer)	5.79	F
Karakung Rd	Haverford Rd	Buffer S	4.47	D
Mill Rd	Earlington Rd	Karakung Dr	3.42	C
SEPTA Busway	Eagle Rd	County Line Rd	0.0	A

Map 3 depicts BLOS results for the major roads within a one-mile radius of the Ardmore Junction station area. These scores are generally poor with the exception of the SEPTA bus-way. Clearly, the SEPTA bus-way provides the best east-west access for a bicyclist accessing the station from the neighborhoods. Many of the facilities have been downgraded when required to meet standards for bicycle access. Of note, is the drop from a pedestrian “C” to a bicycle “F” for Haverford Road which clearly does not provide the distance or separation required for safe cycling. The most dramatic BLOS score is for a short segment labeled Darby Road East, nearly four times the next lowest score. This segment serves as access to Darby Road for traffic driving west on Eagle Road, it is high volume, narrow (with high curbs), and would be dangerous to mix automobile and bicycle traffic.

The other road segments might not be particularly bicycle friendly but none present such high scores. Nothing in the field views explains the differences in BLOS scores with such minor deviations such as Ardmore Avenue and Argyle Road, or even road conditions along Ardmore Avenue.


Radnor Township
Haverford Township
Lower Merion Township
US HWY 30
HAVERFORD RD
FEATHERBED LN
COUNTY LINE RD
SPRING AVE
ARDMORE AVE
CRICKET AVE
SIMPSON RD
SAINT PAULS RD
LINWOOD AVE
HOOD RD
GRANDVIEW RD
WYNNEWOOD RD
INWOOD RD
CHESTNUT AVE
AVON RD
OLCOTT AVE
BRYN MAWR AVE
BELMONT AVE
ROSEMONT AVE
ARGYLE RD
GREYTHORNE RD
LATHAM DR
SPRING AVE
COUNTY LINE RD
AVON RD
HAVERFORD RD
EAGLE RD
EARLINGTON RD
KARAKUNG DR
HOMESTEAD AVE
MILL RD
RIDGEWAY RD
WINTON AVE
COLONY LN
HAMPTON RD
KATHMERE RD
BROOKLINE BLVD
GOLF RD
MILL RD
DARBY RD
CAMPBELL AVE
HASTINGS AVE
BENEDICT AVE
TURNBULL AVE
MARTHART AVE
CHERRY LN
WHITBY RD
HATHAWAY LN
BALA LN
CLOVER LN
ORCHARD RD
SHAWNEE RD
WOODCROFT RD
ELLIS RD
DECATUR RD
COLFAX RD
WEST HILLCREST AVE
EAGLE RD
RALSTON AVE
OAK LN
DARBY RD
GOLFVIEW RD
HAVERFORD RD
WOODCREST AVE
RISING SUN RD
VALLEY VIEW
BERKLEY RD
AUBREY AVE
OVERHILL RD
GOLF HOUSE RD
TUNBRIDGE RD
EXETER RD
TUNBRIDGE RD
ARDMORE AVE
Ardmore Juntion Train Station
Bicycle LOS
A
B
C
D
E
F
MAP 3
Bicycle Level Of Service Within One Mile of Ardmore Juntion Station
0
1,000
Feet
N
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MAY 2005

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AVANDALE PARK & RIDE

The Avandale Park and Ride is a unique facility in the region in that it only serves passenger bus service. This facility is just off the Atlantic City Expressway in a developing low density semi-rural suburban context with large swaths of open space being quickly developed. The Park and Ride is bordered on one side by what appears to be a working class single and multi-family unit subdivision with direct sidewalk access to the buses. New Jersey Transit bus routes 400 (with service between Sicklerville and Philadelphia) , 459 (service between the P&R and Echeleon Mall), 463 (service between the P&R and Woodbury), and 551 (service between Atlantic city and Philadelphia) all converge at a lot with 325 parking slots.

Avandale Park and Ride features a large parking lot, and a single bus loading and unloading area. It is accessible by vehicle via a driveway off of County Highway 536 Spur. During a weekday morning peak when the field survey was done, the parking lot was mostly full. There are two pedestrian walkways leading from the parking lot to adjacent Hampton Place, but no clear pedestrian access to and along 536 Spur, or to the residential subdivision lying due west. There is a bicycle rack located next to the bus loading and unloading area. At the time of the field survey, there were 2 bicycles locked to the rack. Other features include a taxi stand near the bus loading and unloading area, and a portable toilet in a bus idling area, for use by drivers.

Pedestrian Level of Service

Table 4 shows Pedestrian Level of Service (PLOS) data for the roads within a quarter-mile radius of Avandale Park and Ride.

Table 4. Pedestrian Level of Service Within One-Quarter Mile of Avandale Park and Ride.

