Burlington County Bicycle Level of Service Study

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

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Executive Summary

The ***Burlington County Bicycle Level of Service Study*** seeks to determine locations on Burlington County roadways where restriping for bicycle lanes may be appropriate. This report pertains only to roads under the county's jurisdiction (500 and 600 series).

This report uses Bicycle Level of Service (BLOS) analysis to emphasize safety when proposing bicycle lanes. The BLOS measure is particularly sensitive to cartway width, speed limit, and traffic volume, and has been found to be a good indicator of cycling conditions. Staff developed BLOS scores and re-categorized county roads into three categories: "Favorable," "Fair," and "Unfavorable," to summarize the cycling environments on county roads.

A key objective of this study was to assist the county in determining locations in developed areas where bicycle lanes could be added. To that end, to supplement the BLOS analysis, existing on- and off-road bicycle facilities, parks, walkable commercial districts, and Riverline Stations were mapped to determine locations where bicycle lanes could expand existing bicycle networks and enhance local mobility. Reported bicycle crashes were mapped to determine locations where bicycle lanes may improve safety as well as to get an idea where cyclists in the county are already riding.

The county road segments that have favorable BLOS scores and could best enhance local mobility are:

County Road 537 through Moorestown and Maple Shade

County Road 545 through Bordentown Township to Bordentown City

County Road 630 through Beverly City and Willingboro

County Roads 602 and 607 through Palmyra and Cinnaminson

County Road 655 through Burlington City

County Road 613 through Delran and Riverside

County Roads 612 and 621 through Mt. Holly

County Roads 541 and 616 through Medford

County Roads 607 and 616 in Evesham

This study was requested by Burlington County through the Unified Planning Work Program (UPWP) project selection process. The county will use the recommendations in this document as an input in their road restriping program and comprehensive bicycle plan.

CHAPTER 1

Introduction

The ***Burlington County Bicycle Level of Service Study*** is a Fiscal Year 2012 project which seeks to determine locations on Burlington County roadways where bicycle lanes are appropriate. The study is limited to roads that fall under the county's jurisdiction (500 and 600 series roadways). The study was requested by Burlington County through the Unified Planning Work Program (UPWP) project selection process. Recommendations in this document will serve as input into the county road restriping program and to inform its bicycle master plan.

Method

Bicycle-Level-of-Service (BLOS) scores were calculated for all county road segments. BLOS scores are intended to depict quantitatively what a cyclist experiences qualitatively. For example, wide outside lanes and low traffic volumes and speed limits tend to translate into favorable BLOS scores. Once BLOS fields were populated, the BLOS numerical scores and corresponding letter grades were calculated.

To gain a better understanding of how county roadways compared to each other rather than a national standard, scores were re-categorized into three designations: "Favorable", "Fair", and "Unfavorable." Segments in the "Favorable" category are considered more appropriate for bicycle lanes. Segments considered "Unfavorable" are least hospitable for cyclists. In general, simply marking bicycle lanes will not turn an unfavorable cycling environment into a favorable one. As a result, the recommended approach, and the one employed here, is to mark bike lanes where conditions are already favorable to safe cycling.

After calculating BLOS scores, locations such as NJ Transit Riverline stations, walkable commercial districts, parks, and existing bicycle lanes and multi-use trails were mapped to determine locations where new bicycle lanes could connect to existing bicycle facilities as well as important destinations in the county. The emphasis was on expanding networks and enhancing accessibility to key attractions in the county.

BLOS findings were then added to the map of key local attractions. Road segments with "Favorable" BLOS scores that also provided access to key attractions were identified as locations where bicycle lanes are most appropriate. These locations are listed and shown in Chapter 4.

