Appendix K

Bicycle Demand and Suitability Analysis

NJTPA
NORTH JERSEY TRANSPORTATION PLANNING AUTHORITY

THE Louis Berger Group, INC.
RBA

Bicycle Demand and Suitability Analysis

Introduction

The *River Road / Hudson Waterfront Corridor Strategy: A Phase Two Study* focuses on bicycle, pedestrian and transit access through the River Road/Hudson Waterfront Corridor. One of the main goals of the project is to support and encourage more bicycling trips throughout the corridor. In order to make this goal attainable, the deficiencies for how bicyclists access the corridor and travel along it must first be addressed. An important consideration for addressing this need is an estimation of the demand and suitability for bicycling in these areas, particularly related to the use of this mode for commuting purposes.

This technical memorandum illustrates the results of data collection and analytical tools (modeling) developed as part of the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2 to estimate bicycle demand and the suitability of the roadways to accommodate these forms of travel. These tools can be used to establish the need for bicycle accommodations and to establish priority locations. The data reflected in this analysis can be used as a resource in evaluating the efficiency, capacity, and flexibility of the supporting transportation system in the corridor to meet current bicycle demand and accommodate demand for the future.

Bicycle Demand Analysis

A bicycle demand analysis was performed for the corridor to quantify the need for bicycle accommodations in the project corridor. This analysis made use of data, modeling tools and modeling results developed for the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2. The buffer used for the analysis defines a 2-mile radius area for bicycling trips along known as the bicycle "travel shed." This distance identified on the 1990 Nationwide Personal Transportation Survey, for an average bicycle trip for all purposes at 1.8 mile and 2.1 miles for bicycle commuting. The comprehensive results of the complete bicycle demand analysis are shown on the Bicycle Demand map as "Bike Demand Analysis."

Bicycle Demand

In assessing bicycle travel demand, the Bicycle Demand Model (BDM) was used. The BDM indicates the number of bicycle trips projected for a given census tract using 2000 Census and Journey to Work data. The findings are presented in ranges of high, medium and low demand; where low demand equals 0-200 daily bicycle trips, medium demand equals 201-1000 daily bicycle trips, and high demand equals 1000+ daily bicycle trips. It should be noted that the BDM is a very conservative estimate of demand that accounts for utilitarian trips only and does not consider recreational trips.

In this model:

Total Trips = Utilitarian Trips + (2.0 * Commute Trips).

where:

Commute Trips = (0.025 * Transit Users) * (0.06 * College Students) + (0.05 * School Children) + (Workers * Bicycle Mode Share).

and,

Utilitarian Trips = 3.48 * (0.05 * 0.06 * College Students) + (0.05 * School Children) + (Workers * Bicycle Mode Share).

All features listed in the above formulas correspond to definitions and field headings in the following table:

Feature	Definition[1]	Field Header
Total Trips	The number of work related bicycle trips plus the non-work related trips in the tract for the year 2000.	TOT_TRP_00
Utilitarian Trips	Bicycle trips other than work-related in the tract for the year 2000.	UTILIT00
Commute Trips	Number of work-related trips in the tract for the year 2000.	COMMUT00
Transit Users	Number of people in the tract who used transit to get to work for the year 2000.	TRANSIT00
College Students	College enrollment in the tract for the year 2000.	ENROLLMENT
School Children	Number of children between ages 6 and 14 in the tract for the year 2000.	AGE_6_14_0
Workers *	Number of bicycle-related work trips for the year 2000	JTW_00
Bicycle Mode Share	(total number of workers by tract* bicycle mode share).	

Results of Bicycle Demand Analysis:

- According to the model, bicycle demand is medium (201-1,000 daily bicycle trips) for the majority of the River Road project corridor.
- Within the travel shed, demand is either “low” or “medium.” Census tracts exhibiting “low” demand are centralized to Ridgefield Borough and parts of Fort Lee.

Attractor Analysis

An attractor analysis was done to identify and map the site of potential destinations and attractors for bicycling trips. These denote destinations along the River Road corridor that residents would want to travel to, by bicycle, if access and mobility were reasonable and convenient. These attractors included major trip generators such as parks, bus stops, ferry shuttle stops and schools.