Road Name	From	To	PLOS Score	Level of Service
Hampton Pl	Hampton Gate Dr	Hampton Ct	1.88	B
Hampton Ct	Hampton Pl	(No Outlet)	1.92	B
Hampton Gate Dr	Hampton Pl	(No Outlet)	1.9	B
Hyacinth Ln	Hampton Gate Dr	(No Outlet)	1.96	B
Harrington Ln	Hampton Gate Dr	Hopewell Ln	1.85	B
Hopewell Ln	Hathaway Dr	Harrington Ln	1.92	B
Hathaway Dr	Hopewell Ln	Heywood Ln	1.92	B
Hopewell Ln	Harrington Ln	Helmwood Ct	1.92	B
Helmwood Ct	Hopewell Ln	(No Outlet)	1.92	B
Hamlet Ct	Hopewell Ln	(No Outlet)	1.92	B
Hampton Pl	County Hwy 536 Spur	Hopewell Ln	2.81	C
Hartsdale Ln	Hawthorne Rd	Hawthore Rd	1.85	B
Chews Landing Rd	Hawthorne Rd	1/4 mile from P&R	4.01	D
Chews Landing Rd	1/4 mile from P&R	County Hwy 536 Spur	4.28	D
County Hwy 536 Spur	Chews Landing Rd	Hampton Pl	4.7	E

No road segments were awarded a PLOS grade of 'A.' Most road segments received grade 'B.' Hampton Place between County Highway 536 Spur and Hopewell Lane received grade 'C.' Chews Landing Road between Hawthorne Road and 536 Spur received grade 'D,' and 536 Spur received a grade of 'E.' The range between "first and worst" is not that large, and the semi-rural setting giving the impression of safe car free mobility, but it is the absence of sidewalks or buffers which reduce the pedestrian scores.

Map 4 displays PLOS results for the roads within a quarter-mile radius of the station. The quarter-mile area is characterized by a single and multi-family housing subdivision to the north, with direct pedestrian access. To the west lies another single-family home subdivision, with parts of Hartsdale Lane entering the quarter-mile radius. There is no direct access from this subdivision, and pedestrians seeking access to the Park and Ride must utilize Chews Landing Road and County Highway 536 Spur. The remainder of the quarter-mile area is either undeveloped or inaccessible to pedestrians.

Bicycle Level of Service

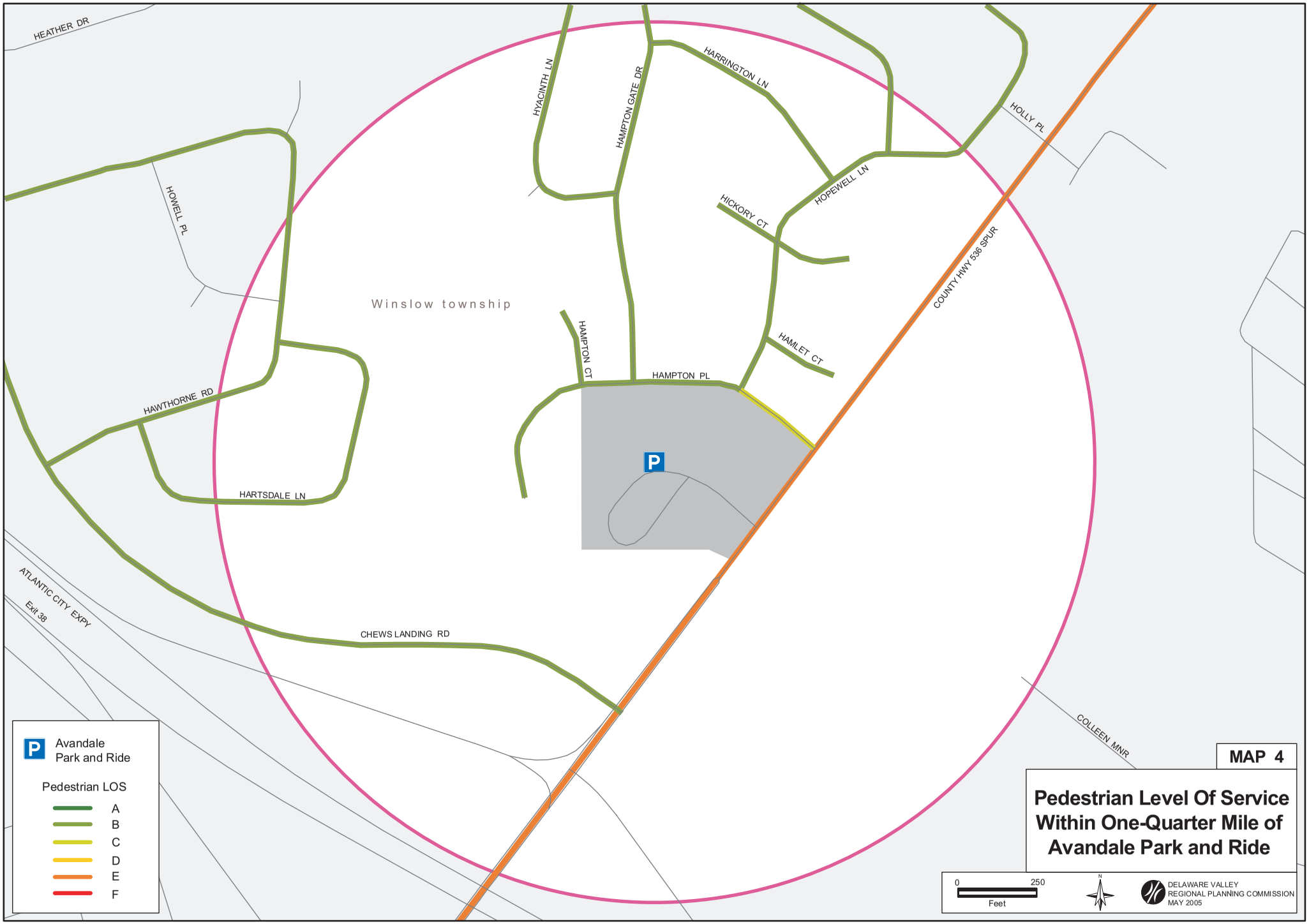
Table 4 shows BLOS data for the major roads within a one-mile radius of the station area.

