

# **EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY**

## **Alternatives Analysis Report**

**Morris County, New Jersey**

### **FINAL REPORT**

Prepared For:

**Morris County, New Jersey**

Prepared By:



With Funding Support From:

**New Jersey Department of Transportation**

Division of Statewide Planning

Local Transportation Planning Assistance Program

July 2013

## **DISCLAIMER STATEMENT**

Through its Local Transportation Planning Assistance (LTPA) program, the New Jersey Department of Transportation (NJDOT) provides technical planning expertise as a service to New Jersey municipalities and counties. The LTPA program strives to assist qualified communities in providing quality planning expertise to a range of local transportation problems and issues. Please note, that in providing consultant services for preparation of this planning study, the New Jersey Department of Transportation makes no commitment, promise, or guarantee, implied or otherwise, to fund the implementation of the recommended improvements in this report.

## **EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY ALTERNATIVES ANALYSIS REPORT**

### **Executive Summary**

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#### **INTRODUCTION**

East Hanover Avenue (CR 650) is a major east-west commuter roadway that connects multiple municipalities, including Morris Plains Borough, Morris Township, and Hanover Township in Morris County, New Jersey, to New Jersey Route 24 (NJ 24). The roadway currently experiences directional congestion during the peak periods, with high eastbound traffic volumes during the AM peak period, and high westbound traffic volumes during the PM peak period. East Hanover Avenue between Speedwell Avenue (US 202) and Whippany Road (CR 511) (Corridor) has traditionally been an industrial corridor with multiple manufacturing and warehouse buildings, mixed with residential and commercial land uses. Over the past twenty years, industrial activities along the Corridor have diminished, leaving multiple large parcels vacant, particularly along the north side of the roadway. These parcels have become the focus of substantial redevelopment projects and proposals that will have a major impact on future traffic operations in the area.

Current congestion issues, along with anticipated redevelopment in the area, make it critical that land use and transportation be evaluated simultaneously, and in close coordination between Morris County and the three municipalities. The redevelopment projects will result in a change in land use that is expected to increase vehicular, pedestrian and bicycle traffic, and will result in a change in peak hour traffic patterns. Addressing the redevelopment of the Corridor on a piecemeal, municipality-by-municipality, basis may constrain current and future economic development in the area. Therefore, a comprehensive approach to planning must be implemented in order to maintain mobility along the Corridor. This calls for a joint transportation and land use planning undertaking that involves the County and the three municipalities.

In order to mitigate the existing and anticipated future traffic conditions, the County of Morris requested assistance from New Jersey Department of Transportation's (NJDOT) Local Transportation Planning Assistance program to analyze the existing and future traffic operations along the already-congested Corridor, and to develop the necessary infrastructure improvement concepts to reduce congestion, increase safety, and improve connections to existing cultural resources, while considering the needs of all users. The goal of this planning effort is to provide a comprehensive plan for the Corridor across the three municipalities that will allow the County to negotiate pro rata contributions for transportation improvements with developers.

#### **METHODOLOGY**

Existing traffic data was collected to develop "average-day" baseline conditions in order to establish a basis for evaluating the impact of the anticipated development along East Hanover Avenue. The data collection program included manual turning movement counts, automatic

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twenty-four hour traffic recorders, travel time runs, pedestrian/bicycle facility assessment, and a crash analysis. An Existing Condition traffic analysis was conducted to identify the nature and location of existing needs on the Corridor. Existing condition volumes were then grown to 2015, the anticipated completion date of many of the proposed redevelopment projects, and 2035, the 20-year design year, based on a background growth rate and trips that would be generated by the proposed redevelopments (**TABLE E.1**). Additional future needs were then identified and used as a basis for developing three alternative scenario concepts for the Corridor (see **TABLE E.2** for summary list of needs).

**TABLE E.1: Approved and Anticipated Developments Impacting Study Area**

Location	Description	Status	Time Frame
The American Road	60 Condominium/Townhouse Units	Approved	2015
The American Road	20,790 SF Office and 48,510 SF Warehouse	Approved	2015
East Hanover Avenue – Across from Mennen Arena	100,000 SF Shopping Center*	Site Under Remediation	2035
East Hanover Avenue – Northwest Corner of Horse Hill Road	90,000 SF Shopping Center with ShopRite	Approved	2015
Horse Hill Road	78 Residential Condominium /Townhouse Units	Approved	2015
East Hanover Avenue – Northeast Corner of Horse Hill Road	20,000 SF Office	Approved	2015
East Hanover Avenue – Northwest Corner of Ridgedale Avenue	125,000 SF Home Improvement Store*	Anticipated	2015
Whippany Road	Bayer Corp. Redevelopment (2,000 Employees)	Approved	2015

\*Land use type assumed based on information provided by Hanover Township.

### ALTERNATIVE SCENARIOS ANALYSIS

Several mitigation measures can be employed to address the needs identified in both the Existing and No Build Conditions. The “Existing Condition” refers to the existing roadway network with 2011 traffic volumes. The “No Build Condition” refers to the existing roadway network with the addition of background traffic growth rates and vehicle-trips anticipated to be generated by the proposed developments. The “Build Condition” refers to the anticipated traffic growth and redevelopments, with potential mitigation measures, shown in the concept plans.

The mitigation strategies were divided into three categories: vehicular infrastructure (signal timing adjustments, turn lanes, etc.), bicycle/pedestrian infrastructure (pedestrian crosswalks,

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signal heads, sidewalk, etc.), and transit infrastructure (bus shelters, benches, bus pull-outs, etc.). The strategies were then compiled into three alternative scenarios that were analyzed in the 2015 and 2035 future years. The three alternative scenarios are described as follows (see **APPENDIX A** for concept plans):

Alternative Scenario 1 (Low-Level Improvements) \$270,000:

Alternative Scenario 1 would optimize the existing physical roadway infrastructure by providing minor improvements that would not require the construction of additional lanes, sidewalks, or transit facilities. Signal timing and coordination would be adjusted to maximize capacity and traffic flow. The existing sidewalk along the north side of the Corridor would be repaired, and new sidewalk would be constructed where there are gaps in that sidewalk in order to create a continuous pedestrian pathway along the Corridor.

Alternative Scenario 2 (Moderate Improvements) \$6,225,000:

Alternative Scenario 2 would provide additional vehicular infrastructure, such as additional turn lanes, channelized right-turns, and improved signal timing. The pedestrian improvements identified in Alternative Scenario 1 would be provided in Alternative Scenario 2, along with additional pedestrian connections to adjacent residential areas and Mennen Arena. In addition, bus shelters and concrete pads would be introduced at some bus stops along the corridor.

Alternative Scenario 3 (Significant Improvements) \$6,370,000 - \$11,110,000:

Alternative Scenario 3 would improve on Alternative Scenario 2 by providing additional improvements to some of the study area intersections, including additional turn lanes. Alternative Scenario 3 would also incorporate a multi-use path to accommodate both bicycles and pedestrians. In addition to the bus shelters and concrete pads that were incorporated in Alternative Scenario 2, Alternative Scenario 3 would also provide bus pull-outs. The order-of-magnitude cost of Alternative 3 is shown as a range because it is dependent upon which properties are acquired at the intersection of East Hanover Avenue and Speedwell Avenue.

The three alternative scenarios were evaluated from a traffic operations standpoint (delay, LOS, queue), how well each alternative would meet the needs identified in the study, and how well each alternative would meet complete street principles.

**CONCLUSIONS**

The conceptual improvements analyzed for this study were designed to accommodate the combination of existing traffic volumes, and the additional traffic that would be generated by the proposed development sites, based on the information available at the time of the study. Changes to the proposed development sites may result in a reduction, or increase, in the number of trips, and the proposed infrastructure improvements could require some modifications. Therefore, the recommended improvements could be gradually implemented over

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time by the County or by developers of the proposed sites, as needed. In addition, the improvements from Alternative Scenario 2 could be constructed at one intersection, while improvements from Alternative Scenario 3 could be constructed at another. However, consideration should be given to selecting the alternatives that best suit the long-term needs of the Corridor for all users.

Based on the results of the analysis, public feedback, and discussions with County and municipal officials, it is recommended that Morris County pursue a combination of improvements recommended all three scenarios (see **TABLE E.2**). The recommended improvements would enhance vehicle operation on the Corridor, and would meet complete streets requirements. The multi-use path and transit stop upgrades would provide access for pedestrians and bicyclists, promote multi-modal travel along the Corridor, and enhance recreational opportunities through connections to other paths and trails nearby. Trailblazing would provide a sense of “place” for the Corridor and improve awareness of the cultural resources along it.

The total cost of the recommended improvements would be approximately \$3.0 million, with \$60,000 for ROW acquisition (not including the multi-use path). In order to implement the recommended improvements, the County should continue to collaborate and coordinate with the municipalities along the corridor and require pro rata contributions from developers based on percentage increase in delay at intersections or total new trips generated on the Corridor. It would also be acceptable for contributions to be made through the construction of the recommended improvements. In addition, the County should ensure that development that occurs along the corridor does not preclude future upgrades of the intersections from Alternative Scenarios 1 or 2 to Alternative Scenario 3.

In addition to the roadway improvements, it is recommended that the County pursue the multi-use path and transit enhancements through public-private partnerships. The County should require that developers construct the multi-use path and transit enhancements along their frontage, and should work with existing property owners to obtain easements for the improvements. It should be noted that the ROW cost shown in **TABLE E.2** does not reflect the ROW cost of \$100,000 per acre for portions of the multi-use path where public-private partnerships could not be established. The total cost of the multi-use path can only be calculated once all partnerships are established.

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**TABLE E.2: Recommendations**

Location	Needs	Alt	Cost Estimate
East Hanover Avenue and Speedwell Avenue (US 202)	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> <li>Improve safety by reducing the number of driveways adjacent to the intersection.</li> <li>Improve pedestrian access and safety.</li> </ul>	1	Construction: \$50,000 ROW: \$0
East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> <li>Eliminate split-phase operation.</li> <li>Improve pedestrian access and safety.</li> </ul>	2	Construction: \$1,075,000 ROW: \$0
East Hanover Avenue and Monroe Street/County and Big Box Driveway	<ul style="list-style-type: none"> <li>Improve access to properties on south side of the Corridor.</li> <li>Improve pedestrian connectivity.</li> </ul>	3	Construction: \$650,000 ROW: \$0
East Hanover Avenue and Ridgedale Avenue*	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> <li>Eliminate split-phase operation.</li> <li>Improve pedestrian access and safety.</li> </ul>	2	Construction: \$685,000 ROW: \$60,000
East Hanover Avenue and Whippany Road	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> </ul>	2	**N/A
Corridor-Wide: Pedestrian/Bicycle Facilities	<ul style="list-style-type: none"> <li>Improve safety along the Corridor by providing pedestrian and bicycle facilities, separating movements, and providing a more cohesive environment.</li> <li>Improve connectivity to cultural resources along the Corridor.</li> <li>Provide pedestrian and bicycle connections to all proposed retail sites along the Corridor.</li> </ul>	3	Construction: \$260,000 ROW: \$100,000/acre
Corridor-Wide: Transit	<ul style="list-style-type: none"> <li>Improve transit amenities along the Corridor to provide improved service to proposed redevelopment sites and existing cultural resources.</li> <li>Increase the attractiveness and usability of the existing transit system.</li> </ul>	3	Construction: \$50,000
Trailblazing/ Streetscaping	<ul style="list-style-type: none"> <li>Provide a more cohesive environment along the Corridor.</li> </ul>	3	Construction: \$50,000
<b>Total Order of Magnitude Cost Estimate</b>			Constr: \$3.0 mil ROW***: \$60,000

\*Accommodations for turning trucks must be considered during the design of the recommended improvements.

\*\*Signal timing enhancements from NJDOT. \*\*\* Does not include ROW/easements for multi-use path. ROW = Right-of-Way Cost; LOS = Level of Service

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TABLE E.3: Implementation Schedule

Improvement	Alternative	Implementation Strategy	Timeline
Speedwell Ave Intersection	1	Coordinate with DOT to implement.	2013 – 2015
Martin Luther King Avenue/Horse Hill Road Intersection	2	Improvements to be coordinated with development of ShopRite and office building sites.	2013 – 2015
Monroe Street/County and Big Box Driveway	3	Additional sidewalks and two-way left-turn lane coordinated with development of former Berlex site.	2013 - 2015
Ridgedale Avenue	2	Improvements to be coordinated with development of former Berlex site.	2013 - 2015
Whippany Road	2	Coordinate with DOT to implement signal timing changes.	2013 - 2015
Pedestrian /Bicycle	3	<p>Coordinate with developers and property owners along the Corridor.</p> <p><b>Phase 1:</b> Martin Luther King Ave sidewalk extensions, south side of corridor between The American Road and Martin Luther King Ave.</p> <p><b>Phase 2:</b> Construct the multi-use path.</p>	<p><b>Phase 1:</b> 2013 – 2015</p> <p><b>Phase 2:</b> 2015 – 2017</p>
Transit	3	<p><b>Phase 1:</b> ShopRite Center bus pull-outs and shelters. (Implement with development).</p> <p><b>Phase 2:</b> Remaining bus pull-outs, shelters, and pads.</p>	<p><b>Phase 1:</b> 2013 – 2015</p> <p><b>Phase 2:</b> 2015 - 2020</p>
Trailblazing/ Streetscaping	3	Pursue with Phase 1 of Multi-Use Path.	2013 – 2015



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## EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY ALTERNATIVES ANALYSIS REPORT

### 1.0 INTRODUCTION

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East Hanover Avenue (CR 650) is a major east-west commuter roadway that connects multiple municipalities, including Morris Plains Borough, Morris Township, and Hanover Township in Morris County, New Jersey, to New Jersey Route 24 (NJ 24). The roadway currently experiences directional congestion during the peak periods, with high eastbound traffic volumes during the AM peak period, and high westbound traffic volumes during the PM peak period. In particular, significant eastbound queuing is experienced at the intersection of East Hanover Avenue (CR 650) and Whippany Road (CR 511) during the AM peak period, while westbound queuing is experienced at the intersection of East Hanover Avenue (CR 650) and Speedwell Avenue (US 202) during the PM peak period. Furthermore, anticipated land use changes along the corridor may exacerbate the existing congestion issues if mitigation measures are not implemented.