Results of Attractor Analysis:

- There are a significant number of schools (55 public and private) that fall within the two-mile buffer from the corridor. This would indicate that a Safe Routes to School plan should be considered for these schools given their proximity to River Road.
- There options for multi-modal travel where a bicycle be used as part of the trip. There are 8 ferry shuttle stops along the River Road project corridor. There are a significant number of bus stops along the River Road project corridor. With bike accommodations aboard these buses, this method of travel is an attractive alternative for a bicyclist tackling

[1] Data Dictionary, *Final GIS Files, Version 2.1 CD of the NJ Statewide Bicycle and Pedestrian Master Plan, Phase 2,* Revised May 2006.

steep elevation changes along the corridor.
- There are a number of major parks along the River Road project corridor such as:
    - Fort Lee Historic Park (Palisades Interstate Park)
    - Edgewater Marina and Park
    - Veteran's Field

Land Use Analysis

A land use analysis was done to identify the commercial, residential, industrial and recreational land uses along the River Road corridor and travel shed. Identifying land uses such as commercial and recreation areas can be used to as a focal point for prioritizing bicycling accommodations and amenities.

Results of Land Use Analysis:

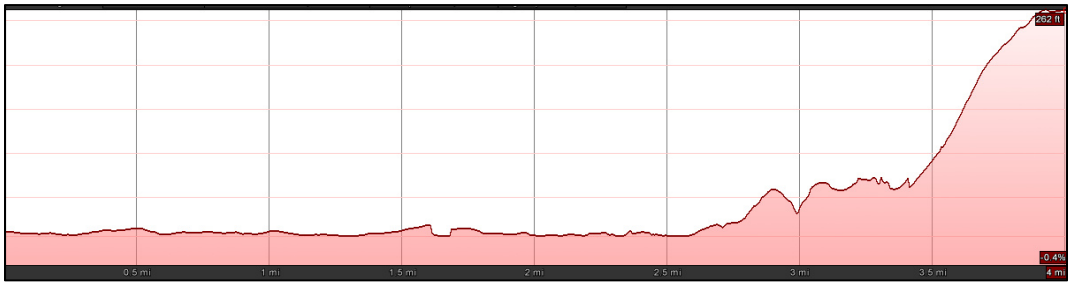
- The travel shed encompasses significant residential tracts. These tracts are identified as either: high density or multiple dwelling or residential, single unit. This suggests that bicycle travel is a reasonable and appropriate mode of travel for the large number of residents to destinations throughout the travel shed.
- North of the GWB, the bicycle demand is "low" (0-200 daily bicycle trips) along the River Road/Hudson Terrace Corridor leading up to the border of Fort Lee and Englewood Cliffs. In these pockets, the land is used by commercial/service uses such as the Fort Lee High School and is adjacent to parkland – notably the Palisades Interstate Park and Coytesville Park. Because the model is census-driven, these areas rank "low" in bicycle demand because people don't live in these tracts.
- There are a number of commercial establishments in the travel shed, especially along the River Road project corridor, which could be considered as attractors for recreational and commuter cyclists currently using this area as part of their travel route.
- Improvements made to install bicycle accommodations along the project corridor could stimulate bicycle travel demand to and from these residential and commercial areas.

Topography Analysis

A topography analysis was done to show the elevation profile of the corridor. Recent studies have shown that flat topography is more likely to facilitate cycling and steep grades change people's attitudes towards bicycling. A study done by Parkin et al (2007) revealed that the willingness to commute by bike was reduced by 10-15% with a 10% increase in grade.[2] Along a corridor like River Road, steep topography may affect bicycling demand and how far cyclists would be willing to travel to avoid the elevation changes. According to analysis done by Hood et al as part of Cycletrack research in San Francisco, persons are willing to bike an extra mile just to avoid 100'elevation gain[3].

Results of Topography Analysis:

From south to north River Road's elevation profile peaks to 263 feet. There is a 338' elevation change to the top of the Palisade Cliff.

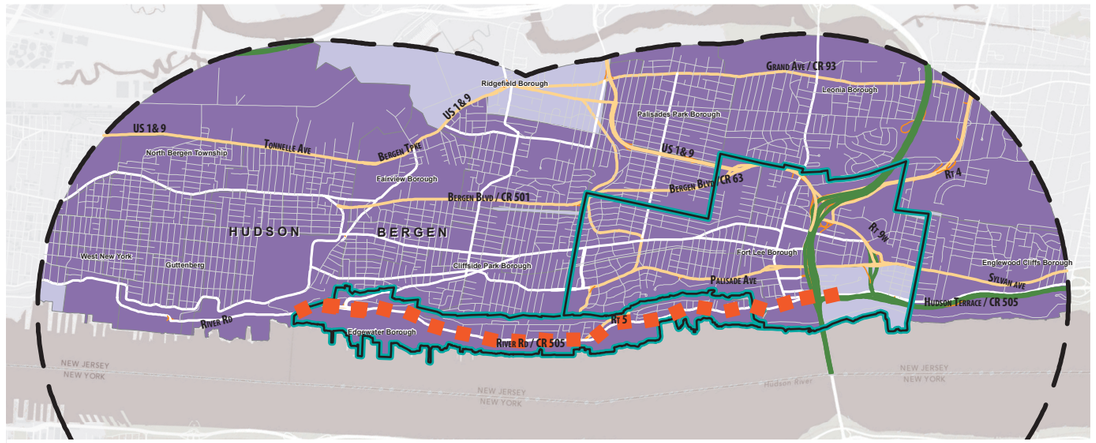


River Road Elevation Profile from south to north (Source: Google Earth)