Table 5. Bicycle Level of Service Within One Mile of Avandale Park and Ride.

Road Name	From	To	BLOS Score	Level of Service
County Hwy 536 Spur	County Boundary	Arbor Meadow Dr	1.74	B
County Hwy 536 Spur	Mink Ln	County Boundary	1.93	B
Chews Landing Rd	County Hwy 536 Spur	Kenwood	0.93	A
Sicklerville Rd	Eisenhower LN	NW Buffer	0.07	A

County Highway 536 Spur is awarded a BLOS score of 'B.' Chews Landing Road receives a score of 'A,' and Sicklerville Road receives a score of 'A.' It is worth noting that the difference in score between PLOS and BLOS scores for County Hwy 536 Spur relate to the width of the road and the absence of sidewalks. Striped shoulders provide comfortable room for bicyclists but are scored only as a hazard for pedestrians.

Map 5 shows BLOS results for the major roads within a one-mile radius of the station area. The one-mile radius area is characterized by flat, semi-rural land that is rapidly suburbanizing. The few major roads tend to be straight and flat, with wide striped shoulders that can accommodate bicycle traffic fairly safely.


HEATHER DR
HYACINTH LN
HAMPTON GATE DR
HARRINGTON LN
HOLLY PL
HOWELL PL
HOPEWELL LN
HICKORY CT
COUNTY HWY 536 SPUR
Winslow township
HAMPTON CT
HAMPTON PL
HAMLET CT
HAWTHORNE RD
HARTSDALE LN
ATLANTIC CITY EXPY
Exit 38
CHEWS LANDING RD
COLLEEN MNR
Avandale
Park and Ride
Pedestrian LOS
A
B
C
D
E
F
MAP 4
Pedestrian Level Of Service
Within One-Quarter Mile of
Avandale Park and Ride
0
250
Feet
N
DELAWARE VALLEY
REGIONAL PLANNING COMMISSION
MAY 2005

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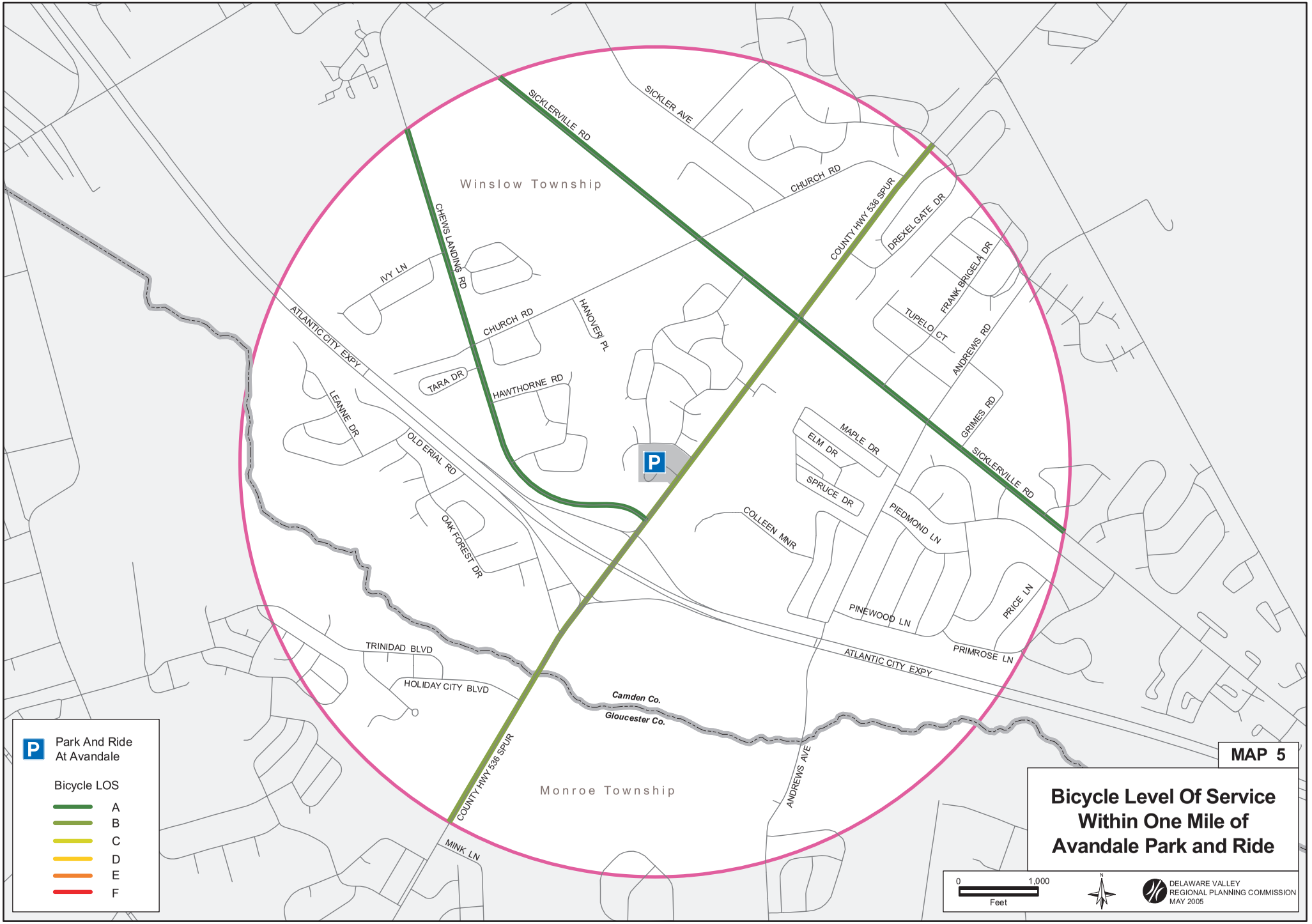
Winslow Township
Monroe Township
SICKLERVILLE RD
SICKLER AVE
CHURCH RD
COUNTY HWY 536 SPUR
DREXEL GATE DR
FRANK BRIGELA DR
TUPELO CT
ANDREWS RD
GRIMES RD
CHEWS LANDING RD
IVY LN
HANOVER PL
ATLANTIC CITY EXPY
TARA DR
HAWTHORNE RD
LEANNE DR
OLD ERIAL RD
OAK FOREST DR
MAPLE DR
ELM DR
SPRUCE DR
COLLEEN MNR
PIEDMOND LN
PINEWOOD LN
PRICE LN
PRIMROSE LN
TRINIDAD BLVD
HOLIDAY CITY BLVD
Camden Co.
Gloucester Co.
ANDREWS AVE
MINK LN
Park And Ride At Avandale
Bicycle LOS
A
B
C
D
E
F
MAP 5
Bicycle Level Of Service Within One Mile of Avandale Park and Ride
0
1,000
Feet
N
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MAY 2005

