APPENDIX G

Tech Memo

RINGWOOD BOROUGH BICYCLE & PEDESTRIAN PLAN DEMAND AND SUITABILITY ANALYSIS

TECHNICAL MEMORANDUM

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New Jersey Department of Transportation

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BICYCLE DEMAND AND SUITABILITY

Bicycle Demand

Bicycle travel demand is an important consideration in selecting and shaping elements of a facility network plan. A bicycle demand analysis was performed for Ringwood utilizing data and modeling tools and results developed for the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2, utilizing the Bicycle Demand Model (BDM). 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, where increased demand can be anticipated with the implementation of improved facilities.

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 kids between ages 6 and 14 in the tract for the year 2000.	AGE_6_14_0
Workers * Bicycle Mode Share	Number of bicycle-related work trips for the year 2000 (total number of workers by tract* bicycle mode share).	JTW_00

Bicycle Attractor Analysis

Another means of assessing demand utilizes trip attractor data developed as part of the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2. For this analysis, bicycle trip attractors (area and point based) were identified and mapped. These included major trip generators such as parks, commercial areas, schools and key destinations. Buffer areas were superimposed over each point-based attractor to highlight potential bicycle travel sheds for bicycle trips to these attractors. The buffer defines a 2-mile radius area for bicycling trips. This distance is based on the 1990 Nationwide Personal Transportation Survey, which identified an average bicycle trip for all purposes at 1.8 mile and 2.1 miles for bicycle commuting.

Results of Bicycle Demand Analysis

The results of the bicycle demand analysis are as follows:

- Bicycle demand by census tract is high throughout the Borough of Ringwood, in all of the commercial and residential areas.
- There are several commercial land uses throughout the Borough, with notable clusters along Skyline Drive.
- There are a number of parks and water features within the Borough that are likely to attract recreational bike trips. Ringwood State Park is a major regional destination for mountain biking for both tourists and residents. Monksville Reservoir and Wanaque Reservoir are also likely to generate recreational bike trips for their scenic views within the Borough.
- There are 9 school properties located within the Borough. The Borough uses various school properties as central meeting locations for residents.

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

- There is a NJ Transit Park and Ride Bus Station located within the Borough. This offers service to both regional destinations such as Manhattan or local destinations such as the Willowbrook Mall.
- The area subtended by the 2-mile buffers around schools and key destinations (such as historical, cultural and recreational features) practically covers the entire Borough, suggesting that there is essentially nowhere within the Borough that is outside the "travel shed" of these bicycle attractors; in other words, according to these criteria, bicycle travel is a reasonable and appropriate mode of travel throughout the Borough.

Bicycle Suitability

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, i.e. it does not include an assessment of the overall suitability of a corridor nor does it 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

It should be noted that bicycle suitability was conducted only for those roadways that were included in the existing database of information developed for the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2. In Ringwood, those roadways are Ringwood Avenue, Greenwood Lake Turnpike and Sloatsburg Road.

Results of Bicycle Suitability Analysis
The results of the bicycle suitability analysis are as follows:

- The major (CMS) roadways in the Borough, given current traffic and geometric characteristics, have relatively lower levels of service for bicycle travel (less suitable for bicycle travel).
- There are a number of segments along Ringwood Avenue, Greenwood Lake Turnpike and Sloatsburg Road that have an acceptable (C or above) level of service.
- The segment of Ringwood Avenue approximately between Milepost 25.0 and 25.1 has a high Level of Service (A) making it more suitable for biking.

PEDESTRIAN DEMAND AND SUITABILITY

Pedestrian Demand

Pedestrian Demand is also an important consideration in selecting and shaping elements of a pedestrian network. A pedestrian demand analysis was carried out for the Borough by utilizing the Pedestrian Compatibility Index (PCI) results from the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2. The Pedestrian Compatibility Index (despite its name) is a surrogate measure of pedestrian demand that indicates the census tracts with the greatest potential for pedestrian demand. The potential demand is based on variables generally understood to contribute to environments conducive to pedestrian activity, such as density, employment, and transit accessibility. The PCI is a combination of 4 indices (multiplicative) which yields a score for each census tract, normalized to a range of 0-100, with values Low = < 8, Medium = 8 - 24, and High = 25 - 100.