East Hanover Avenue between Speedwell Avenue (US 202) and Whippany Road (CR 511) has traditionally been an industrial corridor with multiple manufacturing and warehouse buildings, mixed with residential and commercial land uses. Over the past twenty years, industrial activities along the corridor have diminished, leaving multiple large parcels vacant, particularly along the north side of the roadway. These parcels have become the focus of substantial redevelopment projects and proposals that will have a major impact on future traffic operations in the area. Anticipated redevelopment along the corridor includes a shopping center with a supermarket, big box retail, residential, and office space. Current congestion issues, along with anticipated redevelopment in the area, make it critical that land use and transportation be evaluated simultaneously, and in close coordination between the county and the three municipalities. Addressing the redevelopment of the corridor on a piecemeal, municipality-by-municipality, basis may constrain current and future economic development in the area. Therefore, a comprehensive approach to planning must be implemented in order to maintain mobility along the corridor. Furthermore, the redevelopment projects will result in a change in land use that is expected to increase vehicular, pedestrian, and bicycle volume. Therefore, a comprehensive plan is needed to address the needs of all users. This calls for a joint transportation and land use planning undertaking.

In order to mitigate the existing and anticipated future traffic conditions, the County of Morris requested assistance from New Jersey Department of Transportation's (NJDOT) Local Transportation Planning Assistance (LTPA) program to analyze the existing and future traffic operations along the already-congested corridor, and to develop the necessary infrastructure improvements to reduce congestion and increase safety, while considering the needs of all users. The planning and design concept work effort will provide a comprehensive plan for the corridor across the three municipalities, and will allow the County to negotiate pro rata contributions for transportation improvements with developers.

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**1.1 PURPOSE**

Stantec Consulting Inc. (Stantec), currently under an LTPA Task Order Agreement, was tasked to complete this study in two phases: 1) Planning and 2) Design. The Planning phase includes the traffic analysis, corridor study, preliminary engineering, and community involvement necessary to develop clear direction for the proposed infrastructure improvements. The Design phase includes the efforts required to develop 95% complete contract documents for the implementation of the proposed infrastructure improvements, outside the limits of work for the current proposed and anticipated developments.

The purpose of this document is to summarize the traffic analyses performed for the planning phase of the East Hanover Avenue Corridor Study, present and evaluate three improvement alternative scenarios, recommend a preferred alternative, and develop an implementation plan. This document can then be used by the County to negotiate pro rata contributions for transportation improvements with developers.

**1.2 STUDY AREA**

The study area consists of the East Hanover Avenue (CR 650) corridor between Speedwell Avenue (US 202) and Whippany Road (CR 511) (see **EXHIBIT 1**). The 2.4-mile corridor traverses three municipalities: Morris Plains Borough, Morris Township, and Hanover Township. For the purposes of this study, East Hanover Avenue within the study area will be referred to as the "Corridor".

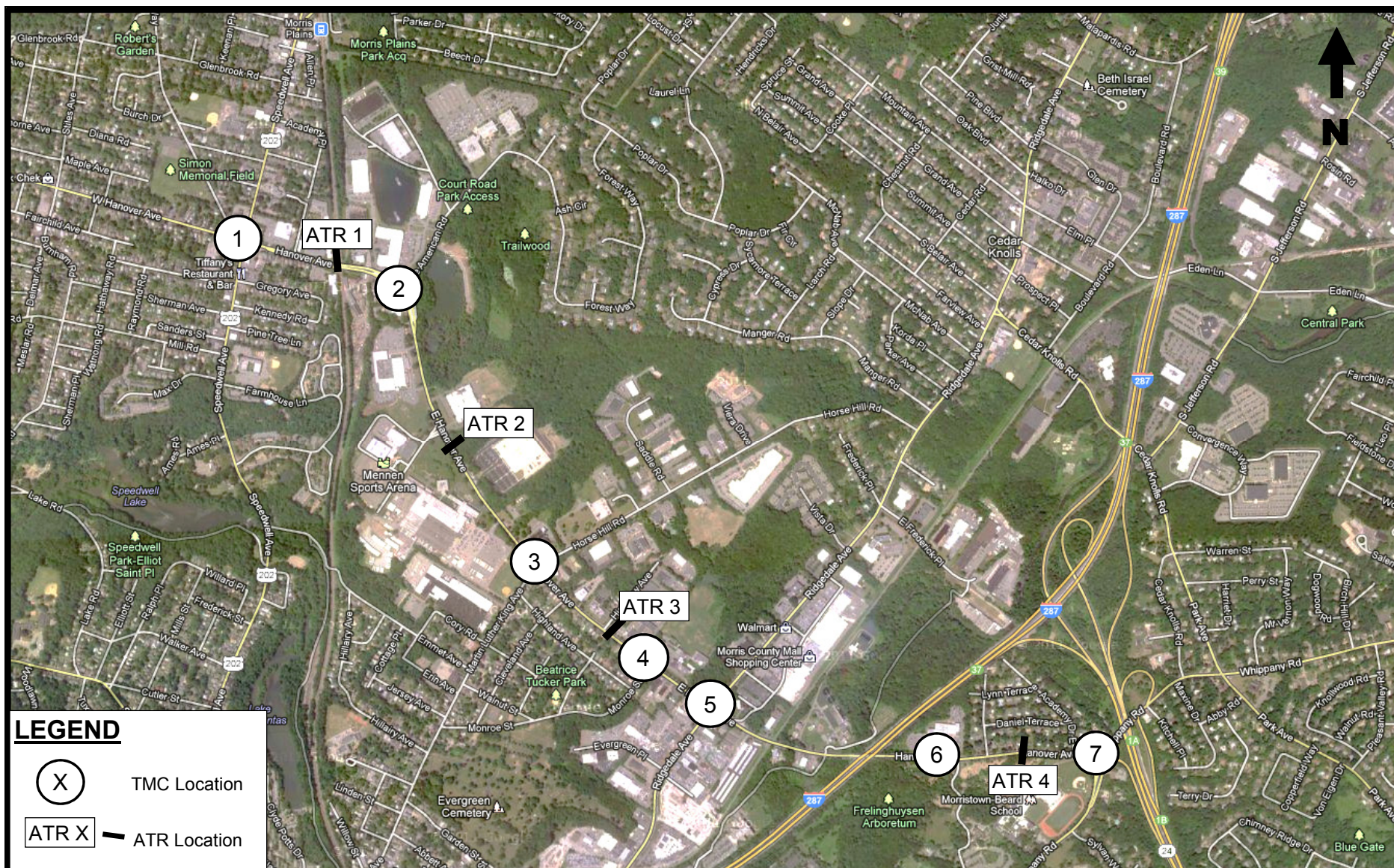
East Hanover Avenue (CR 650) is classified as an Urban Minor Arterial with two twelve-foot lanes in each direction. The posted speed limit ranges from 30 mph between US 202 and The American Road, 40 mph between the American Road and Horse Hill Road/Martin Luther King Avenue, 35 mph between Horse Hill Road/MLK Avenue and Ridgedale Avenue, 40 mph between Ridgedale Avenue and County Library Driveway, and 45 mph between Library Driveway and Whippany Road. The 2011 AADT is approximately 20,000 vehicles, of which approximately 2% are heavy vehicles.

The following seven (7) intersections are included for analysis in the study area:

**A. East Hanover Avenue (CR 650) and Speedwell Avenue (US 202) (signalized)**

Speedwell Avenue (US 202) is an Urban Principal Arterial with a posted speed limit of 30 mph. Both the northbound and southbound approaches have a shared through-right turn lane and a left turn only lane. The eastbound approach has a left-turn only lane, a through lane, and a shared through-right turn lane with a channelized right-turn. The westbound approach has a shared through-right turn lane, a through lane, and a left-turn only lane. The intersection also has striped crosswalks across all four legs of the intersection, with pedestrian signal heads.





## EXHIBIT 1

### Study Area & Traffic Count Locations

Turning Movement Counts (TMC)	Automatic Traffic Recorders (ATR)
Counted 6:30 AM - 9:00 AM & 4:00 PM - 6:30 PM Includes classification of heavy vehicles, peds, and bikes	Bi-directional ATRs installed at each location for at least a seven-day period
Int. 1. Speedwell Ave & E. Hanover Ave - Signalized Int. 2. The American Rd & E. Hanover Ave - Signalized Int. 3. Martin Luther King Ave/Horse Hill Rd & E. Hanover Ave - Signalized Int. 4. Monroe St & E. Hanover Ave - Unsignalized Int. 5. Ridgedale Ave & E. Hanover Ave - Signalized Int. 6. Morris County Library Dr. & E. Hanover Ave - Signalized Int. 7. Whippany Road/NJ 24 EB On-Ramp & E. Hanover Ave - Signalized	ATR 1. E. Hanover Ave between Speedwell Ave and The American Rd (EB/WB) ATR 2. E. Hanover Ave between The American Rd and Martin Luther King Ave/Horse Hill Rd (EB/WB) ATR 3. E. Hanover Ave between Highview Ave and Monroe St (EB/WB) ATR 4. E. Hanover Ave between Morris County Library Driveway and Whippany Rd (EB/WB)



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The intersection is constrained by gas stations on the northwest and southeast corners, and a church on the southwest corner. A former gas station was demolished on the northeast corner.

**B. East Hanover Avenue and The American Road (signalized)**

The American Road is an Urban Local road with a posted speed limit of 25 mph. The southbound approach has a left-turn only lane and a channelized right-turn only lane. The eastbound approach has two through lanes and one left-turn only lane. The westbound approach has two through lanes and one channelized right-turn only lane. There is a striped pedestrian crosswalk with pedestrian signal heads across the American Road approach.

The intersection is constrained by a protected park area with pond on the northeast corner, an office building on the northwest corner, and several businesses on the south side of the intersection.

**C. East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road (signalized)**

Martin Luther King Avenue is the northbound approach to the intersection and is an Urban Minor Arterial with a posted speed limit of 25 mph. Horse Hill Road is the southbound approach to the intersection and is an Urban Local road with a posted speed limit of 35 mph. The northbound approach has a left-turn only lane and a shared through-right lane. The southbound approach has a right-turn only lane and a shared through-left lane. Both the eastbound and westbound approaches have a shared through-left lane and a shared through-right lane.

A park with a baseball field is located on the southwest corner, and a gas station is located on the southeast corner. The proposed ShopRite Center property is located on the northwest corner, while a proposed office redevelopment is located on the northeast corner of intersection. Striped crosswalks are provided across the north and south legs of the intersection; however, pedestrian signal heads are not provided. In addition, it should be noted that the developer of the ShopRite Center will be making modifications to this intersection that include left-turn lanes on East Hanover Avenue. These modifications were incorporated into the No Build and Build analyses.

**D. East Hanover Avenue and Monroe Street (unsignalized)**

Monroe Street is an Urban Local street with a posted speed limit of 30 mph. The northbound approach is stop controlled and has one shared right-left turn lane. The eastbound approach has a through lane and a shared through-right lane. The westbound approach has a through lane and a shared through-left lane.

The intersection is constrained by a residential property on the southwest corner and a carwash on the southeast corner. On the north side of the intersection is a 27-acre former

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Berlex industrial property to be redeveloped for big box retail and related uses. A striped crosswalk is provided along the Monroe Street approach.

**E. East Hanover Avenue and Ridgedale Avenue (signalized)**

Ridgedale Avenue is an Urban Minor Arterial with a posted speed limit of 35 mph. The northbound approach has a left-turn only lane, a through lane, and a shared through-right lane. The southbound approach has a left-turn only lane, a through lane and a right-turn only lane. The eastbound approach has a shared through-left lane and a shared through-right lane. The westbound approach has a shared through-left lane, a through lane, and a channelized right-turn only lane. Striped crosswalks are provided across the north and east legs of the intersection, and pedestrian signal heads are provided at every corner.

The intersection is constrained by a gas station on the southeast corner, a garden center on the southwest corner, and an office building on the northeast corner. On the northwest corner, extending from the Monroe Street intersection along East Hanover Avenue, is the 27-acre former Berlex industrial property to be developed for big box retail and related uses.

**F. East Hanover Avenue and Morris County Library Driveway (signalized)**

The Morris County Library Driveway provides direct access to the Morris County Library parking lot. The southbound approach has a left-turn only lane and a right-turn only lane. The eastbound approach has a shared through-left lane and a through lane. The westbound approach has a through lane and a shared through-right lane. Striped crosswalks with pedestrian signal heads are provided across the east and north legs of the intersection.

The library is located along the north side of the intersection, while the Frelinghuysen Arboretum is located along the south side.

**G. East Hanover Avenue and Whippany Road (CR 511) (signalized)**

Whippany Road is an Urban Minor Arterial with a posted speed limit of 45 mph. The eastbound approach has a left-turn only lane and a shared through-right lane, with a channelized right turn. The northbound approach has a left-turn only lane, two through lanes, and a right-turn only lane. The southbound approach has a left-turn only lane, two through lanes, and a channelized right-turn only lane. The eastern leg is a one-lane on-ramp to NJ Route 24.