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LINDENWOLD STATION

The Lindenwold Station is the terminus point of the PATCO High-Speed Line in New Jersey. Lindenwold also serves as a station with separated platforms for New Jersey Transit's Atlantic City line from Philadelphia's 30th Street Station. There are connections with New Jersey Transit bus routes 401 (service from Philadelphia to Salem), 402 (service from Philadelphia to Pennsville), and 609 (service from Quaker Bridge Mall to the New Jersey DOT Headquarters in Ewing). Parking at this station is significant, with about 3,340 slots available daily, with a bus loading and unloading area adjacent to the station entrance. A pick up and drop off lane sits parallel to the bus area, separated by a concrete median. The PATCO station is indoors, with stair and elevator access to the raised train platforms. There is also a platform for the New Jersey Transit Atlantic City Line, accessible via a pedestrian underpass beneath the PATCO platform and tracks.

Vehicles access the station via entrances on Berlin Road to the south and White Horse Road to the west. There are some sidewalks along the driveways within the vast parking area; however, pedestrian access to areas beyond the parking lot is not clearly marked. At the time of the field survey during mid-morning, the parking lot appeared almost completely full. The area directly north of the station is inaccessible to both vehicles and pedestrians. There are two bicycle racks at Lindenwold Station, located near the east and west entrances to the station. The east rack held fourteen bicycles, and the west rack held five, for a total of 19 bicycles at the station. There is also a taxi stand located in the pick-up and drop-off lane.

Pedestrian Level of Service

Table 5 shows Pedestrian Level of Service (PLOS) data for the roads within a quarter-mile radius of Lindenwold Station.

Table 6. Pedestrian Level of Service Within One-Quarter Mile of Lindenwold Station

Road Name	From	To	PLOS Score	Level of Service
Holyoke Ave	Station Ave	Lehigh Ave	2.5	B
Lehigh Ave	Holyoke Ave	(buffer)	2.47	B
Colgate Ave	Station Ave	Lehigh Ave	1.9	B
Station Ave	Colgate Ave	White Horse Rd	2.52	B
2nd St	Chestnut Ave	Walnut Ave	2.32	B
Chestnut Ave	Gibbsboro Rd	2nd St	1.82	B
Walnut Ave	Gibbsboro Rd	2nd St	1.67	B
Gibbsboro Rd	White Horse Rd	3rd St	3.39	C
White Horse Rd	Gibbsboro Rd	Berlin Rd	2.72	C
Berlin Rd	White Horse Rd	(station parking lot)	4.05	D

No road segments were awarded a PLOS letter grade of 'A.' Most road segments were awarded a letter grade of 'B.' Gibbsboro Road and White Horse Road each received a grade of 'C.' Berlin Road between White Horse Road and the east station entrance received a grade of 'D.' The station access appeared highly exposed from an

observational stance. The large parking facility consumes a great deal of the quarter-mile buffer pushing residential away from the station. The lot size of over 3,000 automobiles also subjects those walking from outlying areas or from their cars to a very challenging vehicular environment during the two hour morning or afternoon peak period.