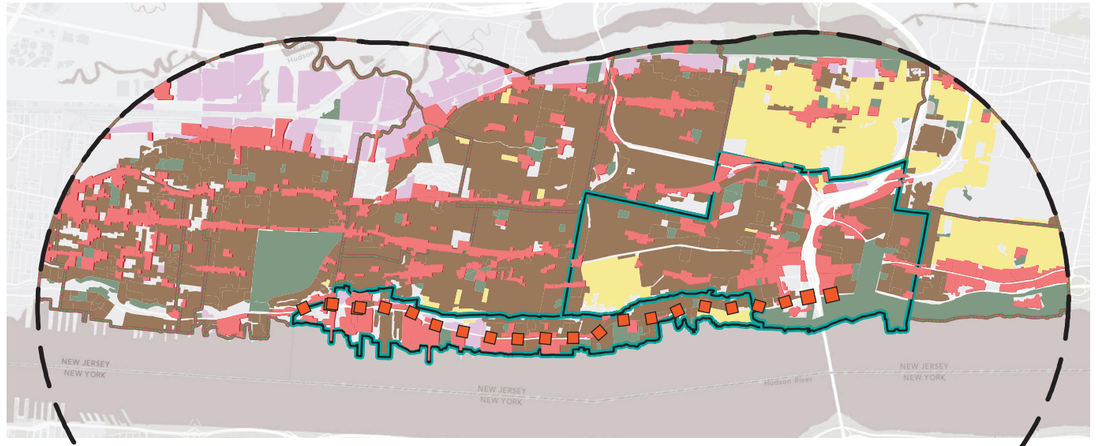
[2] Parkin, J., Wardman, M., Page, M., 2007. Models of perceived cycling risk and route acceptability. Accid. Anal. rev. 39, 364–371.

[3] Hood, J. N. (2010). *A GPS-Based Bicycle Route Choice Model for San Francisco, California.* Professional Report, University of California, Berkeley, Berkeley, California. http://www.cts.umn.edu/events/wstlur/symposium/2011/agenda/documents/presentations/5-wygonik.pdf

Bicycle Demand

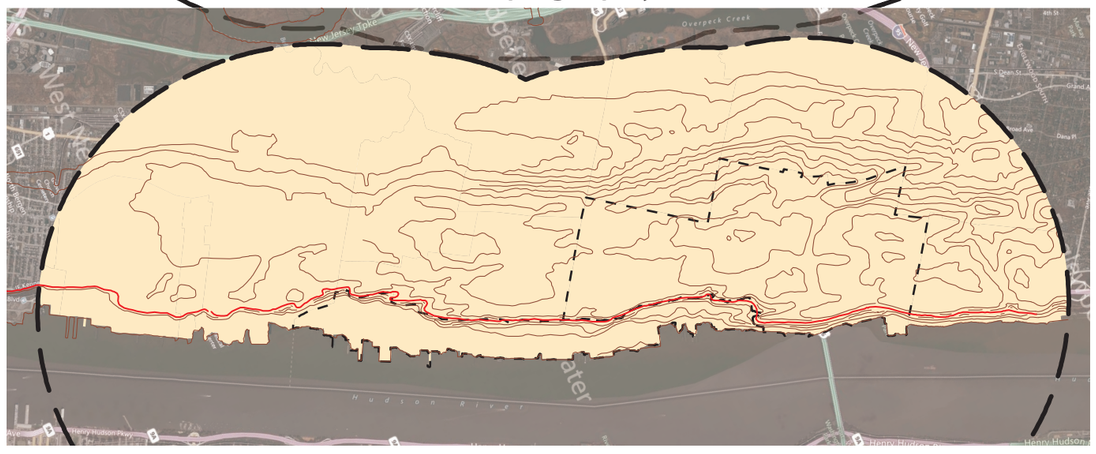


Land Use



Attractors

Topography



Legend

Base Map

- Project Corridor
- 2 mile buffer
- Interstate
- US/State Highway
- Edgewater & Ft. Lee Municipal Border

Bicycle Demand

- Low Demand
- Medium Demand

Land Use

- Commercial/Services
- Residential, Low Density
- Residential, High Density
- Industrial
- Park/Recreation

Attractors

- School
- Bus Stop
- Ferry Shuttle Stop
- Park

Topography

- Contour line
- Top of the Palisade
- Municipal Border

Contour line interval = 20 meters
There are 5 contour lines to the top of the Palisade which equals a 100 meter or 328' elevation change.