The intersection is constrained by NJ 24 on the east, Morristown-Beard School on the southwest corner, and residential properties on the northwest corner. No pedestrian crosswalks or signal heads are provided at this intersection.



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### 1.3 TERMINOLOGY

For the purpose of this study, the “**Existing Condition**” refers to the existing roadway network with 2011 traffic volumes. The “**No Build Condition**” refers to the existing roadway network with the addition of background traffic growth rates and vehicle-trips anticipated to be generated by the proposed developments. The “**Build Condition**” refers to the anticipated traffic growth and redevelopments, with potential mitigation measures, shown in the concept plans (**APPENDIX A**).

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## **2.0 EXISTING TRAFFIC CONDITIONS**

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Existing traffic data was collected to establish “average-day” baseline conditions (vehicular and pedestrian volumes, intersection and lane geometry, sidewalk conditions, etc.).

### **2.1 DATA COLLECTION PROGRAM**

A comprehensive data collection program was implemented during September and October 2011. The program consisted of the following (see **EXHIBIT 1**):

- Manual Turning Movement Counts (TMCs)
- Pedestrian and Bicycle Counts
- Automatic Traffic Recorder (ATR) Counts
- Travel Time Runs
- Crash Analysis
- Multimodal System Assessment

#### **2.1.1 Manual Turning Movement Counts**

Manual turning movement counts (TMCs) were conducted on average weekdays, September 27, 28, and 29 (Tuesday, Wednesday, and Thursday), 2011, during the AM and PM peak periods, between the hours of 6:30 AM to 9:00 AM, and 4:00 PM to 6:30 PM, at the following study area intersections:

- East Hanover Avenue and Speedwell Avenue (signalized);
- East Hanover Avenue and The American Road (signalized);
- East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road (signalized);
- East Hanover Avenue and Monroe Street (unsignalized);
- East Hanover Avenue and Ridgedale Avenue (signalized);
- East Hanover Avenue and Morris County Library Driveway (signalized); and,
- East Hanover Avenue and Whippany Road (signalized).

Turning movement counts were classified into vehicles and heavy vehicles (**APPENDIX B**) and were verified utilizing data provided by the County.

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**2.1.2 Pedestrian and Bicycle Counts**

Pedestrian and bicycle counts were collected as part of the turning movement counts on September 27, 28, and 29 (Tuesday, Wednesday, and Thursday), 2011, during the AM and PM peak periods, between the hours of 6:30 AM to 9:00 AM, and 4:00 PM to 6:30 PM, at the following study area intersections:

- East Hanover Avenue and Speedwell Avenue (signalized);
- East Hanover Avenue and The American Road (signalized);
- East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road (signalized);
- East Hanover Avenue and Monroe Street (unsignalized);
- East Hanover Avenue and Ridgedale Avenue (signalized);
- East Hanover Avenue and Morris County Library Driveway (signalized); and,
- East Hanover Avenue and Whippany Road (signalized).

The count data is summarized in **APPENDIX B**.

**2.1.3 Automatic Traffic Recorders (ATR)**

Twenty-four hour ATR data was collected for a continuous one-week period, between Monday, September 26, and Monday, October 3, 2011, during typical operational conditions. ATRs were placed at the following four locations (see **EXHIBIT 1**):

1. East Hanover Avenue between Speedwell Avenue and The American Road;
2. East Hanover Avenue between The American Road and Martin Luther King Avenue/Horse Hill Road;
3. East Hanover Avenue between Highview Avenue and Monroe Street; and,
4. East Hanover Avenue between the Morris County Library Driveway and Whippany Road.

ATR count summary data is located in **APPENDIX B**.

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**2.1.4 Travel Time Runs**

Speed and delay travel time runs were conducted on Tuesday, September 27, 2011, between the hours of 6:30 AM to 9:00 AM, and 4:00 PM to 6:30 PM. The test vehicle conducted continuous travel time runs for the duration of each peak period, and the driver of the test vehicle was instructed to utilize the floating car method and drive with the flow of traffic in order to emulate average travel conditions along the Corridor. The data obtained in the speed and delay travel time runs was used to evaluate Corridor performance, as well as to calibrate the traffic analysis model.

**2.1.5 Crash Analysis**

Crash data for the most recent three year period, January 2008 – June 2011, was obtained from the Plan4Safety crash database for the entire Corridor in order to identify any locations within the study area with an accident rate that could signal a need for safety improvements.

**2.1.6 Multimodal System Assessment**

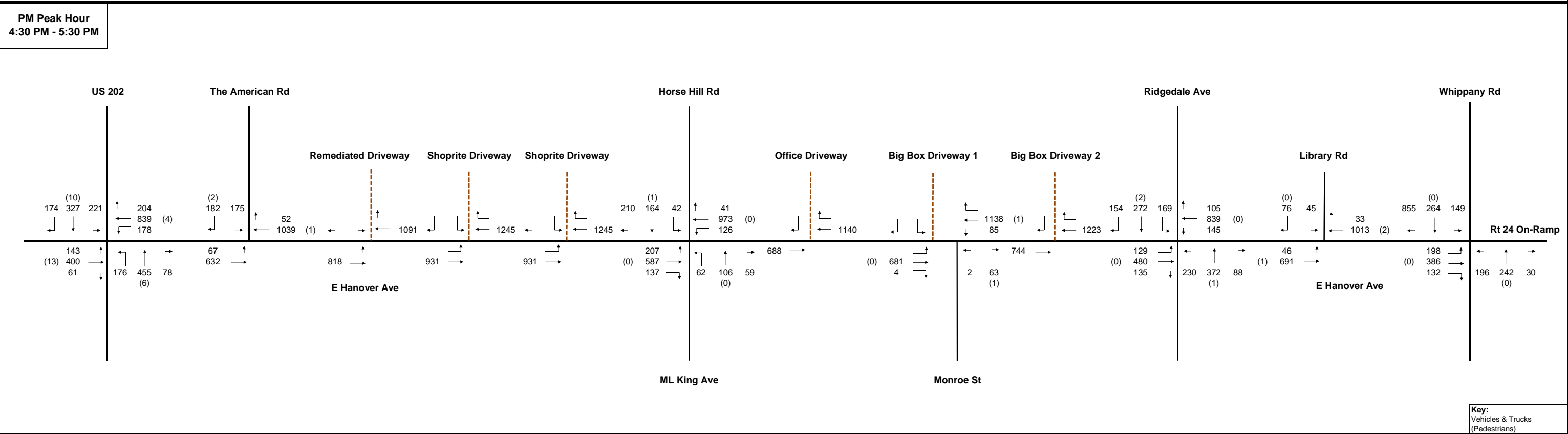
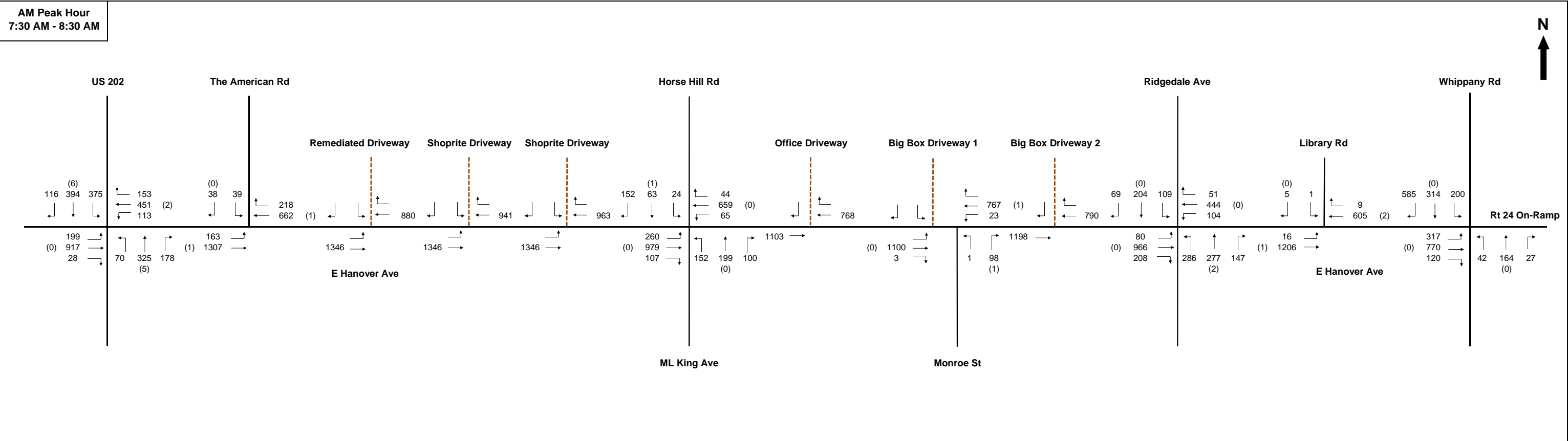
An assessment of existing pedestrian and transit facilities was conducted in October 2011. The assessment consisted of identifying the location of existing pedestrian facilities, including sidewalks, crosswalks, pedestrian signal heads, and other pedestrian pathways, and providing a visual assessment of their condition. In addition, NJ TRANSIT bus stop locations were noted along with any amenities, such as signs, concrete pads, benches, or shelters.

**2.2 DATA COLLECTION RESULTS****2.2.1 2011 Existing Traffic Volumes**

The TMC data was reduced and verified with the ATR data. Based on the data collection results, the study area was determined to have the following vehicular peak hours:

- Weekday AM: 7:30 AM – 8:30 AM
- Weekday PM: 4:30 PM – 5:30 PM

The ATR and TMC data was also used to determine the peak hours that would be most appropriate for analysis. The 2011 Existing Condition AM and PM peak hour traffic volume diagrams are shown in **EXHIBIT 2**. It should be noted that pedestrian and bicycle volumes were low during the AM and PM peak periods. This is most likely due to a combination of limited destinations for pedestrians along the Corridor, as well as the lack of bicycle facilities. Bicyclists have been reported to use the Corridor during the off-peak periods when traffic volumes are lower.



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### 2.2.2 Travel Time Run Results

Travel time runs were conducted to determine the average speed and typical delay along the Corridor during the AM and PM peak periods, in order to provide measures used to calibrate the Existing Condition Synchro model. Test vehicle drivers were instructed to drive with the flow of traffic to emulate the typical driver experience. Four complete runs were conducted during the AM peak period and five complete runs during the PM peak period. Travel speeds were measured based on the total time the vehicle was in motion between study-area intersections. Delay was also measured separately within each link as an additional calibration measure for the simulation model. The results of the travel time runs are summarized in **EXHIBIT 3**.

In general, average speeds during the AM and PM peak periods were at, or below, the posted speed limits along the Corridor. During the AM peak period, eastbound East Hanover Avenue operated close to the posted speed limit between Speedwell Avenue (US 202) and Martin Luther King Avenue/Horse Hill Road. Speeds then decreased in the approach to the Ridgedale Avenue intersection, with an average speed of 12 mph between Monroe Street and Ridgedale Avenue. This is due to the congestion that is experienced in approach to the Ridgedale Avenue intersection. Speeds then increased slightly, before the average speed dropped to 20 mph in advance of the Whippany Road intersection, which correlates with the measured queuing during the AM peak period in advance of Whippany Road. Speeds along westbound East Hanover Avenue were more consistent during the AM peak period.

As discussed above, the Corridor experiences significant directional travel patterns during the AM and PM peak periods. The travel time runs show the impact of the heavy eastbound traffic during the AM peak period. The Corridor experienced heavy traffic volumes in the westbound direction during the PM peak period. This is shown in the travel time runs where recorded speeds were 5 to 10 mph below the posted speed limit, on average, with the exception of the link between Martin Luther King Avenue/Horse Hill Road and The American Road. Average speed on this link temporarily reached 47 mph before vehicles met the back of the queue from the approach to Speedwell Avenue.

### 2.2.3 Existing Pedestrian Facility Assessment

A sidewalk condition survey was performed on Tuesday, October 25, 2011 for six segments of East Hanover Avenue that are located between the seven study area intersections. The location of sidewalks, curb cut locations, crosswalk conditions, and other pedestrian pathways were identified, and a detailed sidewalk condition assessment, including observations of surface spall, panel cracking, and joint deflections, was conducted. A summary of the existing pedestrian facility assessment is shown in **EXHIBIT 4**.

Improving sidewalk conditions, increasing curb cuts, and adding/re-stripping crosswalks may increase the desirability of walking between destinations. The aforementioned improvements would also increase sidewalk walkability. Curb cuts are also crucial to increase accessibility.