Map 6 displays PLOS results for the roads within a quarter-mile radius of the Lindenwold Station. The quarter-mile area is characterized by an automobile-oriented commercial area along Berlin Road directly south of the station, with few pedestrian accommodations. To the west of the station lies a single family home neighborhood with access across White Horse Road from Station Avenue via a striped crosswalk. To the north of the station is another single-family home neighborhood beyond Gibbsboro Avenue. Pedestrians from this neighborhood do not have direct access to the station, and must utilize Gibbsboro Avenue and White Horse Road. The area directly east of the station area is undeveloped and inaccessible to pedestrians.

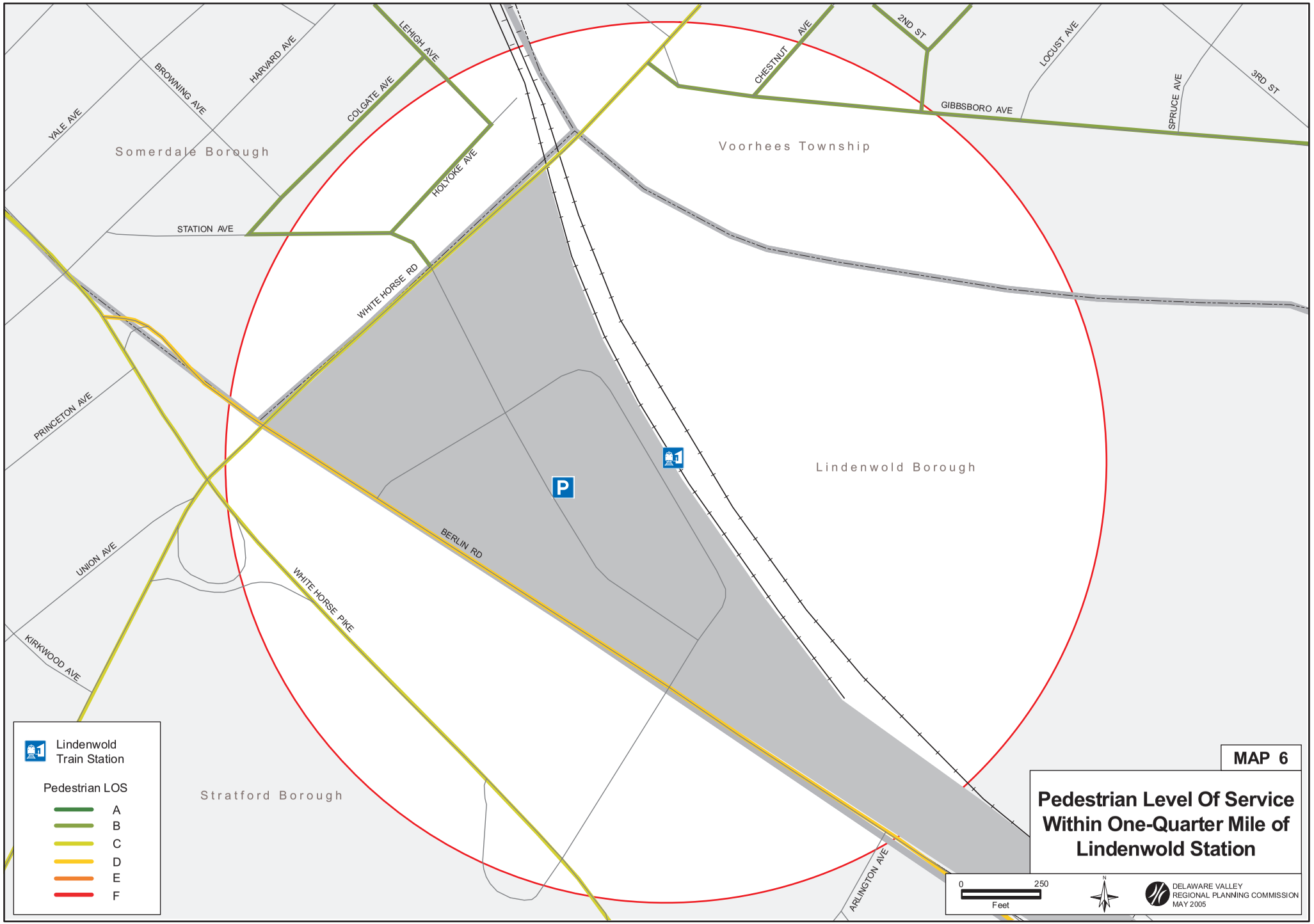
Bicycle Level of Service

Table 6 shows BLOS data for the major roads within a one-mile radius of the station area.

Table 7. Bicycle Level of Service Within One Mile of Lindenwold Station.

Road Name	From	To	BLOS Score	Level of Service
US 30 (Whitehorse Pike)	CR 678 (Somerdale Rd)	CR 669 (Stone Rd)	3.94	D
CR 669 (Stone Rd)	CR 673 (Laurel Rd)	US 30 (Whitehorse Pike)	3.85	D
CR 670 (Burnt Mill Rd)	CR 678 (Somerdale Rd)	CR 684 (Gibbsboro Rd)	4.07	D
CR 673 (White Horse Rd)	CR 669 (Warwick Rd)	Echelon Dr	3.94	D
CR 684 (Gibbsboro Rd)	CR 673 (Whitehorse Rd)	CR 701 (Hilliards Rd)	4.20	D
CR 697 (Broadway Ave)	CR 669 (Stone Rd)	US 30 (Whitehorse Pike)	3.85	D
CR 702 (Egg Harbor Rd)	US 30 (Whitehorse Pike)	Elm Ave	4.30	D
CR 727 (Atlantic Ave)	CR 677 (Sommerdale Rd	CR 699 (Stone Rd)	4.20	D
Vassar Ave	CR 669 (Warwick Rd)	US 30 (Whitehorse Pike)	3.85	D
Laurel Rd	CR 670 (Burnt Mill Rd)	Echelon Dr	3.85	D
Echelon Dr	Laurel Rd	CR 673 (Whitehorse Rd)	3.72	D