Pedestrian Attractor Analysis
As with bicycle travel, utilizing trip attractor data developed as part of the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2, pedestrian trip attractors (area and point based) were identified and mapped. These included major trip generators such as parks, commercial areas, schools and key destinations. Buffer areas were superimposed over each point-based attractor to highlight potential pedestrian travel sheds for walking trips to these attractors. The buffer defines a 1/2-mile radius area for pedestrian trips. This distance is based on the 1990 Nationwide Personal Transportation Survey, which identifies an average walk for all purposes at 0.7 and 0.9 miles for commuting purposes.

Results of Pedestrian Demand Analysis
The results of the pedestrian demand analysis are as follows:

- According to the PCI, pedestrian demand is low throughout the entire Borough.
- Using a buffer radius of a 1/2-mile for pedestrians, the pedestrian "travel shed" defined by the buffered areas around schools and key destinations (such as historical, cultural and recreational features), covers a majority of the eastern portion of the Borough. According to these criteria, this suggests the pedestrian travel is a reasonable and appropriate model of travel to these destinations throughout this part of the Borough.

Pedestrian Suitability

Pedestrian suitability was evaluated utilizing the Pedestrian Crossability Index. This index evaluates roadway crossing opportunities with high, medium or low opportunity levels corresponding to the estimated percentage of time that sufficient gaps in traffic area available to cross safely. The factors incorporated include speed, traffic volume, number of lanes, median width, median type and presence. The crossability index evaluates factors at the "link level", not a corridor. Therefore, it does not take into consideration either the distance from the nearest intersection or grade separated crossings, the type of traffic control at nearby intersections or sight distance.

It should be noted that pedestrian suitability was conducted only for those roadways that were included in the existing database of information developed for the New Jersey Statewide Bicycle and Pedestrian Master Plan, Phase 2. In Ringwood, these roadways are Ringwood Avenue, Greenwood Lake Turnpike and Sloatsburg Road.

Results of Pedestrian Suitability Analysis

- Ringwood Avenue has both a medium and high crossability index. The segment of the roadway approximately between milepost 25.1 and milepost 31.14 has high crossability making it less difficult to cross.
- Greenwood Lake Turnpike and Sloatsburg Road both have high crossability indexes making them less difficult to cross.

BICYCLE DEMAND AND SUITABILITY ANALYSES

8/29/08

Legend

BICYCLE DEMAND (DAILY BIKE TRIPS)

- LOW (0 - 200)
- MEDIUM (201 - 1000)
- HIGH (OVER 1000)

BICYCLE COMPATIBILITY INDEX

- LOS F - LESS COMPATIBLE
- LOS E
- LOS D
- LOS C
- LOS B
- LOS A - MORE COMPATIBLE

BASE LAYERS

- SCHOOL
- KEY DESTINATION
- BUS STATION
- ABANDONED RAILROAD
- EXISTING TRAILS
- MUNICIPAL BOUNDARY
- PARK
- COMMERCIAL AREA
- WATER
- 2 MILE RADIUS FROM SCHOOL
- 2 MILE RADIUS FROM KEY DESTINATION