**EXHIBIT 3**

Travel Time Runs - Tuesday, September 26, 2011 - AM and PM Peak Periods  
 Project: East Hanover Corridor Study, Morris County

**AM Peak Hour Summary**  
**EB East Hanover Avenue**

Link	Link Distance (ft)	Travel Time (sec)	Travel Speed (mph)	Delay (sec)	Total Time (sec)
Speedwell Ave to The American Rd	1843	37.8	33.3	0.0	37.8
The American Rd to Horse Hill Rd	3570	61.8	39.4	19.0	80.8
Horse Hill Rd to Monroe St	1739	40.0	29.6	0.0	40.0
Monroe St to Ridgedale Ave	779	45.5	11.7	17.0	62.5
Ridgedale Ave to Library	2650	57.5	31.4	23.5	81.0
Library to Whippany Rd	1900	64.8	20.0	146.5	211.3

**AM Peak Hour Summary**  
**WB East Hanover Avenue**

Link	Link Distance (ft)	Travel Time (sec)	Travel Speed (mph)	Delay (sec)	Total Time (sec)
Whippany Rd to Library	1900	35.3	36.7	0.0	35.3
Library to Ridgedale Ave	2650	50.8	35.6	78.0	128.8
Ridgedale Ave to Monroe St	779	20.5	25.9	0.0	20.5
Monroe St to Horse Hill Rd	1739	34.0	34.9	59.5	93.5
Horse Hill Rd to The American Rd	3570	65.3	37.3	0.0	65.3
The American Rd to Speedwell Ave	1843	37.8	33.3	43.8	81.5

**PM Peak Hour Summary**  
**EB East Hanover Avenue**

Link	Link Distance (ft)	Travel Time (sec)	Travel Speed (mph)	Delay (sec)	Total Time (sec)
Speedwell Ave to The American Rd	1843	57.0	22.0	0.0	57.0
The American Rd to Horse Hill Rd	3570	58.0	42.0	49.8	107.8
Horse Hill Rd to Monroe St	1739	30.0	39.5	0.0	30.0
Monroe St to Ridgedale Ave	779	26.0	20.4	62.0	88.0
Ridgedale Ave to Library	2650	48.8	37.1	0.0	48.8
Library to Whippany Rd	1900	39.8	32.6	52.3	92.1

**PM Peak Hour Summary**  
**WB East Hanover Avenue**

Link	Link Distance (ft)	Travel Time (sec)	Travel Speed (mph)	Delay (sec)	Total Time (sec)
Whippany Rd to Library	1900	40.3	32.2	0.0	40.3
Library to Ridgedale Ave	2650	56.0	32.3	70.5	126.5
Ridgedale Ave to Monroe St	779	20.0	26.6	0.0	20.0
Monroe St to Horse Hill Rd	1739	51.8	22.9	40.5	92.3
Horse Hill Rd to The American Rd	3570	52.0	46.8	43.3	95.3
The American Rd to Speedwell Ave	1843	33.0	38.1	347.3	380.3

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Speedwell Avenue to The American Road

Between Speedwell Avenue and The American Road, full concrete sidewalk coverage is provided along the northern side of East Hanover Avenue, while only partial coverage is provided along the southern side. The southern sidewalk ends just west of The American Road (**EXHIBIT 4 PHOTO 1**). Curb cuts are provided at the Speedwell Avenue intersection and along the northern and southern sidewalks. Crosswalk striping at the Speedwell Avenue intersection was observed to be in fair condition. Pedestrian signal heads are provided for the crosswalks on all four legs of the intersection.

Overall sidewalk condition was found to be fair. Surface spalling and panel cracking was not observed on either the northern or southern sidewalks. Minimal panel deflection was observed. However, there was significant vegetation growth in sidewalk cracks along the southern sidewalk.

The American Road to Martin Luther King Avenue/Horse Hill Road

Between The American Road and Martin Luther King Avenue/Horse Hill Road, concrete sidewalk coverage is nearly complete along the northern side of East Hanover Avenue. There is no sidewalk along the south side of this segment. Curb cuts are not provided at The American Road intersection and at all driveway locations along the northern sidewalk. Crosswalk striping at The American Road intersection is incomplete and in poor condition.

Overall sidewalk condition was found to be poor. Although surface spalling and panel cracking was not observed, vegetation overgrowth on the western portion of this sidewalk segment, including the encroachment of shrubs and tall grass, reduces the effective sidewalk width to one foot in some locations (**EXHIBIT 4 PHOTO 2**). Minimal panel deflection was observed.

Martin Luther King Avenue/Horse Hill Road to Monroe Street

Between Martin Luther King Avenue/Horse Hill Road and Monroe Street, concrete sidewalk coverage is nearly complete along the northern side of East Hanover Avenue. There is an approximate 450-foot gap in sidewalk coverage at the western end of this segment (**EXHIBIT 4 PHOTO 3**). There is no sidewalk along the southern section of East Hanover Avenue. Curb cuts are provided at the northeastern and northwestern corners of the Martin Luther King Avenue intersection. Crosswalk striping at the Martin Luther King Avenue intersection is incomplete and observed to be in poor condition. Crosswalks are not provided across this section of East Hanover Avenue.

Overall sidewalk condition was found to be fair. Surface spalling and panel cracking was not observed. However, tree root growth has caused significant sidewalk panel deflection near Monroe Street. Vegetation growth in sidewalk cracks was minimal.





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Morris County Department of Engineering

East Hanover Avenue  
Corridor Study

Multimodal Survey



Scale: 1"= 800'

EXHIBIT 4



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Monroe Street to Ridgedale Avenue

Between Monroe Street and Ridgedale Avenue, concrete sidewalk coverage is complete along the northern side of East Hanover Avenue. A 60-foot southern sidewalk is located along the south side of this segment near the Monroe Street intersection, leaving a 700-foot sidewalk gap to the Ridgedale Avenue intersection (**EXHIBIT 4 PHOTO 5**). Crosswalk striping at the Monroe Street intersection is incomplete and in poor condition. Curb cuts are only provided at the southeastern and southwestern corners of the Monroe Street intersection since there are no crosswalks across this section of East Hanover Avenue. However, curb cuts are provided along the entire length of the northern sidewalk.

Overall sidewalk condition was found to be fair. Surface spalling and panel cracking was not observed. However, significant sidewalk panel deflection near Monroe Street, caused by tree root growth, was observed. Vegetation growth in sidewalk cracks was minimal.

Ridgedale Avenue to Library Driveway

Between Ridgedale Avenue and Library Driveway, concrete sidewalk coverage is complete along the northern side of East Hanover Avenue. However, curb cuts are not provided at all locations along the length of the northern sidewalk. There is a small section of concrete sidewalk located on the southern side of the roadway, along the gas station property on the southeast corner of the Ridgedale Avenue intersection. One curb cut, which has a utility pole placed in front of it, is provided at the southeastern corner of the intersection. Crosswalks are only striped across the north and west legs of the intersection, and were observed to be in poor condition.

A gravel and asphalt path is provided along the south side of the Corridor between the Patriot's Path access and Library Driveway (**EXHIBIT 4 PHOTO 6**). However, the condition of this pathway was observed to be poor in some locations. The overall condition of the northern sidewalk was observed to be poor. Significant sidewalk panel deflection and cracking was observed, and there are uneven surfaces with asphalt pavement and gravel at the at-grade railroad crossing (**EXHIBIT 4 PHOTO 4**). Sidewalk crack vegetation growth was also observed.

Patriot's Path enters the study area just west of the I-287 overpass; however, there is no direct crosswalk provided to link the northern and southern sections of the path. To cross East Hanover Avenue, signs direct users of the path to utilize the crosswalk at the Library Driveway, which results in a diversion of approximately 2,600 feet.

Library Driveway to Whippany Road

Between the Library Driveway and Whippany Road, concrete sidewalk coverage is complete along the northern side of East Hanover Avenue. A sidewalk is located along the southern segment between the Library Driveway intersection and the entrance to the Arboretum. The

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Library Driveway intersection has curb cuts and crosswalks that are in fair condition and provide a complete connection between all sidewalks. There are curb cuts along the entire length of the northern sidewalk.

Overall sidewalk condition was observed to be fair. Surface spalling and panel cracking was not observed on either the northern or southern sidewalks. Minimal panel deflection and vegetation growth in sidewalk cracks was observed. There are no crosswalks or curb cuts at the intersection of East Hanover Avenue and Whippany Road, which has no sidewalks.

**2.2.4 Transit Facility Assessment**

Existing transit facilities were also identified and assessed during the sidewalk assessment. NJ TRANSIT Bus Route 872 provides the only transit service that operates along the Corridor (**EXHIBIT 4**). Route 872 has limited service with eight westbound trips and eight eastbound trips between 6:00 AM and 7:00 PM on weekdays. No weekend service is provided. The route enters the Corridor at Martin Luther King Avenue, and continues west through the study area to Speedwell Avenue, with signed stops just west of the Martin Luther King Avenue intersection, at the Colgate Palmolive building, at the Mennen Arena, and at the intersection with Speedwell Avenue. A sidewalk is provided along the northern side of the Corridor to access the westbound stops. No sidewalk is provided to access the eastbound stops.

NJ TRANSIT operates several bus routes that are adjacent to the study area. Bus routes 871 and 874 operate along Ridgedale Avenue and connect Morristown and Wayne with a combined 13 northbound and southbound trips between 6:00 AM and 7:00 PM on weekdays. These routes also provide limited Saturday service. Stops for the two routes are located approximately 700 feet to the north and south of the Corridor on Ridgedale Avenue and can be accessed via concrete sidewalks.

Bus routes 875 and 880 operate along Speedwell Avenue (US 202), and have stops just north of the Corridor that are accessed via concrete sidewalks. Route 875 provides seven northbound and southbound trips between 7:00 AM and 6:00 PM on weekdays. No weekend service is provided. Route 880 provides 12 southbound trips and 11 northbound trips between 6:00 AM and 8:00 PM on weekdays, with limited Saturday service.

NJ TRANSIT also operates commuter rail service within the study area. The Morristown Line passes under the Corridor just east of the intersection with Speedwell Avenue. The Morris Plains station is located approximately 2,700 feet north of the intersection of East Hanover Avenue and Speedwell Avenue. There are 39 inbound trips to Hoboken/NYC and 40 outbound trips from Hoboken/NYC from this stop on weekdays, and 21 inbound and 21 outbound trips on the weekend.

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#### 2.2.5 Crash Analysis Results

Plan4Safety, the State's crash database, was used to obtain crash data for the Corridor during the period from January 2008 to June 2011. The results are summarized in **TABLE 1**. There were 192 crashes on the Corridor during this period, consisting of 143 property damage only crashes and 49 injury crashes. There were no fatalities. The top three crash types were rear-end (76), right-angle (38), and side-swipe (30), which are common crash types for multi-lane corridors with a mixture of signalized and unsignalized intersections and driveways. Of the 192 crashes, 95% occurred between 6:00 AM and 9:00 PM, with approximately 30% of all crashes occurring between 3:00 PM and 6:00 PM. Most (82% or 158) of the crashes occurred on dry pavement.

When comparing the types of crashes to the statewide average, the average percentage of rear-end, right-angle, side-swipe, head-on, and "pedacyclist" (pedestrian-cyclist) crashes exceeds the statewide average percentages for similar County roadways (**TABLE 2**).

#### Intersection Crashes

An evaluation of crashes was conducted for each of the study area intersections to identify any intersections that may suggest the need for safety improvements (**EXHIBIT 5**). Current statewide crash reporting guidance states that only crashes that occur within the intersection are reported as "intersection crashes". However, given the nature of the congestion at the study area intersections, crashes could occur in advance of an intersection that are associated with traffic conditions generated by that intersection. Therefore, any crash that occurred within 200 feet of the study area intersection was included in the analysis.

Based on these evaluation criteria, the largest number of crashes occurred at the intersections with Speedwell Avenue (US 202), Martin Luther King Avenue/Horse Hill Road, and Ridgedale Avenue. The intersection of East Hanover Avenue and Speedwell Avenue (US 202) experienced the most crashes during the study period (43 crashes). Of those, rear-end (16), right-angle (14), and side-swipe (9) comprised the top three crash types. These are typical crash types for a highly congested signalized intersection. Furthermore, driveways are close to the signalized intersection on all four approaches, which complicates traffic operations in this area.

The intersection of East Hanover Avenue and Ridgedale Avenue experienced the second most crashes during the study period (31 crashes). Three crash types comprised the majority of the crashes: 13 rear-end, six right-angle, and six side-swipe. In addition, there were two head-on/angular crashes at this intersection. The intersection of East Hanover Avenue and Martin Luther King Avenue/ Horse Hill Road experienced the third-most number of crashes. Of the 25 crashes, 12 were rear-end, five were right-angle, two were side-swipe, and two were head-on/angular crashes.