As noted above, these “D” scores may not fully reflect the field observations, which suggest very challenging environment for bicyclists. One example being the White Horse Road which narrows going over a bridge, making the crossing quite hazardous if two automobiles and a cyclist should go over at the same time. Traffic speed and volumes, and unchecked number of curb cuts make the Berlin Road corridor a dangerous environment for a bicycle to share with an automobile. This sort of danger is shown in Map 7 which shows BLOS results for the major roads within a one-mile radius of the station area. The residential development to the south and west of the station suffers from poor LOS on the main roads The residents to the north along Gibbsboro and White Horse Roads have circuitous access to Lindenwold, including the afore mentioned overpass, which only magnifies a cyclist’s exposure to road danger.


Somerdale Borough
Voorhees Township
Lindenwold Borough
Stratford Borough
YALE AVE
BROWNING AVE
HARVARD AVE
LEHIGH AVE
COLGATE AVE
HOLYOKE AVE
STATION AVE
WHITE HORSE RD
PRINCETON AVE
UNION AVE
KIRKWOOD AVE
WHITE HORSE PIKE
BERLIN RD
CHESTNUT AVE
2ND ST
GIBBSBORO AVE
LOCUST AVE
SPRUCE AVE
3RD ST
ARLINGTON AVE
P
Lindenwold Train Station
Pedestrian LOS
A
B
C
D
E
F
MAP 6
Pedestrian Level Of Service Within One-Quarter Mile of Lindenwold Station
0
250
Feet
N
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MAY 2005

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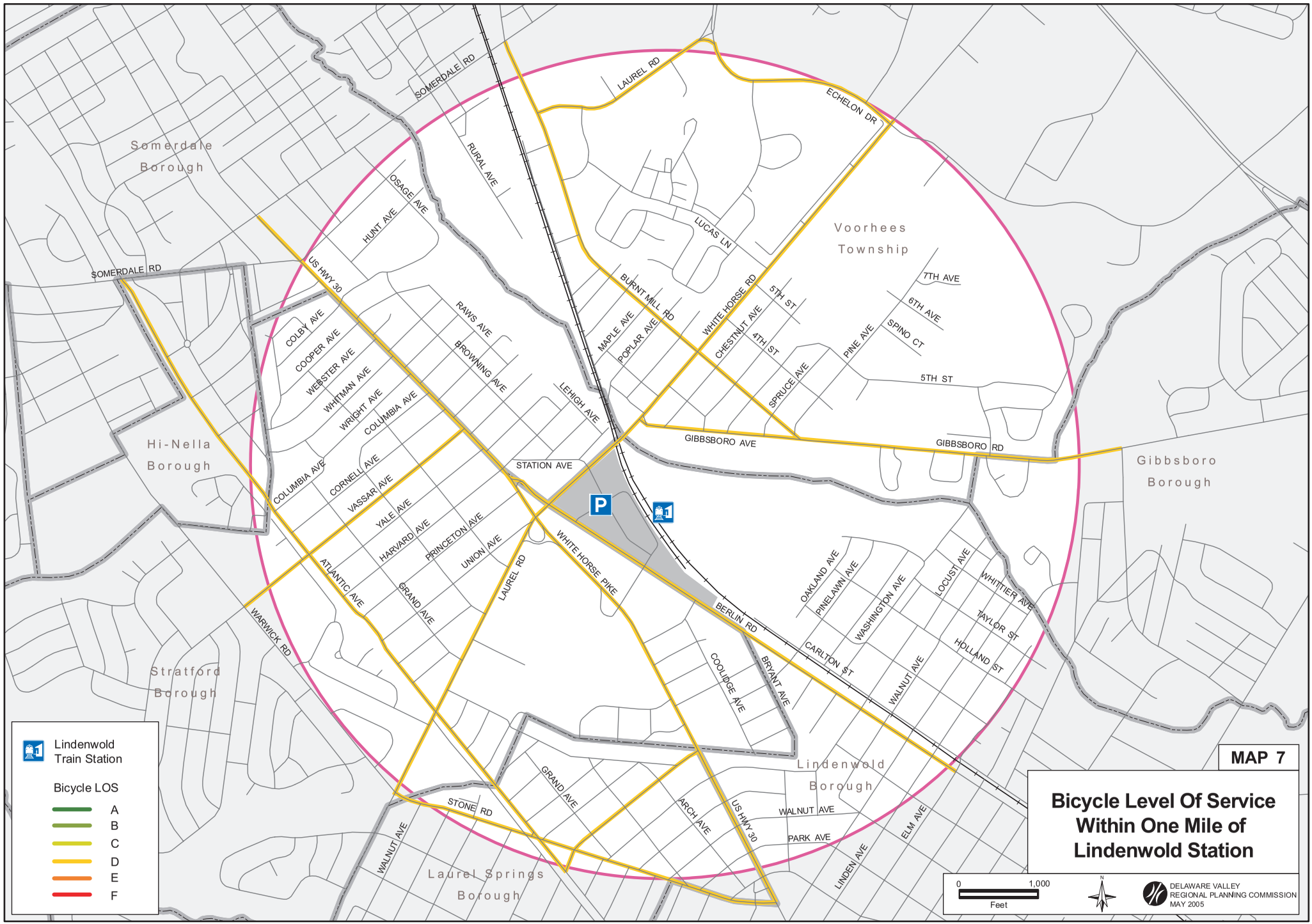
Somerdale Borough
Hi-Nella Borough
Stratford Borough
Laurel Springs Borough
Voorhees Township
Gibbsboro Borough
Lindenwold Borough
SOMERDALE RD
LAUREL RD
ECHELON DR
RURAL AVE
OSAGE AVE
HUNT AVE
US HWY 30
LUCAS LN
BURNT MILL RD
MAPLE AVE
POPLAR AVE
WHITE HORSE RD
CHESTNUT AVE
5TH ST
4TH ST
7TH AVE
6TH AVE
SPINO CT
PINE AVE
SPRUCE AVE
5TH ST
GIBBSBORO AVE
GIBBSBORO RD
RAWS AVE
BROWNING AVE
LEHIGH AVE
COLBY AVE
COOPER AVE
WEBSTER AVE
WHITMAN AVE
WRIGHT AVE
COLUMBIA AVE
CORNELL AVE
VASSAR AVE
YALE AVE
HARVARD AVE
PRINCETON AVE
UNION AVE
GRAND AVE
ATLANTIC AVE
WARWICK RD
STATION AVE
LAUREL RD
WHITE HORSE PIKE
BERLIN RD
OAKLAND AVE
PINELAWN AVE
WASHINGTON AVE
LOCUST AVE
WHITTIER AVE
TAYLOR ST
HOLLAND ST
CARLTON ST
WALNUT AVE
COOLIDGE AVE
BRYANT AVE
GRAND AVE
STONE RD
ARCH AVE
US HWY 30
WALNUT AVE
PARK AVE
ELM AVE
LINDEN AVE
Lindenwold Train Station
Bicycle LOS
A
B
C
D
E
F
MAP 7
Bicycle Level Of Service Within One Mile of Lindenwold Station
0
1,000
Feet
N
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MAY 2005