CHAPTER 2

Bicycle-Level-of-Service Analysis

Introduction

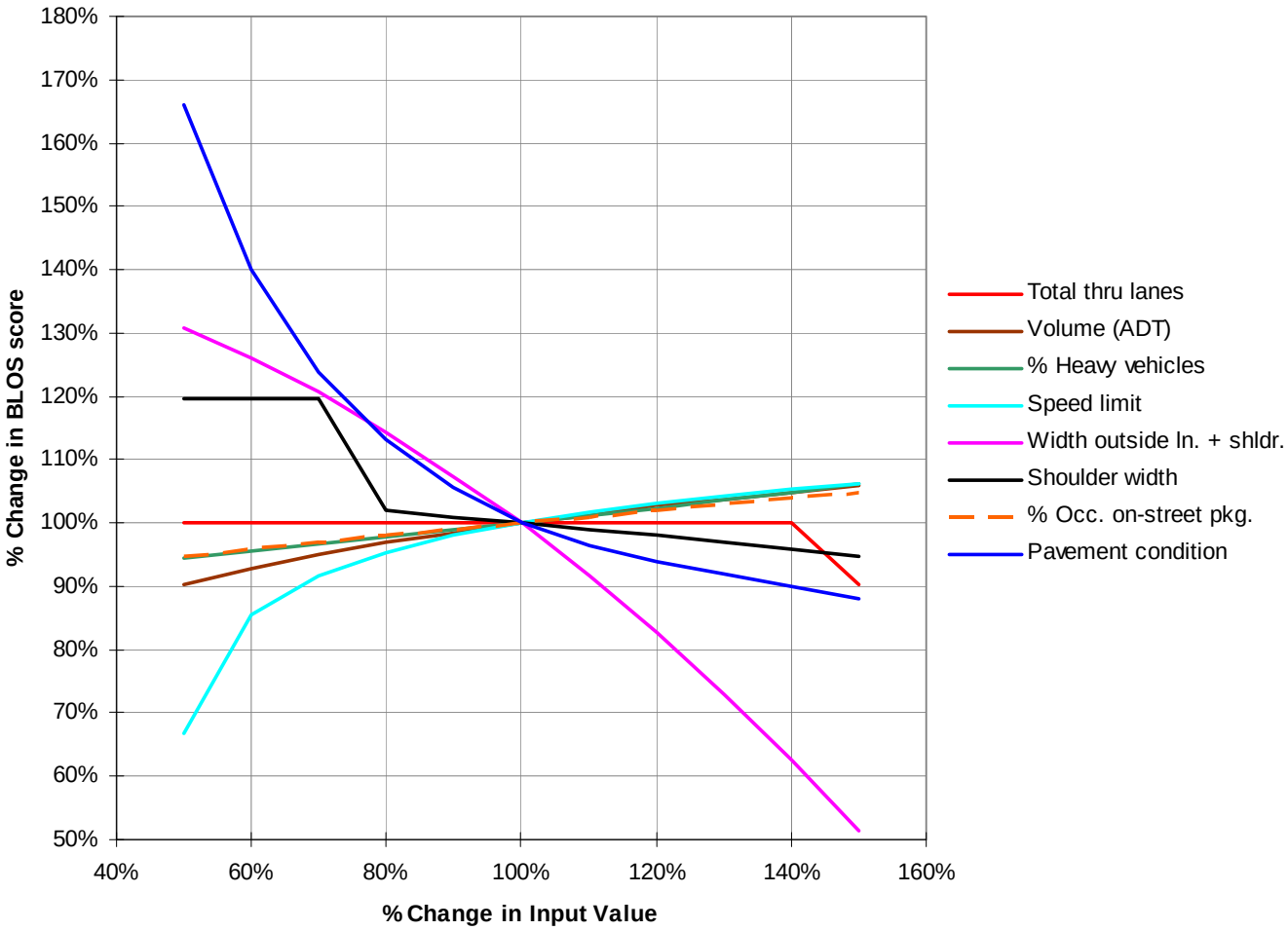
Bicycle Level of Service (BLOS) is a scoring system meant to summarize quantitatively what a cyclist experiences qualitatively. For example, low speed limits and traffic volumes, wide outside travel lanes, and the absence of on-street parking result in favorable BLOS scores. High speeds, high vehicular traffic volumes, ample on-street parking, and narrow outside lanes translate into unfavorable scores.

In the case of the BLOS model, the two factors with the largest impact on scores are the combined width of the outside lane and shoulder and pavement condition. In the model, pavement condition is based on FHWA's five point pavement surface condition rating, and the baseline (100%) value reflects a grade of 3 (fair). A roadway's speed limit also has a substantial impact, particularly in the positive direction where a speed limit is reduced. The sensitivity analysis reflected in Figure 1 (on the following page) illustrates the general trend and magnitude of the impacts of changes in the values of these inputs.