**EXHIBIT 5**  
**EAST HANOVER AVENUE CRASH SUMMARY TABLES**  
**By Study Area Intersection (within 200 Feet)**  
**Accident Analysis (1/1/08 to 6/30/11)**

Speedwell Ave Intersection Crashes      2008      2009      2010      2011      Total Average

Number of Accidents      22 + 8 + 3 + 10 = 43      12

Collision Type

Rear End	5	4	1	6	16	5
Right Angle	9	2	2	1	14	4
Same Direction - Side Swipe	5	2	0	2	9	3
Fixed Object	0	0	0	0	0	0
Head On/Angular	1	0	0	0	1	0
Left Turn	0	0	0	1	1	0
Pedalcyclist	1	0	0	0	1	0
Other	0	0	0	0	0	0
Animal	0	0	0	0	0	0
Backing	0	0	0	0	0	0
Opposite Direction - Side Swipe	0	0	0	0	0	0
Pedestrian	1	0	0	0	1	0

The American Rd Intersection Crashes      2008      2009      2010      2011      Total

Number of Accidents      3 + 2 + 2 + 1 = 8

Collision Type

Rear End	2	0	2	0	4
Right Angle	0	0	0	0	0
Same Direction - Side Swipe	1	0	0	0	1
Fixed Object	0	2	0	0	2
Head On/Angular	0	0	0	0	0
Left Turn	0	0	0	0	0
Pedalcyclist	0	0	0	0	0
Other	0	0	0	0	0
Animal	0	0	0	1	1
Backing	0	0	0	0	0
Opposite Direction - Side Swipe	0	0	0	0	0
Pedestrian	0	0	0	0	0

MLK Ave/Horse Hill Rd Intersection Crashes      2008      2009      2010      2011      Total

Number of Accidents      7 + 6 + 7 + 5 = 25

Collision Type

Rear End	4	1	3	4	12
Right Angle	1	1	3	0	5
Same Direction - Side Swipe	0	2	0	0	2
Fixed Object	0	0	0	0	0
Head On/Angular	0	1	0	1	2
Left Turn	0	1	0	0	1
Pedalcyclist	0	0	1	0	1
Other	1	0	0	0	1
Animal	0	0	0	0	0
Backing	1	0	0	0	1
Opposite Direction - Side Swipe	0	0	0	0	0
Pedestrian	0	0	0	0	0

Monroe St Intersection Crashes      2008      2009      2010      2011      Total

Number of Accidents      4 + 1 + 2 + 0 = 7

Collision Type

Rear End	1	0	1	0	2
Right Angle	2	1	1	0	4
Same Direction - Side Swipe	1	0	0	0	1
Fixed Object	0	0	0	0	0
Head On/Angular	0	0	0	0	0
Left Turn	0	0	0	0	0
Pedalcyclist	0	0	0	0	0
Other	0	0	0	0	0
Animal	0	0	0	0	0
Backing	0	0	0	0	0
Opposite Direction - Side Swipe	0	0	0	0	0
Pedestrian	0	0	0	0	0

**EXHIBIT 5**  
**EAST HANOVER AVENUE CRASH SUMMARY TABLES**  
**By Study Area Intersection (within 200 Feet)**  
**Accident Analysis (1/1/08 to 6/30/11)**

Ridgedale Ave Intersection Crashes

	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>Total</u>
Number of Accidents	9	12	6	4	31

Collision Type

Rear End	5	3	2	3	13
Right Angle	2	2	1	1	6
Same Direction - Side Swipe	1	4	1	0	6
Fixed Object	0	0	1	0	1
Head On/Angular	1	1	0	0	2
Left Turn	0	1	1	0	2
Pedalcyclist	0	0	0	0	0
Other	0	1	0	0	1
Animal	0	0	0	0	0
Backing	0	0	0	0	0
Opposite Direction - Side Swipe	0	0	0	0	0
Pedestrian	0	0	0	0	0

Library Driveway Intersection Crashes

	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>Total</u>
Number of Accidents	2	2	0	2	6

Collision Type

Rear End	1	0	0	0	1
Right Angle	0	0	0	0	0
Same Direction - Side Swipe	0	0	0	1	1
Fixed Object	0	1	0	1	2
Head On/Angular	1	0	0	0	1
Left Turn	0	0	0	0	0
Pedalcyclist	0	1	0	0	1
Other	0	0	0	0	0
Animal	0	0	0	0	0
Backing	0	0	0	0	0
Opposite Direction - Side Swipe	0	0	0	0	0
Pedestrian	0	0	0	0	0

Whippany Road Intersection Crashes

	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>Total</u>
Number of Accidents	9	4	1	0	14

Collision Type

Rear End	4	3	1	0	8
Right Angle	1	0	0	0	1
Same Direction - Side Swipe	0	1	0	0	1
Fixed Object	3	0	0	0	3
Head On/Angular	0	0	0	0	0
Left Turn	0	0	0	0	0
Pedalcyclist	0	0	0	0	0
Other	0	0	0	0	0
Animal	0	0	0	0	0
Backing	0	0	0	0	0
Opposite Direction - Side Swipe	1	0	0	0	1
Pedestrian	0	0	0	0	0

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**TABLE 1: Summary of Corridor Crash Statistics**

<b>Total Crashes</b>		192
<b>Severity</b>	Fatal	0
	Injury	49
	Property Damage Only	143
<b>Crash Type</b>	Animal	6
	Backing	2
	Fixed Object	18
	Left Turn / U Turn	6
	Opposite Direction - Head On	7
	Opposite Direction - Side Swipe	1
	Other	2
	Overturned	1
	Pedacyclist	3
	Pedestrian	1
	Right Angle	38
	Same Direction - Rear End	76
	Same Direction - Side Swipe	30
	Struck Parked Vehicle	1
<b>Time of Day</b>	12:00 AM – 6:00 AM	2
	6:00 AM – 9:00 AM	32
	9:00 AM – 12:00 PM	32
	12:00 PM – 3:00 PM	35
	3:00 PM – 6:00 PM	56
	6:00 PM – 9:00 PM	28
	9:00 PM – 12:00 AM	9
<b>Surface Condition</b>	Dry	158
	Icy	2
	Snowy	4
	Slush	1
	Wet	18
	Unknown	9

## EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY ALTERNATIVES ANALYSIS REPORT

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**TABLE 2: Comparison of Study Area to Statewide Average**

Crash Type	Average Crash Percentage for Study Period	2010 Average for County Roadways
Rear End	41.79%	32.45%
Right Angle	22.39%	18.77%
Same Direction - Side Swipe	15.67%	11.70%
Fixed Object	5.97%	11.33%
Head On/Angular	4.48%	3.31%
Left Turn	2.99%	4.65%
Pedacyclist	2.24%	0.97%
Other	1.49%	0.76%
Animal	0.75%	4.73%
Backing	0.75%	2.28%
Opposite Direction - Side Swipe	0.75%	N/A
Pedestrian	0.75%	1.91%

The intersections with Martin Luther King Avenue/Horse Hill Road and Ridgedale Avenue operate under a split-phased timing plan, with no left-turn lanes on the East Hanover Avenue approaches. These configurations were implemented to reduce the number of right-angle crashes associated with the left-turns; however, the lack of left-turn lanes may have contributed to the high percentage of rear-end crashes. Installing left-turn lanes may reduce the number of rear-end crashes by removing vehicles waiting to make a left turn from the through lanes. The addition of right-turn lanes may also assist in reducing the number of rear-end crashes.

The remaining study area intersections experienced less than fifteen total crashes during the study period, and no major factors were identified for improvement.

### Right-Angle Crashes

A further examination of the crash data indicated that a large percentage of the right-angle crashes were occurring at driveways along the Corridor. Of the 38 right-angle crashes reported on the Corridor during the analysis period, 23 were associated with vehicles entering or exiting driveways. The number of right-angle driveway crashes was particularly high near Speedwell Avenue, where there were ten reported at the Lukoil driveway, four reported at the ACME driveway, one reported at the CITGO driveway, and one reported at the St. Virgil's driveway. These crashes may be attributed to the congestion around the intersection, which may result in drivers becoming impatient and taking more risk to enter or exit these locations. Because of the proximity of the driveways to the intersection, drivers may not be able to see vehicles that are turning onto East Hanover Avenue from Speedwell Avenue. Therefore, implementing access



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controls around signalized intersections, to ensure a minimum distance from the intersection, may help to reduce the number of right-angle crashes associated with the driveways.

**2.3 CULTURAL RESOURCES**

In addition to providing a commuter route to NJ 24, the Corridor provides access to several important cultural resources; the Mennen Arena, Patriot's Path, Morris County Library, and Frelinghuysen Arboretum, which are all County-owned facilities. The Mennen Sports Arena is a full service ice center with three rinks. It hosts a variety of ice activities, such as hockey games, public skating, and skating lessons. In addition, it also hosts non-ice events, such as the Annual Shrine Circus, craft shows, and antique fairs, among other events. Peak operational times for the arena are weekends and weekday evenings. Although located within one-half mile of several residential areas, the facility currently has no pedestrian or bicycle connection.

Patriot's Path is a developing network of trails and open spaces that connects several dozen Federal, State, County, and municipal parks, watersheds, and other points of interest in the County. The Path provides connections to the Lenape Trail in Essex County, Allamuchy Mountain State Park in Sussex County, and the Village of High Bridge in Hunterdon County. The trail system supports hiking, biking, and equestrian uses, and is paved in some areas. The Path enters the study area just west of the I-287 overpass; however, there is no direct crossing over East Hanover Avenue. Path users are instructed to travel approximately 1,300 feet south to the signalized intersection of East Hanover Avenue and the Library driveway to cross East Hanover Avenue, and then return 1,300 feet back to the trail, which results in a total trip diversion of approximately 2,600 feet.

In 2011, approximately 262,000 people visited the Morris County Library, located east of the I-287 overpass. The library offers a variety of media, including books, CDs and tapes, movies, audiobooks, and records. Other services include educational classes, book clubs, certified proctors, notary services, public meeting spaces, and special events and exhibits. Peak operational times for the Library occur during evenings and weekends.

Opposite the Morris County Library is the Frelinghuysen Arboretum, a 127-acre property consisting of an educational center, woodlands, meadows, and gardens linked by trails. A segment of the Patriot's Path traverses the park. The Arboretum is open daily from 9:00 AM to dusk. Peak visiting times occur on weekends and holidays; however, there are a significant number of visitors during the weekday afternoons and evenings from spring through fall.

The above County cultural resources are significant recreation and educational facilities in the region. Therefore, this study will include an evaluation of methods to enhance the connectivity to these resources for vehicles, pedestrians, and bicyclists. Particular attention should be given to connecting Patriot's Path, the Library, and the Arboretum to the residential areas north of Ridgedale Avenue, as well as Mennen Arena. Providing improved pedestrian and bicycle

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connections would enhance the access and usability of these resources, particularly Patriot's Path and the trail network within the Arboretum.

## 2.4 CAPACITY ANALYSIS METHODOLOGY

Capacity analysis, a procedure used to estimate the traffic-carrying ability of roadway facilities over a range of defined operating conditions, was performed using Synchro 7/SimTraffic simulation models, which are based on the methodology of the *2000 Highway Capacity Manual (HCM)* to establish average volume to capacity (V/C) ratios, delays and Level of Service (LOS) for each intersection. Roadway geometry, signal timing, and traffic data were entered into the model. The model was then validated/calibrated using the travel time runs. The results of the calibration are shown in **EXHIBIT 6**.

The V/C ratio relates the demand at a particular intersection (traffic volume) to the available capacity. The available capacity for each movement varies depending on number of lanes, lane width, perception/reaction time, green time, and cycle length, among others. A V/C ratio of 1.0 means that the demand for a particular movement is equal to the capacity. A movement with a V/C ratio at or over 1.0 is considered undesirable because the movement volume exceeds the capacity, which results in queuing, indicating unmet demand along that approach. Even though Synchro is based on the *2000 HCM*, Stantec manually incorporated recommendations from the *2010 HCM*, which states that any movement with a V/C ratio over 1.0 should automatically receive an LOS F.

LOS is an evaluation of the quality of operation of an intersection and is a measure of the average delay a driver experiences while traveling through the intersection. LOS is dependent on a range of defined operating conditions such as traffic demand, lane geometry, and traffic signal timing and phasing.

LOS can range from A to F and is based on the average control delay per vehicle in seconds. For a signalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 80 seconds per vehicle. For an unsignalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 50 seconds per vehicle. The *2000 HCM* delay criteria for signalized and unsignalized intersections are summarized in **TABLE 3**.

**EXHIBIT 6**

Sim Traffic Model Calibration

Project: East Hanover Corridor Study, Morris County

Client: NJDOT

**AM Peak Hour Summary  
EB East Hanover Avenue**

Link	Travel Time (sec)	Delay (sec)	Total Time (sec)	Model Time (sec)	%Diff
Speedwell Ave to The American Rd	37.8	0.0	37.8	34.9	-8%
The American Rd to Horse Hill Rd	61.8	19.0	80.8	83.3	3%
Horse Hill Rd to Monroe St	40.0	0.0	40.0	45.0	12%
Monroe St to Ridgedale Ave	45.5	17.0	62.5	63.2	1%
Ridgedale Ave to Library	57.5	23.5	81.0	82.8	2%
Library to Whippany Rd	64.8	146.5	211.3	254.3	18%

**PM Peak Hour Summary  
EB East Hanover Avenue**

Link	Travel Time (sec)	Delay (sec)	Total Time (sec)	Model Time (sec)	%Diff
Speedwell Ave to The American Rd	57.0	0.0	57.0	55.5	-3%
The American Rd to Horse Hill Rd	58.0	49.8	107.8	97.7	-10%
Horse Hill Rd to Monroe St	30.0	0.0	30.0	32.6	8%
Monroe St to Ridgedale Ave	26.0	62.0	88.0	80.7	-9%
Ridgedale Ave to Library	48.8	0.0	48.8	56	14%
Library to Whippany Rd	39.8	52.3	92.1	108.5	16%

**AM Peak Hour Summary  
WB East Hanover Avenue**

Link	Travel Time (sec)	Delay (sec)	Total Time (sec)	Model Time (sec)	%Diff
Whippany Rd to Library	35.3	0.0	35.3	37.3	6%
Library to Ridgedale Ave	50.8	78.0	128.8	127.1	-1%
Ridgedale Ave to Monroe St	20.5	0.0	20.5	19.7	-4%
Monroe St to Horse Hill Rd	34.0	59.5	93.5	84.3	-10%
Horse Hill Rd to The American Rd	65.3	0.0	65.3	62.0	-5%
The American Rd to Speedwell Ave	37.8	43.8	81.5	94.4	15%

**PM Peak Hour Summary  
WB East Hanover Avenue**

Link	Travel Time (sec)	Delay (sec)	Total Time (sec)	Model Time (sec)	%Diff
Whippany Rd to Library	40.3	0.0	40.3	36.3	-10%
Library to Ridgedale Ave	56.0	70.5	126.5	114.8	-10%
Ridgedale Ave to Monroe St	20.0	0.0	20.0	22.2	10%
Monroe St to Horse Hill Rd	51.8	40.5	92.3	85.3	-8%
Horse Hill Rd to The American Rd	52.0	43.3	95.3	93.3	-2%
The American Rd to Speedwell Ave	33.0	347.3	380.3	406	7%

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<b>TABLE 3: LOS Criteria for Signalized and Unsignalized Intersections</b>		
<b>Level of Service</b>	<b>Average Control Delay (seconds/vehicle)</b>	
	<b>Signalized</b>	<b>Unsignalized</b>
A	Less than or equal to 10.0	Less than or equal to 10.0
B	>10.0 and ≤ 20.0	>10.0 and ≤ 15.0
C	>20.0 and ≤ 35.0	>15.0 and ≤ 25.0
D	>35.0 and ≤ 55.0	>25.0 and ≤ 35.0
E	>55.0 and ≤ 80.0	>35.0 and ≤ 50.0
F	Greater than 80.0 or V/C greater than 1.0*	Greater than 50.0 or V/C greater than 1.0*
Source: 2000 Highway Capacity Manual *2010 Highway Capacity Manual Standard		

All Synchro 7 output files are included in **APPENDIX D**.