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III. SUMMARY AND RECOMMENDATIONS

PLOS and BLOS are simple and effective methods of representing the quality of pedestrian and bicycle facilities. From the data compiled on the three stations in this report, we offer specific recommendations on improving pedestrian and bicycle access to stations. These recommendations may be limited in their transferability between stations due to the unique characteristics of each station. Some general guidelines, however, may be used elsewhere to provide adequate safety and access in the encouragement of walking and bicycling to transit stations.

The standard PLOS and BLOS collection method is an easily replicable means to create a regional database for all transit facilities. Such a database should include information on all of the inputs needed to compute BLOS and PLOS, gathered through a combination of secondary sources and field work. Though some data already exists with the DOTs, it should be consolidated into a single place for simplicity and efficiency in the study of bicycle and pedestrian access to transit. One means to accomplish this is DVRPC's regional transit database which is nearing completion. This is a web based database organizing regional transit data (parking, TOD, various studies) by station. Once this resource comes on line and as content is added, pedestrian and bicycle information will become readily accessible within the contest of other station level studies.

Overall, pedestrian and bicycle access to transit stations should be encouraged through the provision of adequate facilities and public improvements, incentives, and marketing. Transit users who walk or ride a bike to the station help ease traffic congestion, as well as the strain on crowded parking facilities. Such activity promotes physical fitness, and helps spur demand for mixed-use, pedestrian oriented development that does not require automobile travel for access, making more efficient use of land and the existing transportation network. Specific recommendations are provided for each station below:

Ardmore Junction

Ardmore Junction station is surrounded by a significant amount of residential development that is conducive to walking and bicycling to the station. Issues that should be addressed when making public improvements in the area include an clarifying the pedestrian paths beneath the underpass along West Hathaway Lane and the parallel Hathaway Lane busway pedestrian crossing. Both present dangerous access by either sharing the narrow underpass with automobiles or crossing West Hathaway Lane to get to the busway crossing. A striped or grade-separated pedestrian path, speed bumps, or other traffic calming measures, would improve pedestrian safety and access in this area.

Though most of the residential streets surrounding the station are rated as pedestrian friendly, Haverford Road is less so. It is the busiest, widest street in the study area, and also receives the poorest marks in terms of PLOS. A long stretch of sidewalk borders

the road without any buffer between the pedestrian and the automobiles, obviously the result of earlier road widening to three lanes. Improvements to consider for Haverford Road include widening sidewalks to at least five feet, though this might involve acquiring some residential front yards. There should be a buffer between the curb and the sidewalk to further separate pedestrians from fast-moving vehicular traffic.

Pedestrian striping and signals should be added to the intersection of Haverford Road and West Hathaway Lane to improve pedestrian safety and access from neighborhoods to the north of the station. Additionally, the intersection of Haverford Road and Lorraine Avenue should include clear pedestrian striping and signals. Both intersections should utilize pedestrian-actuated signals to provide ample time to cross Haverford Road safely.