Much of the data required for BLOS calculations was available through NJDOT's Linear Referencing System (LRS) road network, which contains road management data for all public roadways throughout New Jersey. Other information was available through Burlington County's GPS-driven data collection system used by road maintenance crews. For the remaining input fields, it was necessary to estimate using other methods. The various inputs and different processes used to populate each input field are summarized below. Each of these inputs is one the BLOS model considers significant to the comfort of on-road cyclists.

Note: A lower numerical BLOS score corresponds with a more favorable rating.

Figure 1: BLOS Sensitivity Analysis



Source: DVRPC, 2011

Scoring Criteria

What follows are the input fields and the collection methods used in the BLOS model to generate scores and grades for segments along Burlington County roadways.

Length of segment in miles (LS): Calculated by GIS

Number of through lanes (L Th #): Existing in LRS dataset

Number of turning lanes (L Tu #): Not available – not included in calculation

Roadway configuration (Con): Values were left at default 'U' (undivided bidirectional) except where there was only one through lane, in which case 'OW' (one-way) values were populated.

Traffic volume (AADT): Some road segments already had traffic counts identified (generally DVRPC traffic counts). Where traffic volumes did not exist,

they were populated using average values for each roadway functional class in Burlington County. This was done by dividing daily Vehicle Miles Traveled (VMT) by functional class mileage using the county-level data provided by the New Jersey Bureau of Transportation Data Development, Roadway Systems Section (2007).

Peak/daily ratio (Kd): Not available – left at the default 0.10

Directional split (D): Not available – left at the default 0.565

Percent of heavy vehicles in traffic mix (HV%): Populated by functional class using DVRPC average regional values for “heavy trucks” plus buses. Data was provided by the DVRPC modeling staff and is derived from traffic counts and travel surveys over time.

Posted Speed limit (SPp): Generally this was available in the LRS dataset or in GPS data provided by the county. Where it was missing, it was populated using reviews of Google Street View imagery.

Combined width of outside lane and shoulder (Wt): This was derived from the LRS. For each road segment, Wt = [(pavement width / number of lanes) + shoulder width].

Width of shoulder (WI): Existing in LRS dataset. It is worth noting that while some road segments in the county currently have bicycle lanes, this is not a consideration in the BLOS scoring, which does not quantify any difference between a shoulder and a bicycle lane.

Width of pavement striped for on-street parking (ONLY where this striped area is to the right of an existing bike lane) (WPS): Not relevant to this exercise and not included in calculation.

On-street parking (OSPA, OSPD, OOSP): The BLOS model typically requires a counted number of parked cars in one or both directions, combined with a road segment length and the percentage of the road segment designated for on-street parking, to calculate an occupied on-street parking percentage (which is then factored into the BLOS score calculation). Because of the scale of this analysis, staff decided to skip a step and estimate the portion of the segment occupied by on-street parking. To do this for each segment in the study area, Google Maps imagery was consulted. This method assumes that these aerial photos were taken on a typical day and that observed parking conditions are typical.

Pavement condition (PCt): Pavement Quality Index ratings (PQI, ranging from one to five) were taken from NJDOT’s Pavement Management System data and merged with the LRS network. Where values were missing, a standard value of 3.5 was used as a default, this reflects a rating of ‘fair’.

Creation of the BLOS Layer and Burlington County Scaled Scores

Once BLOS fields were populated, the BLOS numerical scores and corresponding letter grades were calculated and joined to the LRS-based GIS layer. Grades and their corresponding score ranges are depicted in Table 1. Lower BLOS scores indicate more favorable conditions for bicyclists.

Table 1: BLOS Grades and Score Ranges

BLOS Grade	BLOS Score
A	<=1.5
B	1.5 - 2.5
C	2.5 - 3.5
D	3.5 – 4.5
E	4.5 – 5.5
F	> 5.5

Source: Transportation Research Board, 1997

According to the typical BLOS scale, no county roadway segments in Burlington County received a BLOS grade better than C and the vast majority of road segments received a D or lower. These low grades were not surprising considering the volumes and speeds of many county roadways, but this outcome necessitated a closer look at the BLOS scores.