## 2.5 2011 EXISTING CONDITION CAPACITY ANALYSIS RESULTS

The results of the 2011 Existing Condition capacity analysis are shown in **EXHIBIT 7**.

### East Hanover Avenue and Speedwell Avenue (US 202)

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better, except:

- The eastbound (EB) left-turn movement operates at LOS F in both the AM and PM peak hours;
- The EB through movement operates at LOS F in the AM peak hour;
- The westbound (WB) left-turn movement operates at LOS E and F in the AM and PM peak hours, respectively;
- The WB through and WB right-turn movements operate at LOS F in the PM peak hour;
- The northbound (NB) through movement operates at LOS F in the AM peak hour;
- The NB right-turn movement operates at LOS F in the AM peak hour; and,
- The southbound (SB) left-turn movement operates at LOS F and E in the AM and PM peak hours, respectively.

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East Hanover Avenue and The American Road

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better.

East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better, except:

- The WB left and through movements operate at LOS E during the AM peak hour;
- The WB right-turn movement operates at LOS F during the AM peak hour;
- The NB left and through movements operate at LOS F during the AM peak hour; and,
- The NB right-turn movement operates at LOS E in the AM peak hour.

East Hanover Avenue and Monroe Street

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better, except:

- The NB left-turn movement operates at LOS F during the AM peak hour.

East Hanover Avenue and Ridgedale Avenue

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better, except:

- All EB movements operate at LOS E in the AM peak hour;
- The WB left-turn movement operates at LOS E in the AM peak hour;
- The NB through movement operates at LOS E during the PM peak hour;
- The SB left-turn movement operates at LOS F in the PM peak hour; and,
- The SB through movement operates at LOS F in both the AM and PM peak hour.

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East Hanover Avenue and Morris County Library Driveway

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better, except:

- The EB through movement operates at LOS F during the AM peak hour.

East Hanover Avenue and Whippany Road

Based on the analysis results, all lane groups at the study intersection operate at LOS D or better, except:

- The EB through and right-turn movements operates at LOS F in both the AM and PM peak hour.

**2.6 2011 EXISTING CONDITION QUEUING ANALYSIS RESULTS**

SimTraffic was utilized to measure queuing along the Corridor (**EXHIBIT 8**). Based on the results of the queuing analysis, several areas along the Corridor were identified as experiencing significant queuing during the AM and PM peak hours (average queue > 1,000 feet). These areas include:

East Hanover Avenue and Speedwell Avenue (US 202)

- The eastbound approach experiences an average queue of approximately 3,000 feet during the AM peak hour.
- The westbound approach experiences an average queue exceeding 1,700 feet during the PM peak hour.
- The northbound approach experiences an average queue exceeding 1,200 feet during the AM peak hour.
- The southbound approach experiences an average queue of approximately 1,000 feet during the AM peak hour.

East Hanover Avenue and The American Road

Queuing along the westbound and southbound approaches is experienced during the PM peak hour. However, these queues are a result of the queuing that extends from the intersection of East Hanover Avenue and Speedwell Avenue. Therefore, the total length of the queue from Speedwell Avenue is shown in the East Hanover Avenue and Speedwell Avenue intersection analysis. Therefore, to reduce redundancy, queuing at this intersection will not be discussed separately in the remainder of the queue analyses presented in this report.

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East Hanover Avenue and Whippany Road

- The eastbound approach experiences an average queue of approximately 2,100 feet during the AM peak hour.

## **2.7 SUMMARY OF EXISTING NEEDS**

Based on the site evaluations, capacity analysis, and queuing analysis, several needs were identified. The needs include:

- Reducing queuing at the intersection of East Hanover Avenue and Speedwell Avenue, as well as East Hanover Avenue and Whippany Road;
- Improving traffic operations at all study area intersections to a minimum LOS D;
- Eliminating the split-phased signal operations at the intersections of East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road, and East Hanover Avenue and Ridgedale Avenue;
- Reducing the number of driveways that are close to signalized intersections;
- Improving safety along the Corridor by providing pedestrian and bicycle facilities.
- Improving safety along the Corridor by separating turning movements at signalized and unsignalized intersections to reduce stopping in through lanes.
- Improving existing pedestrian facilities to provide a continuous pedestrian route along the Corridor; and,
- Providing pedestrian and bicycle connections to existing cultural resources.

## EXHIBIT 7

2011 Existing, 2015 No Build, 2035 No Build LOS Table  
CAPACITY ANALYSIS RESULTS

		2011 Existing						2015 No Build						2035 No Build					
Intersection	LANE GROUP	AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak		
		V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service
East Hanover Ave & US 202 Signalized	EB-L	0.70	354.3	F	0.56	88.2	F	0.88	316.1	F	0.60	90.5	F	1.06	381.2	F	0.66	231.9	F
	EB-T	0.89	82.2	F	0.41	25.9	C	1.08	87.6	F	0.49	25.9	C	1.20	84.9	F	0.60	39.0	D
	EB-R	0.89	51.1	D	0.41	1.8	A	1.08	53.5	F	0.49	2.7	A	1.20	41.4	F	0.60	11.8	B
	WB-L	0.49	60.5	E	0.45	109.5	F	0.58	120.1	F	0.60	156.5	F	0.64	146.1	F	0.83	168.3	F
	WB-T	0.61	43.8	D	1.00	131.0	F	0.71	55.7	E	1.21	158.4	F	0.80	75.4	E	1.46	167.0	F
	WB-R	0.61	23.1	C	1.00	146.2	F	0.71	27.9	C	1.21	161.1	F	0.80	41.0	D	1.46	216.1	F
	NB-L	0.18	33.0	C	0.57	28.4	C	0.21	36.7	D	0.69	43.7	D	0.26	38.5	D	0.88	47.5	D
	NB-T	0.78	98.6	F	0.72	26.1	C	0.91	110.3	F	0.80	57.8	E	1.02	108.3	F	0.92	75.1	E
	NB-R	0.78	95.6	F	0.72	22.1	C	0.91	110.4	F	0.80	53.5	D	1.02	108.0	F	0.92	68.5	E
	SB-L	0.87	118.7	F	0.79	55.8	E	1.08	175.5	F	1.12	405.6	F	1.22	186.2	F	1.33	390.8	F
	SB-T	0.56	25.4	C	0.71	30.4	C	0.61	41.9	D	0.77	65.0	E	0.68	38.6	D	0.85	70.0	E
	SB-R	0.56	21.7	C	0.71	29.6	C	0.61	37.7	D	0.77	63.8	E	0.68	34.9	C	0.85	72.5	E
Intersection	-	82.5	F	-	67.8	E	-	96.1	F	-	110.0	F	-	104.6	F	-	124.9	F	
East Hanover Ave & The American Rd Signalized	EB-L	0.32	4.6	A	0.18	10.7	B	0.42	5.8	A	0.27	9.5	A	0.48	6.2	A	0.31	10.5	B
	EB-T	0.41	0.1	A	0.20	0.0	A	0.48	0.0	A	0.24	0.0	A	0.54	0.0	A	0.30	0.0	A
	WB-T	0.57	1.8	A	0.65	20.3	C	0.65	2.7	A	0.77	57.0	E	0.69	3.0	A	0.92	74.4	E
	WB-R	0.15	0.0	A	0.04	2.2	A	0.18	0.0	A	0.06	6.5	A	0.20	0.0	A	0.06	13.2	B
	SB-L	0.09	17.2	B	0.51	45.4	D	0.14	17.9	B	0.62	277.6	F	0.16	17.3	B	0.78	320.9	F
	SB-R	0.02	0.0	A	0.11	50.8	D	0.03	0.0	A	0.14	384.6	F	0.04	0.0	A	0.16	325.4	F
	Intersection	-	1.2	A	-	17.9	B	-	1.7	A	-	63.4	E	-	1.8	A	-	75.0	E
East Hanover Ave & Horse Hill Rd/MLK Ave Signalized	EB-L	0.92	20.9	C	0.87	29.1	C	0.71	19.5	B	0.79	37.2	D	0.71	22.0	C	0.71	25.9	C
	EB-T	0.92	20.9	C	0.87	29.7	C	0.79	19.8	B	0.56	18.8	B	0.83	21.8	C	0.72	22.7	C
	EB-R	0.92	21.7	C	0.87	27.4	C	0.79	19.8	B	0.56	18.8	B	0.83	21.8	C	0.72	22.7	C
	WB-L	0.95	70.3	E	0.91	37.1	D	0.29	11.0	B	0.44	12.8	B	0.27	9.0	A	0.49	13.9	B
	WB-T	0.95	74.4	E	0.91	38.7	D	0.59	20.1	C	0.93	38.1	D	0.68	23.0	C	1.23	136.1	F
	WB-R	0.95	84.1	F	0.91	37.6	D	0.59	20.1	C	0.93	38.1	D	0.68	23.0	C	1.23	136.1	F
	NB-L	0.66	101.1	F	0.48	37.6	D	0.65	40.0	D	0.43	29.7	C	0.68	39.5	D	0.64	46.7	D
	NB-T	0.83	84.3	F	0.47	29.5	C	0.75	37.2	D	0.33	18.7	B	0.76	35.5	D	0.38	21.5	C
	NB-R	0.83	77.2	E	0.47	17.3	B	0.75	37.2	D	0.33	18.7	B	0.76	35.5	D	0.38	21.5	C
	SB-L	0.41	47.8	D	0.70	41.8	D	0.64	42.9	D	0.90	52.8	D	0.65	41.8	D	1.07	97.1	F
	SB-T	0.41	45.0	D	0.70	38.5	D	0.64	42.9	D	0.90	52.8	D	0.65	41.8	D	1.07	97.1	F
	SB-R	0.39	5.3	A	0.48	9.5	A	0.37	7.0	A	0.39	8.2	A	0.38	6.2	A	0.44	5.2	A
Intersection	-	47.7	D	-	32.2	C	-	22.7	C	-	30.4	C	-	24.1	C	-	72.6	E	
East Hanover Ave & Monroe St Unsignalized	EB-T	0.51	0.0	A	0.28	0	A	0.56	0.5	A	0.36	22.3	C	0.63	3.1	A	0.43	25	C
	EB-R	0.25	0.0	A	0.14	0.0	A	0.28	0.2	A	0.18	0.1	A	0.32	0.0	A	0.22	34.5	D
	WB-L	0.05	8.1	A	0.10	9.4	A	0.05	9.4	A	0.13	81.5	F	0.07	18.2	C	0.16	94.5	F
	WB-TR	0.32	0.0	A	0.44	0.0	A	0.38	0.5	A	0.58	13.1	B	0.42	1.0	A	0.69	15.5	C
	NB-L	0.29	64.8	F	0.11	16.9	C	0.22	**	F	0.12	**	F	0.31	**	F	0.19	**	F
	NB-R	0.29	29.4	D	0.11	9.1	A	0.22	**	F	0.12	**	F	0.31	**	F	0.19	**	F
	Intersection	-	2.8	A	-	1.2	A	-	1.7	A	-	42.8	E	-	16.8	C	-	59.3	F
East Hanover Ave & Ridgedale Ave Signalized	EB-L	0.98	61.0	E	0.87	48.3	D	1.14	97.1	F	1.11	148.9	F	1.26	149.7	F	1.31	139.8	F
	EB-T	0.98	67.8	E	0.87	47.4	D	1.14	115.9	F	1.11	133.7	F	1.26	128.4	F	1.31	146.3	F
	EB-R	0.98	74.7	E	0.87	54.6	D	1.14	109.9	F	1.11	174.9	F	1.26	150.6	F	1.31	155.5	F
	WB-L	0.88	57.5	E	0.83	33.1	C	1.06	202.9	F	1.06	128.4	F	1.18	289.8	F	1.23	131.1	F
	WB-T	0.88	54.8	D	0.83	31.3	C	1.06	200.2	F	1.06	129.5	F	1.18	284.0	F	1.23	132.4	F
	WB-R	0.03	1.0	A	0.06	2.3	A	0.03	101.6	F	0.07	74.0	E	0.04	158.6	F	0.08	80.2	F
	NB-L	0.90	46.7	D	0.79	50.9	D	1.06	117.3	F	1.04	141.5	F	1.19	128.9	F	1.13	155.6	F
	NB-T	0.53	33.7	C	0.82	57.5	E	0.61	48.4	D	0.98	99.4	F	0.85	73.7	E	1.05	102.0	F
	NB-R	0.53	31.7	C	0.82	54.7	D	0.61	38.7	D	0.98	97.8	F	0.85	70.1	E	1.05	97.8	F
	SB-L	0.35	45.6	D	0.59	89.5	F	0.43	105.1	F	0.69	154.1	F	0.54	116.5	F	0.72	145.9	F
	SB-T	0.85	132.9	F	1.00	181.5	F	0.96	224.7	F	1.26	272.8	F	1.05	225.2	F	1.34	261.0	F
	SB-R	0.26	4.2	A	0.43	17.3	B	0.28	7.9	A	0.47	40.7	D	0.31	12.7	B	0.52	40.9	D
Intersection	-	60.3	E	-	54.7	D	-	129.3	F	-	135.4	F	-	157.4	F	-	137.7	F	
East Hanover Ave & Library Driveway Signalized	EB-L	0.38	53.7	D	0.38	14.0	B	0.47	90.6	F	0.48	24.7	C	0.52	117.8	F	0.99	25.0	C
	EB-T	0.38	87.5	F	0.38	3.4	A	0.47	125.4	F	0.48	5.9	A	0.52	124.4	F	0.99	8.1	A
	WB-T	0.18	0.3	A	0.47	3.7	A	0.22	0.1	A	0.55	23.9	C	0.24	0.2	A	0.56	99.8	F
	WB-R	0.18	0.0	A	0.47	5.3	A	0.22	0.2	A	0.55	14.6	B	0.24	0.0	A	0.56	101.6	F
	SB-L	0.01	0.0	A	0.12	9.2	A	0.01	2.9	A	0.14	9.4	A	0.01	4.7	A	0.27	8.1	A
	SB-R	0.03	3.5	A	0.19	5.4	A	0.03	2.9	A	0.22	8.6	A	0.04	4.7	A	0.39	12.3	B
	Intersection	-	55.4	E	-	4.1	A	-	77.1	E	-	17.1	B	-	73.8	E	-	63.1	E
East Hanover Ave & Whippany Rd Signalized	EB-L	0.36	26.3	C	0.35	46.6	D	0.55	22.9	C	0.41	30.8	C	0.60	29.9	C	0.46	32.4	C
	EB-T	0.99	142.3	F	0.88	111.6	F	1.12	109.0	F	0.96	58.0	E	1.25	119.1	F	1.10	65.9	F
	EB-R	0.99	115.8	F	0.88	91.5	F	1.12	97.9	F	0.96	30.6	C	1.25	110.7	F	1.10	40.9	F
	NB-L	0.27	50.8	D	0.72	46.3	D	0.34	50.1	D	0.77	44.3	D	0.38	46.8	D	0.81	48.2	D
	NB-T	0.24	28.6	C	0.19	15.8	B	0.36	29.3	C	0.29	21.0	C	0.39	29.3	C	0.34	21.8	C
	NB-R	0.09	30.5	C	0.05	20.7	C	0.09	27.9	C	0.07	23.1	C	0.11	30.5	C	0.09	22.9	C
	SB-L	0.75	52.1	D	0.66	47.7	D	0.81	64.2	E	0.77	48.2	D	0.87	85.5	F	0.79	46.2	D
	SB-T	0.32	21.5	C	0.22	18.4	B	0.36	22.4	C	0.33	22.9	C	0.40	24.0	C	0.39	26.9	C
	SB-R	0.38	0.0	A	0.56	0.0	A	0.45	0.0	A	0.70	1.2	A	0.50	0.0	A	0.81	16.4	B
Intersection	-	47.5	D	-	42.4	D	-	44.9	D	-	24.1	C	-	49.1	D	-	32.1	C	
East Hanover Ave & Big Box Driveway Signalized	EB-L							0.07	3.1	A	0.11	67.9	E	0.06	6.7	A	0.11	138.0	F
	EB-T							0.47	0.9	A	0.31	100.9	F						