0 0.5 1 2 Miles

Data Sources: Roads, NJDOT; Bicycle Demand, NJ Statewide Bicycle and Pedestrian Master Plan, Phase 2; Land Use, 2007, NJDEP; Schools, NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS); Bus Stops, NJ TRANSIT; Topography, NJDEP

River Road/Hudson Waterfront Corridor Strategy: A Phase Two Study

Bicycle Demand Analysis

NJTPA NORTH JERSEY TRANSPORTATION PLANNING AUTHORITY

RBA

April 2013

Bicycle Suitability Analysis

The bicycle suitability analysis uses the Bicycle Compatibility Index (BCI) to provide an indication of the "bicycle suitability" of a given roadway segment, i.e., its perceived ability to accommodate bicycle travel. This is the model used to establish roadway suitability in the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2. The BCI evaluates factors influencing the preferences of bicycle riders to use a particular route alternative based on a bicyclist's perception of a route's safety level. The BCI rates the suitability of a roadway for bicyclists based on lane widths, traffic volumes, speed limits, existence of on-street parking, location within a residential area, and roadway classification. The Level of Service (LOS) for the route is then determined based on the value of the BCI. This is a "link level" analysis. It does not assess the suitability of intersections in terms of their ability to accommodate bicycle traffic.

In this model:

BCI = 3.67 - 0.966 (Bicycle Lane, Shoulder: Yes = 1)

- 0.410 (Bicycle Lane or Shoulder Width)

- 0.498 (Curb Lane Width)

+ 0.002 (Curb Lane Volume)

+ 0.0004 (Other Lane Volume) + 0.022 (Speed)

+ 0.506 (Parking: Yes = 1)

- 0.264 (Area: Residential = 1) + Adjustment Factor

- Lower values indicate a “good” Level of Service
- Greater values indicate a “poor” Level of Service
- BCI decreases for greater lane widths, shoulders, and location in a residential area (improves LOS)
- BCI increases with smaller lane and shoulder widths, higher traffic volumes, on-street parking, and higher speed limits (degrades LOS)

The BCI has values and corresponding Level of Service (LOS) are shown below:

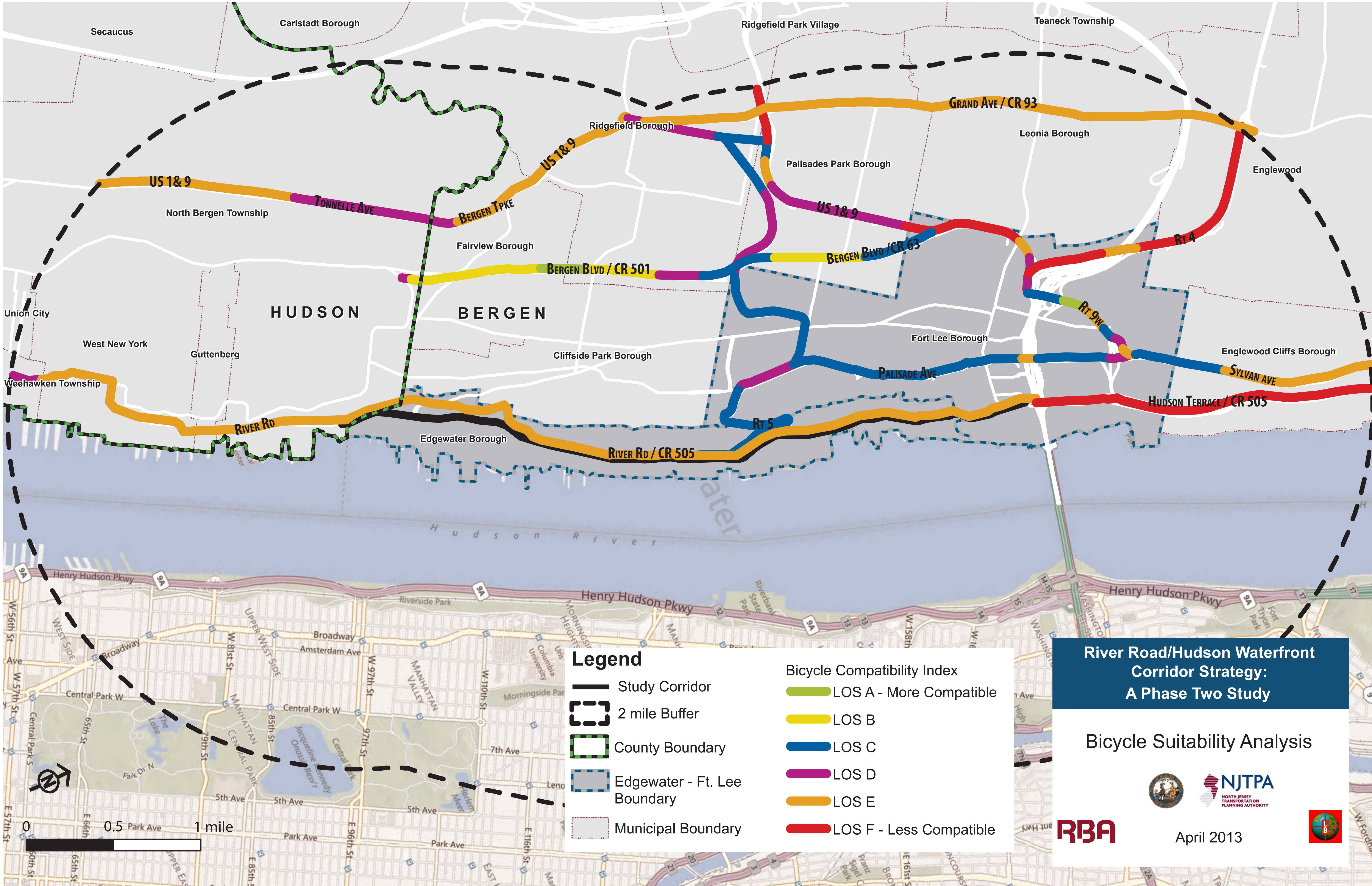
BCI Range	LOS
0 to 1.50	A
1.51 to 2.40	B
2.41 to 3.40	C
3.41 to 4.40	D
4.41 to 5.30	E
5.31 & Greater	F

The 2-mile buffer, as used for bicycle demand, allows us to look at the suitability of parallel routes to the River Road corridor for bicycling for all-purpose trips and commuting.

It should be noted that as part of the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2, bicycle suitability modeling was conducted only for *existing* Congestion Mitigation System (CMS) roadways. The results of the bicycle suitability analysis are shown on the *Bicycle Suitability Analysis* map as the "Bicycle Compatibility Index."

Results of Bicycle Suitability Analysis:

- The link segment of the River Road corridor between the Edgewater Boundary and Sylvan Street has a less than acceptable (D or below) level of service which is less suitable for bicycle travel.
- The link segment of the River Road corridor between the GWB and Sylvan Street is noted as the least suitable for bicycle travel with a level of service grade of F.
- Link segments that are upland, such as Route 5 (except for the segment between milepost 1.8 and 2.16) and Palisade Avenue, have an acceptable (C or above) level of service which is more suitable for bicycle travel.


River Road/Hudson Waterfront Corridor Strategy: A Phase Two Study
Bicycle Suitability Analysis
NJTPA
North Jersey Transportation Planning Authority
RBA
April 2013
Legend
Study Corridor
2 mile Buffer
County Boundary
Edgewater - Ft. Lee Boundary
Municipal Boundary
Bicycle Compatibility Index
LOS A - More Compatible
LOS B
LOS C
LOS D
LOS E
LOS F - Less Compatible
0
0.5
1 mile
HUDSON
BERGEN
Secaucus
Carlstadt Borough
Ridgefield Park Village
Teaneck Township
Ridgefield Borough
Leonia Borough
Palisades Park Borough
Englewood
North Bergen Township
Fairview Borough
Union City
West New York
Guttenberg
Cliffside Park Borough
Fort Lee Borough
Englewood Cliffs Borough
Weehawken Township
Edgewater Borough
Grand Ave / CR 93
US 1&9
Tonnelle Ave
Bergen Tpke
Bergen Blvd / CR 501
Bergen Blvd / CR 63
Rt 4
Rt 9W
Palisade Ave
Sylvan Ave
Hudson Terrace / CR 505
River Rd
River Rd / CR 505
Rt 5
Hudson River
Henry Hudson Pkwy
Broadway
Amsterdam Ave
Central Park W
Riverside Park
Morningside Park
Park Ave
5th Ave
7th Ave