Re-scaling Scores for County Comparison

To get a better understanding of how county roads compared to one another, rather than to a national standard, BLOS score ranges were re-categorized to better represent Burlington County's road network. The re-scaled BLOS score ranges and designations are shown in Table 2.

Table 2: Favorable/Unfavorable BLOS Scores

BLOS Score Range	Ranking
Lower than 6.25	**Favorable**
6.25 – 7.50	**Fair**
Greater than 7.50	**Poor**

Source: DVRPC, 2011

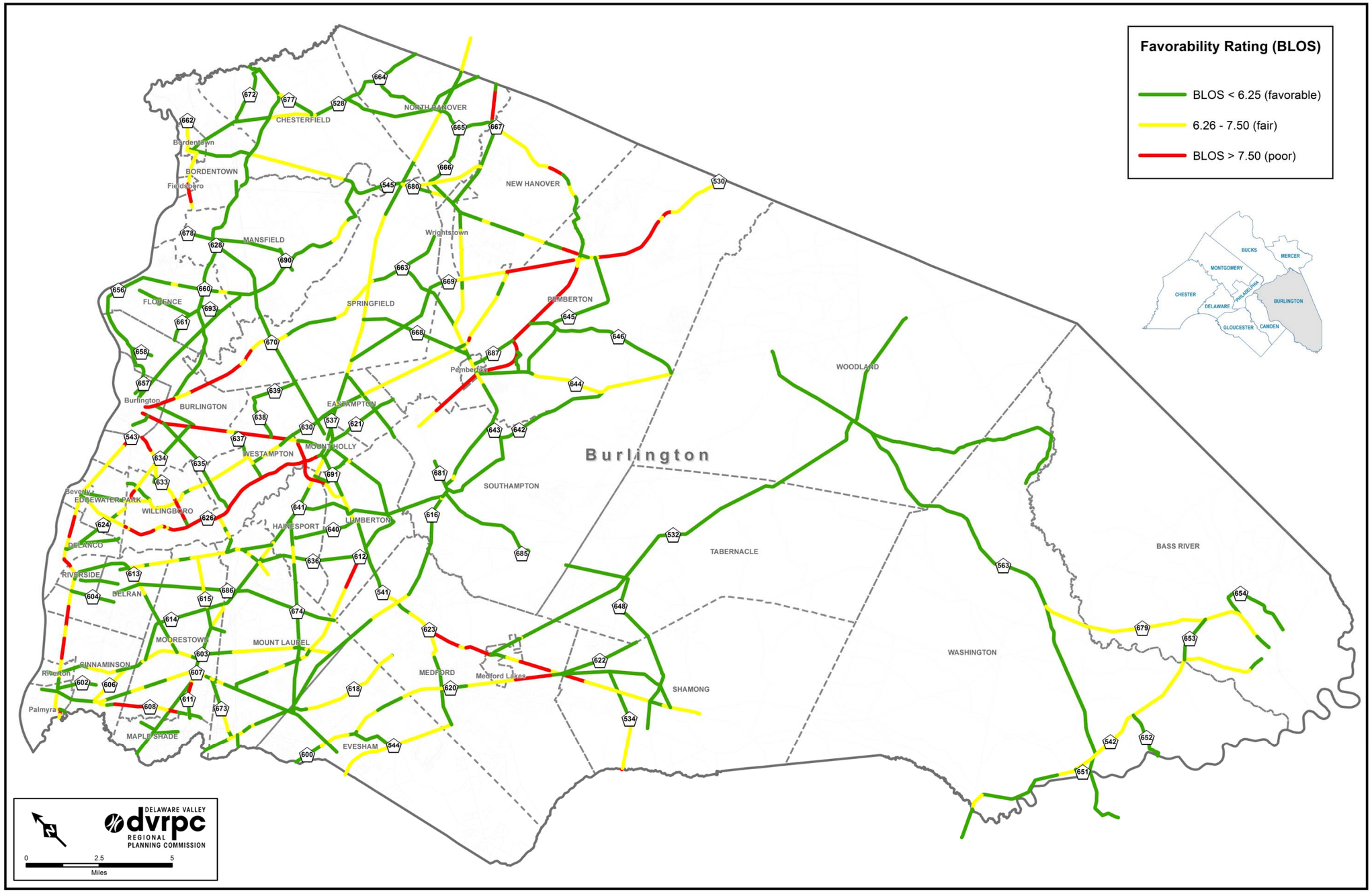
Road segments that received BLOS scores below 6.25 were designated as 'Favorable'. While this includes road segments that have a BLOS grade of 'F' under normal BLOS conditions, 6.25 is the average BLOS score for all county road segments, so any segment with a BLOS lower than 6.25 is more suitable for bicyclists than the typical county road. For the purpose of this study, these segments are the most appropriate locations for bicycle lanes, although a more detailed technical analysis should be performed before installing them.