**EXHIBIT 8**
**QUEUEING RESULTS**

2011 Existing, 2015 No Build, 2035 No Build

Intersection	Approach	Existing				2015 No Build				2035 No Build			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
		Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue
<b>East Hanover Ave &amp; US 202</b> <i>Signalized</i>	<b>EB</b>	2,992	ESA	137	257	3,621	ESA	140	233	3,672	ESA	1,487	2,416
	<b>WB*</b>	222	336	1,413	2,343	329	499	1,813	2,327	438	712	1,879	2,379
	<b>NB</b>	1,255	2,055	274	451	1,648	2,061	689	1,334	1,752	2,140	1,520	1,824
	<b>SB</b>	1,000	2,560	273	437	1,939	ESA	1,826	2,510	2,859	ESA	1,845	2,583
<b>East Hanover Ave &amp; The American Rd</b> <i>Signalized</i>	<b>EB-L</b>	40	81	32	69	50	94	32	75	47	88	20	58
	<b>WB*</b>	53	132	312	1,090	63	122	654	1,485	67	130	1,004	1,748
	<b>SB</b>	28	59	205	754	36	65	891	1,800	35	74	1,061	1,821
<b>East Hanover Ave &amp; Horse Hill Rd/MLK Ave</b> <i>Signalized</i>	<b>EB</b>	295	495	242	363	158	260	133	227	134	229	145	248
	<b>WB</b>	360	555	351	554	165	271	236	314	163	264	234	338
	<b>NB</b>	387	755	82	147	480	910	88	164	377	715	89	167
	<b>SB</b>	59	117	119	208	91	198	867	1,811	89	169	1,891	2,682
<b>East Hanover Ave &amp; Ridgedale Ave</b> <i>Signalized</i>	<b>EB</b>	590	903	276	409	405	481	407	424	408	474	407	425
	<b>WB</b>	207	306	298	440	765	1,433	1,932	2,892	1,543	2,422	2,508	3,114
	<b>NB</b>	194	292	232	451	627	1,019	833	1,161	876	1,171	906	1,231
	<b>SB</b>	292	591	652	1,269	575	1,087	1,195	1,531	701	1,316	1,221	1,480
<b>East Hanover Ave &amp; Library Driveway</b> <i>Signalized</i>	<b>EB**</b>	534	1,439	78	152	786	1,739	98	181	836	2,033	556	1,089
	<b>WB</b>	9	49	111	209	9	39	325	1,221	7	40	1,318	2,750
	<b>SB</b>	5	22	27	60	7	27	35	71	5	23	51	106
<b>East Hanover Ave &amp; Whippany Rd</b> <i>Signalized</i>	<b>EB**</b>	1,684	2,410	425	715	1,707	2,392	393	617	1,726	2,378	407	616
	<b>NB</b>	45	87	127	212	61	112	140	233	69	113	183	291
	<b>SB</b>	123	199	78	142	132	263	128	300	198	390	538	1,421
<b>East Hanover Ave &amp; Big Box Driveway</b> <i>Signalized</i>	<b>EB</b>					39	133	441	944	104	261	628	1,258
	<b>WB</b>					37	100	75	134	48	116	73	138
	<b>SB</b>					14	41	34	94	16	43	39	92

Approach queues represent the highest queue of all the movements for that approach.

Source: SimTraffic

ESA - Exceeds Study Area (&gt;4,000) Adjacent intersections that are not included in the study area may affect arrivals and queuing.

\* WB PM Queue from Speedwell Ave intersection extends past The American Road

\*\* EB AM Queue from Whippany Road intersection extends past Library Driveway

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### **3.0 2015 AND 2035 NO BUILD CONDITIONS**

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#### **3.1 FUTURE NO BUILD CONDITION TRAFFIC VOLUMES**

##### **3.1.1 Background Traffic Growth**

It was assumed that the anticipated completion year for the majority of the planned redevelopment sites would be 2015. Therefore, a future design year of 2035 (site development completion + 20 years) was selected to analyze the long-term impacts of any proposed improvements to the corridor. North Jersey Transportation Planning Authority (NJTPA) population and employment growth forecasts for Morris County, Morris Plains Borough, Morris Township, and Hanover Township were used to develop background growth rates (**EXHIBIT 9**). Based on these forecasts, the following annual growth rates were utilized as components to developing 2015 and 2035 traffic volumes:

- 2011 – 2015: 2.0% per year, or 8% over 4 years.
- 2015 – 2035: 0.50% per year, or 10% over 20 years.

##### **3.1.2 Office and Retail Vacancies**

An assessment of traffic volumes between 2008, the beginning of the economic downturn, and 2011, the date of data collection, was conducted in order to evaluate the impact of local office and retail vacancies on the study area roadway network. Morris County supplied ATR data collected in 2008 for East Hanover Avenue between Whippany Road and the County Library Driveway, which showed an ADT of 19,737. An ATR at the same location in 2011 recorded an ADT of 21,200. While there is not a direct correlation between traffic volumes on the Corridor and the activity at retail and office sites along the Corridor, it provides a good indicator of the impacts of the economic downturn within the study area.

Based on the ATR data, it was assumed that activity along the corridor remained relatively consistent. In addition, Hanover Township approved a site plan for a new office/warehouse building on The American Road, which indicates a healthier office market in the area. Therefore, it was assumed that the background growth rates would be adequate to account for any additional infill of existing office or retail space that may occur in the future.

##### **3.1.3 Site-Specific Developments**

Several redevelopment projects are anticipated for parcels along, or near, the Corridor. These projects have the potential to generate additional traffic and pedestrian volume that could influence operations along the roadway. Based on meetings held with County and Municipal

**EXHIBIT 9**  
**POPULATION AND EMPLOYMENT FORECASTS**  
**2010 to 2035**

County / Municipality	POPULATION			EMPLOYMENT		
	2010	2035	Annual Growth Rate 2010-2035	2010	2035	Annual Growth Rate 2010-2035
<b>Morris County:</b>						
Hanover Township	13,710	14,430	0.20%	33,480	35,150	0.19%
Morris Township	22,310	22,420	0.02%	13,580	13,690	0.03%
Morris Plains Borough	5,530	5,880	0.25%	8,760	8,780	0.01%
<b>AREA TOTAL</b>	<b>41,550</b>	<b>42,730</b>	<b>0.11%</b>	<b>55,820</b>	<b>57,620</b>	<b>0.13%</b>
Morris County, NJ	492,280	523,500	0.25%	309,520	364,300	0.65%

**Recommended Background Growth Rates: 0.50%**

Source: NJTPA Population and Employment Growth Forecasts

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representatives, several potential redevelopment projects were identified that incorporate residential, warehouse, office, and retail uses (**TABLE 4**).

**TABLE 4** shows the approved and anticipated redevelopment projects that could affect the study area. Information was obtained from County and Municipal representatives as to the land use, size, and time frame for each site. A traffic study for the proposed ShopRite shopping center was obtained from Morris County and used to provide trip generation and distribution information for the center. The Institute of Transportation Engineers (ITE) *Trip Generation Manual* (8<sup>th</sup> Edition) was utilized to generate trips for the remaining sites listed. It should be noted that the proposed redevelopment of the former Alcatel-Lucent (aka Bell Labs) site as the North American Headquarters for Bayer Corporation is located approximately two miles north of the intersection of East Hanover Avenue and Whippany Road. Given its size, it is anticipated that a portion of the trips generated by Bayer would pass through the study area. Based on existing travel patterns in the region, an estimated 25% of the trips generated were applied to the Corridor.

The majority of the sites in **TABLE 4** are approved; however, two sites, marked with an asterisk (\*) are anticipated, but did not have a current proposal for review by the municipal or County planning boards. One of the sites, located across from Mennen Arena is currently undergoing environmental remediation, but does not have a proposed redevelopment plan. Based on the types of potential uses that could occur on the site, a 100,000 SF shopping center was assumed because it would generate the highest peak hour traffic volume of all the potential land use types. The second site, located on the northwest corner of the intersection of East Hanover Avenue and Ridgedale Avenue, was slated for a home improvement warehouse in previous applications. Based on discussions with representatives for Hanover Township, it was determined that a future home improvement warehouse should be assumed for the parcel in this analysis.

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**TABLE 4: Approved and Anticipated Developments Impacting Study Area**

Location	Description	Status	Time Frame
The American Road	60 Condominium/Townhouse Units	Approved	2015
The American Road	20,790 SF Office and 48,510 SF Warehouse	Approved	2015
East Hanover Avenue – Across from Mennen Arena	100,000 SF Shopping Center*	Site Under Remediation	2035
East Hanover Avenue – Northwest Corner of Horse Hill Road	90,000 SF Shopping Center with ShopRite	Approved	2015
Horse Hill Road	78 Residential Condominium /Townhouse Units	Approved	2015
East Hanover Avenue – Northeast Corner of Horse Hill Road	20,000 SF Office	Approved	2015
East Hanover Avenue – Northwest Corner of Ridgedale Avenue	125,000 SF Home Improvement Store*	Anticipated	2015
Whippany Road	Bayer Corp. Redevelopment (2,000 Employees)	Approved	2015

\*Land use type assumed based on information provided by Hanover Township.

### 3.1.4 Site-Specific Improvements

Based on the traffic impact study for the proposed ShopRite shopping center, the developer of the site is planning to contribute to several improvements along East Hanover Avenue. The improvements include providing left-turn lanes at each of the driveways along East Hanover Avenue. Left-turn lanes would also be added to the eastbound and westbound East Hanover Avenue approaches to the intersection of Martin Luther King Avenue/Horse Hill Road, eliminating the need for split-phase timing. These proposed improvements were included in the No Build condition analyses at the intersection of East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road.

Morris County provided Stantec with information on a proposal to create a new signalized intersection just west of Monroe Street. The driveway would serve both the County garage and the proposed big box/home improvement warehouse site on the northwest corner of East Hanover Avenue and Ridgedale Avenue. A left-turn lane would be provided along eastbound East Hanover Avenue into the site. Assumptions were made as to the exact configuration of the intersection, which was added into the No Build condition analyses.

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### 3.1.5 Trip Generation and Distribution

Trip generation and distribution for the proposed ShopRite shopping center was obtained from the traffic impact study provided by the developer. The ITE *Trip Generation Manual* (8<sup>th</sup> Edition) was used to estimate the number of trips that would be generated by the proposed developments that did not have traffic impact studies (**EXHIBIT 10**). Trips were then distributed based on existing and anticipated travel patterns. In addition, assumptions were made as to the location of the access points for the proposed developments located on East Hanover Avenue. The trip distribution diagrams are contained in **APPENDIX C**.