RINGWOOD BOROUGH

Passaic County, NJ

Miles

0 0.25 0.5 1

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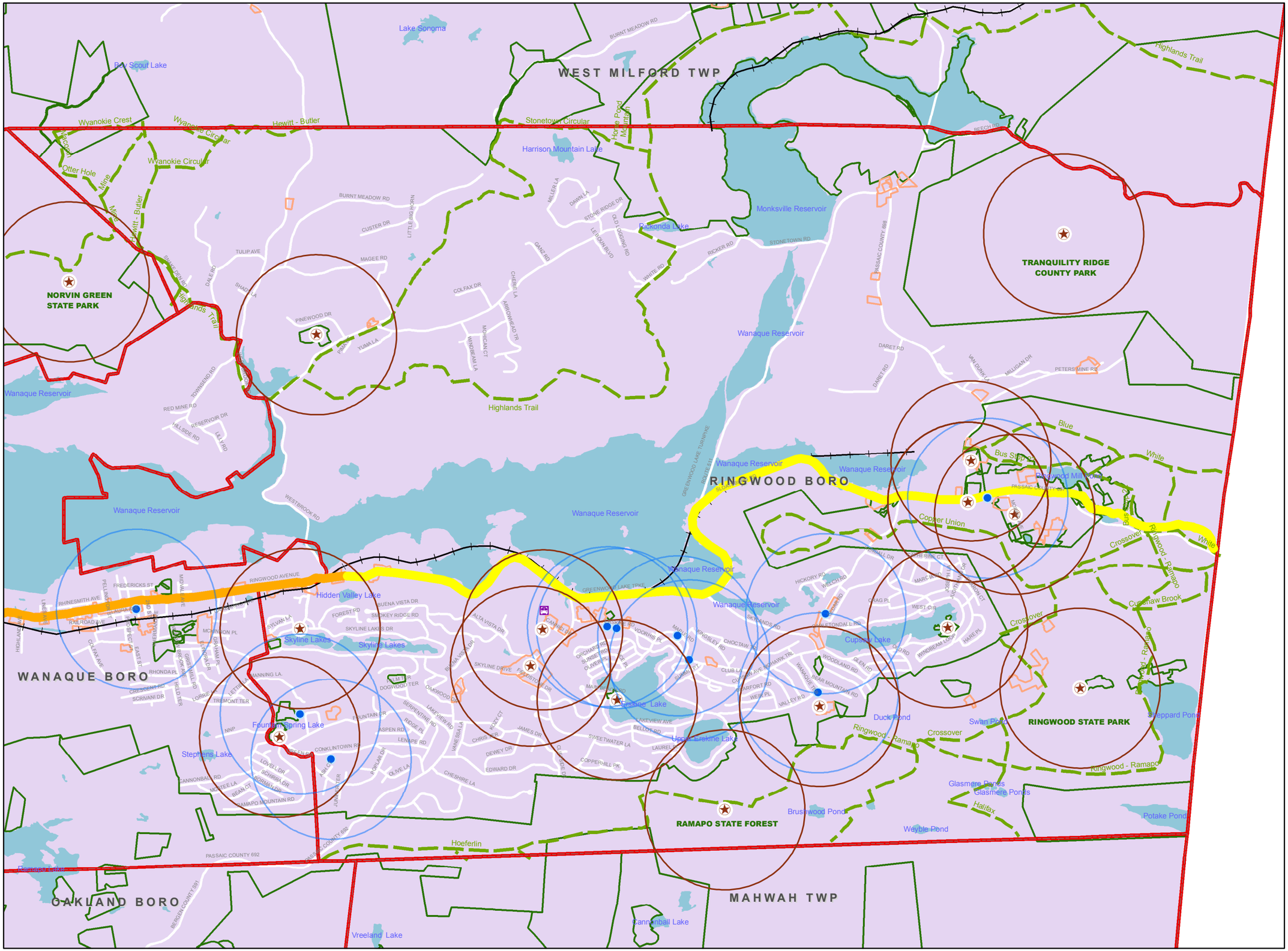

PEDESTRIAN DEMAND AND SUITABILITY ANALYSES

8/29/08

Legend

PEDESTRIAN DEMAND

- LOW
- MEDIUM
- HIGH

PEDESTRIAN CROSSABILITY INDEX

- LOW (0-33) MORE DIFFICULT TO CROSS
- MEDIUM (34-66)
- HIGH (67-100) LESS DIFFICULT TO CROSS

BASE LAYERS

- SCHOOL
- KEY DESTINATION
- BUS STATION
- ABANDONED RAILROAD
- EXISTING TRAILS
- MUNICIPAL BOUNDARY
- PARK
- COMMERCIAL AREA
- WATER
- 1/2 MILE RADIUS FROM SCHOOL
- 1/2 MILE RADIUS FROM KEY DESTINATION

RINGWOOD BOROUGH

Passaic County, NJ

Miles
0 0.15 0.3 0.6

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