Segments scoring between 6.25 and 7.50 have a BLOS ranking of ‘Fair.’ Bicycle lanes may be appropriate at these locations if they connect to higher-ranked segments or if there are factors (such as a high volume of bicycle use) that make bicycle lanes a viable option.

Segments scoring below 7.50 on the BLOS scale have a ranking of ‘Poor’ and bicycle lanes should not be considered on these locations without alterations that would improve BLOS scores.

Figure 2 depicts BLOS scores and corresponding Favorability Rankings on county roads.

Figure 2: Bicycle Level of Service Scores/Favorability Rankings on County Roads



CHAPTER 3

Enhancing Local Access

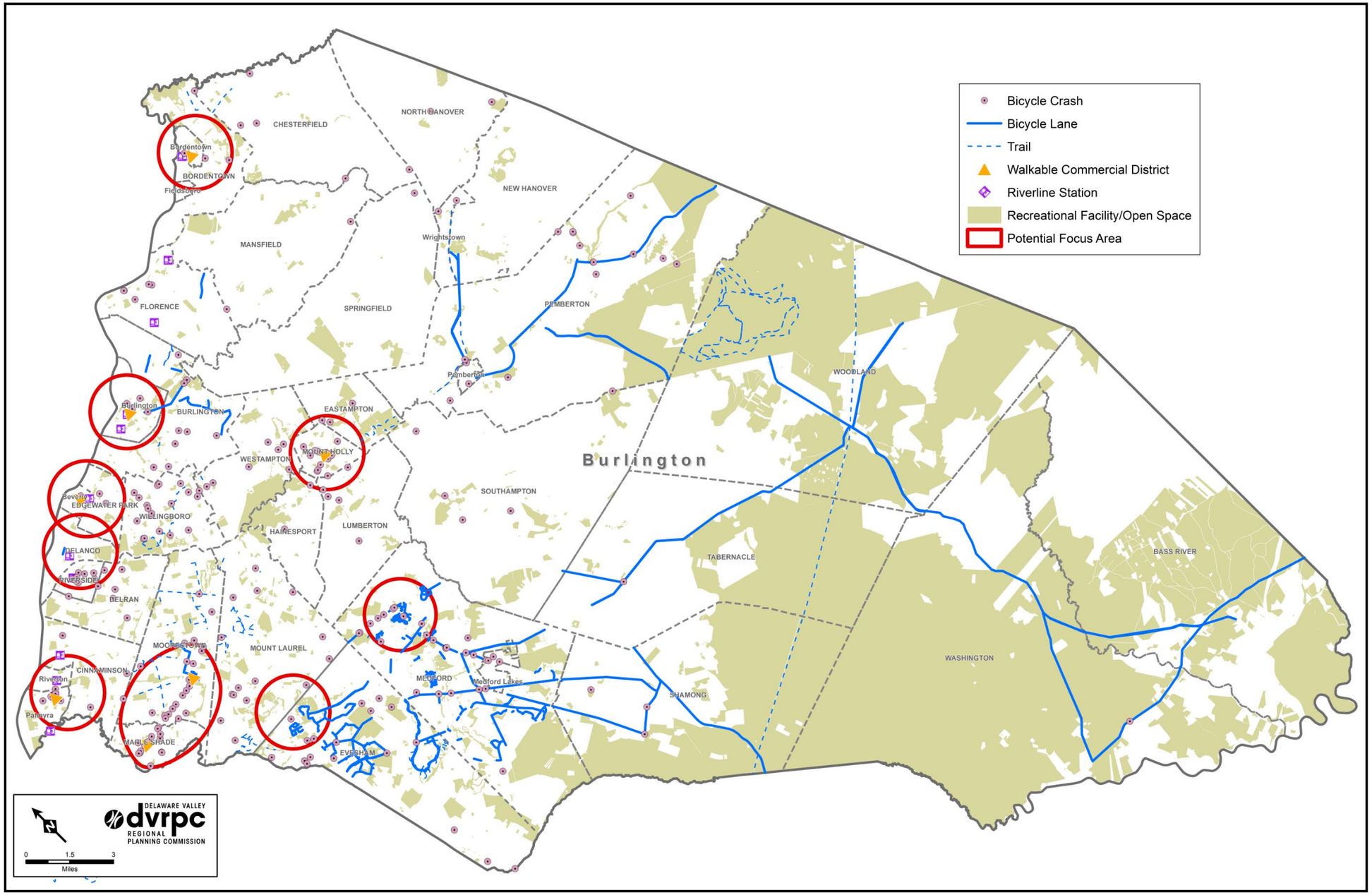
As noted, a primary catalyst for this study was the county's desire to improve bicycle accessibility in its more developed sections. To supplement the BLOS scores, select destinations were mapped to illustrate areas in the county where there are attractions or other factors that may encourage bicycling. These destinations were:

- Existing on-road bicycle facilities and trails (this includes designated sidepaths)
- Parks and open space
- New Jersey Transit Riverline stations
- Walkable commercial districts

Additionally, the locations of reported bicycle crashes were mapped. Bicycle crashes can indicate both a need for designated bicycle facilities as well as a demand.

Figure 3 depicts the existing bicycle network, local attractions and the locations of reported bicycle crashes in Burlington County. A red circle indicates areas where bicycle lanes may be particularly appropriate based on the factors listed above.

Figure 3: Recommended Focus Areas



CHAPTER 4

Recommendations

Based on the BLOS analysis and the factors described in Chapter 3, the following road segments are most appropriate for bicycle lanes. Figure 4 depicts these locations.

1. ***County Road 610 in Maple Shade and County Road 537 through Moorestown and Maple Shade***

This roadway had the highest number of bicycle crashes in the county while still scoring favorably for BLOS. Some accommodations should be made to improve the roadway for cyclists.

2. ***County Road 545 through Bordentown Township to Bordentown City***

Bordentown City is a DVRPC Classic Town with a downtown area and a Riverline Station. Improving access through Bordentown Township via County Road 545 (and perhaps CR 528 from Chesterfield) would enhance access from the east.

3. ***County Road 630 through Beverly City and Willingboro***

Bicycle lanes would improve connections to Beverly City's commercial district and Riverline Station to residents in Willingboro.

4. ***County Roads 602 and 607 through Palmyra and Cinnaminson***

Bicycle lanes along either of these roads would enhance bicycle access to Palmyra Borough's shopping district as well as its Riverline Station.

5. ***County Road 656 through Burlington City***

This would enhance access to the Burlington Riverline station as well as to the Burlington Town Center and riverfront.

6. ***County Road 613 through Delran and Riverside Townships***

Bicycle lanes along this road would improve access to the Riverside Station on the Riverline.

7. County Roads 612 and 621 through Mount Holly

Mount Holly is a DVRPC-designated Classic Town. Bicycle lanes along either of these roadways would enhance access to the area.

8. County Roads 541 and 616 through Medford

Bike lanes would enhance access to the township's sidepath system.