At a minimum, bicycle racks should be installed in the parking area (state-of-the-art would be best). These could be placed near the base of the staircase to the outbound rail platform, such that bicyclists will not have to use guard rails, parking signs, and other makeshift bicycle parking strategies. Bicycle access to Ardmore Junction station is generally good, especially with the presence of the Hathaway Lane busway offering a grade-separated path radiating nearly one mile to the north and south of the station. The bicycle storage facilities, however, are nonexistent.

Avandale Park and Ride

The Avandale Park and Ride is successful in its role as an automobile oriented transit facility. The pedestrian walkways connecting the subdivision to the station offer safe, easy access. The path leading to the bus loading and unloading areas is unclear with moving cars and buses presenting a potential hazard to pedestrians. There is no pedestrian access from County Highway 536 Spur, and PLOS along that stretch of roadway in front of the station is poor.

There is no direct pedestrian access from the neighborhood west of the station. Pedestrians must use Chews Landing Road, a high-speed two-lane road with very poor PLOS scores. Improvements to that stretch of road should include wider shoulders striped on the cartway, and defined buffers between the cartway and the sidewalk. The sidewalk could be grade separated from the cartway. The stretch of County Highway 536 Spur between Chews Landing Road and the Park and Ride entrance should be improved to include similar shoulder, buffer, and sidewalk treatments. Vehicle speeds should be reduced from 45 mph to 35 mph in this segment and signage should alert drivers to the presence of pedestrians.

Hampton Place between County Highway 536 Spur and Hopewell Lane is 36 feet wide with no sidewalks. Public improvements to this segment should include the installation of sidewalks with adequate buffers. The township should consider narrowing the total width of the cartway, as 36 feet of width with no lane or shoulder striping encourages much higher vehicle speeds than the 25 mph speed permits. This speed presents a

hazard to pedestrians seeking access to the station from the neighborhood across Hampton Place.

BLOS near the Park and Ride is good. Improvements might include the addition of striped bicycle lanes on County Highway 536 Spur and Chews Landing Road. Most bicycle patrons would likely come from the neighborhoods to the north and west. Within the Park and Ride, there is a bicycle rack. However, it is obsolete and of poor quality, permitting the securing of only a single wheel, rather than the entire frame.

Lindenwold

Lindenwold has a several-thousand car parking lot which was full on the day of the field survey, however, its facilities for non-motorized access from surrounding areas was lacking. The sidewalks circulating within the vast parking lot are clearly designed to accommodate pedestrians walking from their vehicles to the station entrance, and not those coming from beyond the parking lot. Pedestrian striping and signage could enhance safety for pedestrians during the peak morning or afternoon hours when automobiles arrive or depart.

Berlin Road, which fronts the parking lot to the south, lacks sidewalks, and can be treacherous to walk along, as vehicle speeds are often significantly higher than the 25 mph posted speed limit. Berlin Road's intersection with White Horse Road also has neither pedestrian signals nor striping. Public improvements to Berlin Road should include the installation of sidewalks of at least five feet in width, with buffers separating the sidewalk from the curb.

White Horse Road is the primary point of access between the neighborhoods to the west and north of the station, lacks adequate facilities between Berlin Road and Station Avenue. Additionally, the intersection of White Horse Road and Station Avenue, though striped, lacks a signal, and poses a potential hazard to pedestrians seeking station access. A pedestrian actuated signal should be installed here.

The segment of White Horse Road extending over the railroad overpass to Gibbsboro Road features a narrow sidewalk with no buffer alongside high-speed traffic. Ideally, a buffer should be placed between the curb and the sidewalk. Another strategy would be to utilize traffic calming measures along this stretch, such as speed humps, which would improve pedestrian and bicycle safety and access to the station.

The bicycle access was also deemed poor along the major roads. They suffer from narrow roads and high speeds creating unsafe conditions. The addition of sidewalks along Berlin Road would also provide a measure of safety for bicycles, even though mixing pedestrian and bicycle flows is deemed undesirable. Finally, up to date bicycle racks at the station would add an incentive. It would be a bonus if the racks were monitored to remove stripped or abandoned bicycle frames.

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INCREASING INTER-MODAL ACCESS TO TRANSIT: PHASE II

Publication No.: 05022

Date Published: July 2005

Geographic Area Covered: One mile and one quarter mile radii surrounding three transit stations in Delaware and Camden counties.

Key Words: Ardmore Junction; Avandale Park and Ride; Lindenwold Station, Bicycle Level of Service (BLOS), Pedestrian Level of Service (PLOS), Pedestrian safety, bicycle safety.

Abstract: Phase II of the two part study assess pedestrian and bicycle accessibility in the areas surrounding Ardmore Junction, Avandale Park and Ride, and Lindenwold Station using PLOS and BLOS software. Field views were conducted to collect data and assess non-motorized mobility enhancements supporting station access. The analysis revealed that even where pedestrian access within a quarter mile radius was acceptable, bicycle access within a mile radius may be unacceptable. The absence of road buffers along sidewalks, visible striping at intersections, and appropriate bicycle racks at stations all degrade the non-motorized travel environment. Improvements in the buffering, striping, and bicycle racks at stations and their surrounding areas would do a lot to improve the non-motorized access and use of transit stations.

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