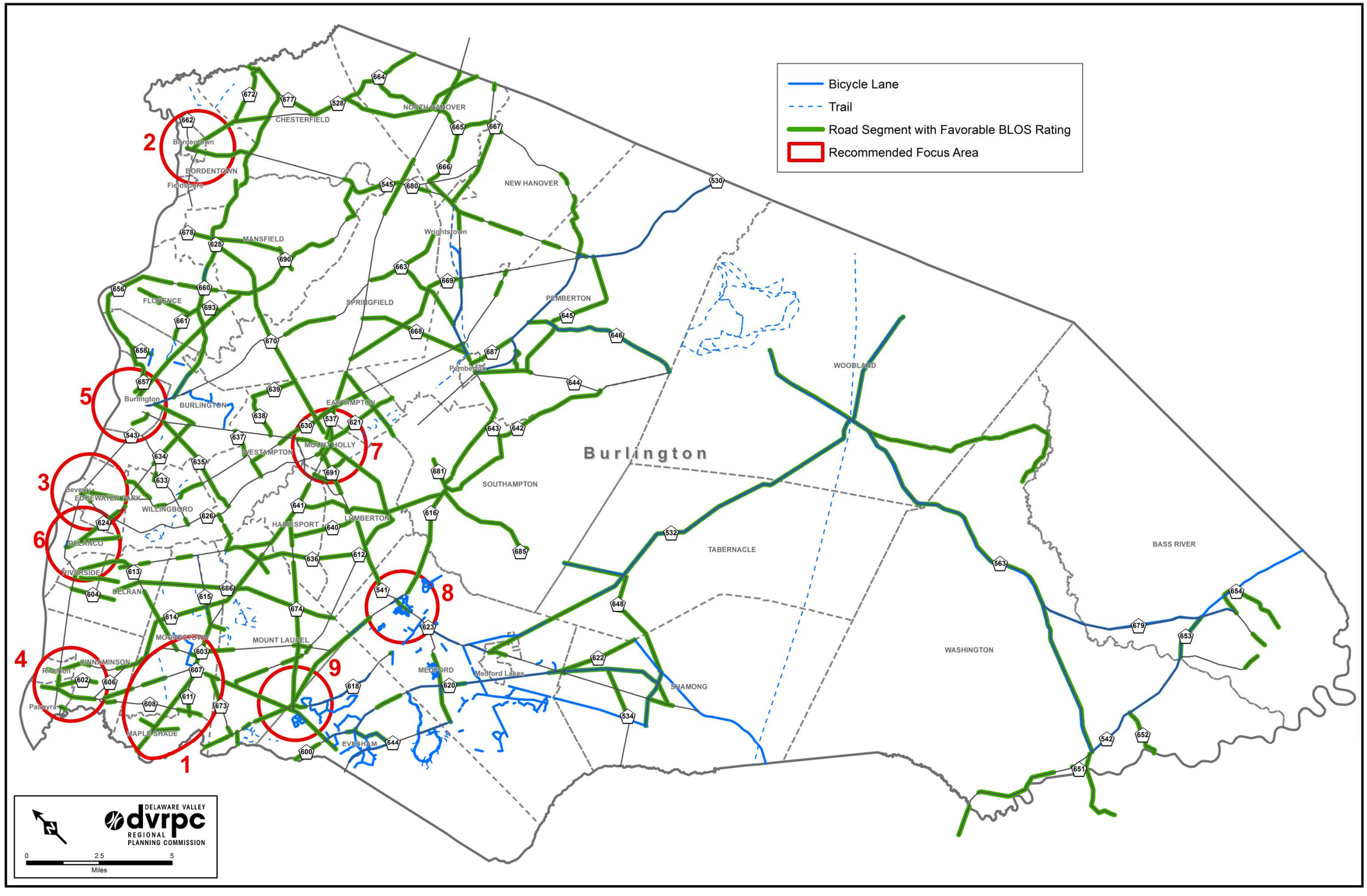
9. County Roads 607 and 616 in Evesham

Bicycle lanes would improve access to Evesham's sidepath system. Connections could potentially be made to bicycle lanes in Voorhees, Camden County.

Next Steps

The segments listed above had 'Favorable' BLOS scores and enhanced access to key attractions in the county. For the purposes of this study, they are the most appropriate locations to add bicycle lanes to county roadways. These recommendations will serve as an input into the county's ongoing road restriping plan. They will also be a factor in the county's bicycle master plan, scheduled to begin in Fiscal Year 2013.

Figure 4: Bicycle Lane Recommendations



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Abstract: This study uses Bicycle Level of Service (BLOS) to evaluate bicycling conditions on county roads in Burlington County, New Jersey and make recommendations for locations where bicycle lanes are most appropriate. To supplement the BLOS analysis, key attractions were mapped to determine where new bicycle lanes could expand already-existing networks of bicycle facilities and enhance accessibility to important destinations.

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