### 3.1.6 Pedestrian and Bicycle Trip Generation

The Corridor currently experiences minimal pedestrian and bicycle traffic during the AM and PM peak hours; however, increased bicycle and pedestrian activity has been reported during off-peak hours, particularly on weekends. It is anticipated that the addition of retail sites along the Corridor will increase pedestrian and bicycle activity along the Corridor, particularly between the retail sites and the adjacent residential neighborhoods. However, predicting the increase in pedestrian and bicycle trip generation is difficult because there is limited pedestrian trip generation data available, especially for suburban communities.

The Federal Highway Administration (FHWA) released a report in 1994 compiling pedestrian and trip generation data from a variety of studies. The majority of the studies were conducted in urban areas where pedestrian activity is typically high, and each of the studies show slightly different results. Two studies were identified that contained data on suburban areas. One study, conducted by Kagan, Scott, and Avin (1978), collected data at 215 sites around the country, and developed a trip generation rate for various land uses. That study predicted a pedestrian trip generation rate for a neighborhood shopping center of ten to fifteen pedestrians per hour per 1,000 square feet. The study also predicts less than five pedestrians per hour per 1,000 square feet for an office building. Another study, conducted by Comsis Corporation in 1993, estimated that pedestrian trips in suburban areas with access to rail transit would make up 6% of the total trips generated by a retail site, and 4.5% of commuting trips generated by an office site. The study also provides an estimated mode share for bikes for the same retail and commuting trips of 0.2% for both uses.

Using this data, an estimate of pedestrian trip generation for the proposed office and retail redevelopment sites was calculated. **TABLE 5** shows that the Kagan, Scott, and Avin study predicts a very high pedestrian trip generation rate for each of the land uses. This may be indicative of data collection for the study performed in more-dense suburban areas. The Comsis study seems to provide a more realistic estimate of pedestrian trip generation for the study area. Therefore, the Comsis estimates will be used in this study.

In addition to the pedestrian and bicycle trips being generated by the proposed redevelopment sites, the FHWA *Compendium of Available Bicycle and Pedestrian Trip Generation Data in the*

**TRIPS GENERATED BY PROPOSED SITES**  
**EXHIBIT 10**

**Proposed Developments with Estimated Completion Date Before 2015**

DESCRIPTION				AM PEAK HOUR			PM PEAK HOUR		
				(7:45 AM – 8:45 AM)			(4:30 PM – 5:30 PM)		
CODE	LAND USE	DEVELOPMENT NAME	AMOUNT	IN	OUT	TOTAL	IN	OUT	TOTAL
230	Residential Condominium/ Townhome	Off The American Road	60 dwelling units	4	22	26	21	10	31
230	Residential Condominium/ Townhouse	Off Horse Hill Road	78 dwelling units	6	28	34	27	13	41
710	Office Building	Corner of E. Hanover Ave and Horse Hill Rd	20,000 SF	27	4	31	5	25	30
710	Office Building	Bayar Corp. Redevelopment	2,000 Employees	772	105	877	136	664	800
862	Home Improvement Superstore	Corner of Ridgedale Ave and E. Hanover Ave	125,000 SF	90	68	158	142	154	296
710	Office Building	Proposed Office/Warehouse on American Rd	20,790 SF	28	4	32	5	26	31
150	Warehouse	Proposed Office/Warehouse on American Rd	48,510 SF	11	3	15	4	12	16
*	Shopping Center	ShopRite Center	90,000 SF	88	57	145	291	302	593

\*Trip Generation from Omland Engineer's Traffic Impact Study

**Proposed Developments with Estimated Completion Between 2015 and 2035**

DESCRIPTION				AM PEAK HOUR			PM PEAK HOUR		
				(7:45 AM – 8:45 AM)			(4:30 PM – 5:30 PM)		
CODE	LAND USE	DEVELOPMENT NAME	AMOUNT	IN	OUT	TOTAL	IN	OUT	TOTAL
820	Shopping Center	Remediated Site South of The American Rd	100,000 SF	94	60	154	312	324	636



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*United States* (1994) presents studies that were conducted to determine how providing pedestrian and bicycle facilities can increase pedestrian and bicycle trips. A study conducted by Lott, Tardiff, and Lott (1978) found that by providing pedestrian and bicycle facilities, the number of bicycles and pedestrians utilizing particular corridors increased between 8.2% and 87.1%.

Given the number of recreational/cultural facilities along the Corridor, providing pedestrian and bicycle facilities to connect the residential areas with the retail and office developments may provide an added benefit of promoting additional recreational trips.

**TABLE 5A: AM Peak Hour Pedestrian and Bicycle Trip Generation**

Location	Description	AM Peak Hour Vehicle Trips	Ped Trip Estimates (Kagan, Scott, Avin)	Ped Trip Estimates (Comsis)	Bike Trip Estimates (Comsis)
East Hanover Avenue – Across from Mennen Arena	100,000 SF Shopping Center	154	1,000	10	1
East Hanover Avenue – Northwest Corner of Horse Hill Road	90,000 SF Shopping Center with ShopRite	145	900	4	1
East Hanover Avenue – Northeast Corner of Horse Hill Road	20,000 SF Office	31	100	2	0
East Hanover Avenue – Northwest Corner of Ridgedale Avenue	125,000 SF Home Improvement Store	158	1,250	10	1
<b>TOTAL</b>			<b>3,250</b>	<b>26</b>	<b>3</b>

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**TABLE 5B: PM Peak Hour Pedestrian and Bicycle Trip Generation**

Location	Description	PM Peak Hour Vehicle Trips	Ped Trip Estimates (Kagan, Scott, Avin)	Ped Trip Estimates (Comsis)	Bike Trip Estimates (Comsis)
East Hanover Avenue – Across from Mennen Arena	100,000 SF Shopping Center	636	1,000	38	2
East Hanover Avenue – Northwest Corner of Horse Hill Road	90,000 SF Shopping Center with ShopRite	593	900	36	2
East Hanover Avenue – Northeast Corner of Horse Hill Road	20,000 SF Office	30	100	2	0
East Hanover Avenue – Northwest Corner of Ridgedale Avenue	125,000 SF Home Improvement Store	296	1,250	18	1
<b>TOTAL</b>			<b>3,250</b>	<b>94</b>	<b>5</b>

### 3.1.7 2015 No Build Condition Traffic Volumes

The background growth rate of 2.0% per year was applied to the 2011 Existing Condition traffic volumes and the trips generated by the proposed developments were added to develop 2015 No Build Condition AM and PM peak hour volumes. The 2015 No Build Condition AM and PM peak hour volumes are shown in **EXHIBIT 11**.

### 3.1.8 2015 No Build condition Capacity Analysis Results

The results of the 2015 No Build Condition capacity analysis are shown in **EXHIBIT 7**.

#### East Hanover Avenue and Speedwell Avenue (US 202)

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- All eastbound (EB) movements would operate at LOS F in the AM peak hour;
- The EB left-turn movement would operate at LOS F in the PM peak hour;
- The westbound (WB) left-turn movement would operate at LOS F in the AM peak hour;

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- All WB movements would operate at LOS F in the PM peak hour;
- The WB through movement would operate at LOS E in the AM peak hour;
- The northbound (NB) through and right-turn movements would operate at LOS F and E in the AM and PM peak hour, respectively;
- The southbound (SB) left-turn movement would operate at LOS F in both the AM and PM peak hours; and,
- The SB through and right-turn movements would operate at LOS E in the PM peak hour.

**East Hanover Avenue and The American Road**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The WB through movement would operate at LOS E in the PM peak hour; and,
- The SB left and right-turn movements would operate at LOS F in the PM peak hour.

**East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better.

**East Hanover Avenue and Big Box Driveway**

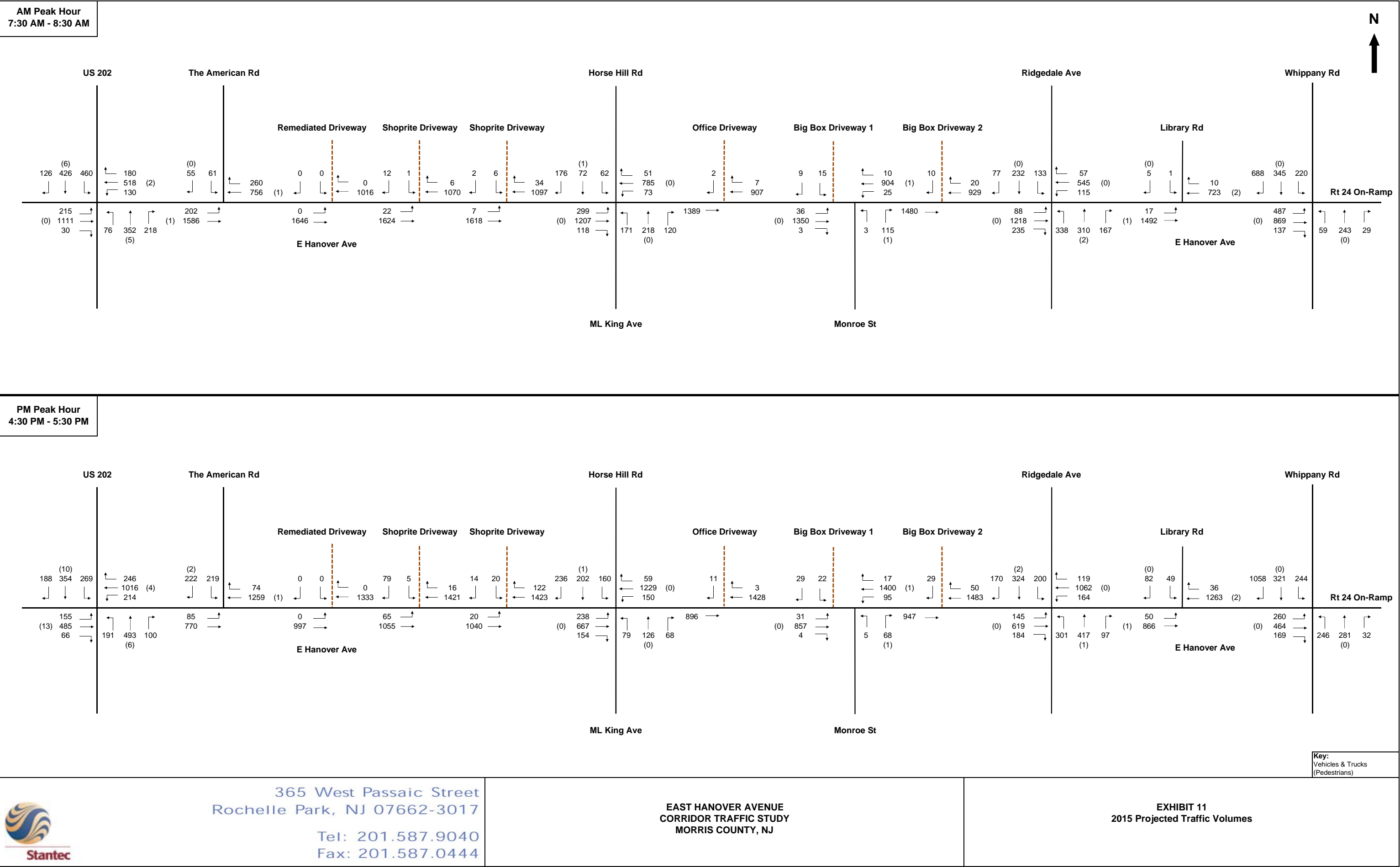
Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The EB left-turn movement would operate at LOS E during the PM peak hour;
- The EB through movement would operate at LOS F during the PM peak hour; and,
- The SB left-turn movement would operate at LOS F during the PM peak hour.

**East Hanover Avenue and Monroe Street**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The WB left-turn movement would operate at LOS F in the AM peak hour; and,



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- The NB left and right-turn movements would operate at LOS F in the AM and PM peak hours.

**East Hanover Avenue and Ridgedale Avenue**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- All EB movements would operate at LOS F in both the AM and PM peak hour;
- The WB through and left-turn movements would operate at LOS F in both the AM and PM peak hour;
- The WB right-turn movement would operate at LOS F and E in the AM and PM peak hour, respectively;
- The NB left-turn movement would operate at LOS F in both the AM and PM peak hour;
- The NB through and right-turn movements would operate at LOS F in the PM peak hour; and,
- The SB through and left-turn movements would operate at LOS F in the both the AM and PM peak hour.

**East Hanover Avenue and Morris County Library Driveway**

Based on the analysis results, all lane groups at the study intersection would operate at LOS C or better, except:

- The EB left-turn and through movement operates at LOS F during the AM peak hour.

**East Hanover Avenue and Whippany Road**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The EB through movement would operate at LOS F and E in the AM and PM peak hours, respectively;
- The EB right-turn movement would operate at LOS F in the AM peak hour, respectively; and,
- The SB left-turn movement would operate at LOS E in the AM peak hour.

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It should be noted that the delay at this intersection decreases from the 2011 Existing Condition due to the significant additional queuing experienced at the intersection of East Hanover Avenue and Ridgedale Avenue, which changes the arrival patterns.

**3.1.9 2015 No Build Condition Queuing Results**

SimTraffic was utilized to measure queuing along the Corridor (**EXHIBIT 8**). Based on the results of the queuing analysis, several areas along the Corridor were identified as experiencing significant queuing during the AM and PM peak hours (average queue > 1,000 feet). These areas include:

East Hanover Avenue and Speedwell Avenue (US 202)

- The eastbound approach would experience an average queue exceeding 3,600 feet during the AM peak hour.
- The westbound approach would experience an average queue exceeding 1,800 feet during the PM peak hour.
- The northbound approach would experience an average queue exceeding 1,600 feet during the AM and PM peak hours.
- The southbound approach would experience an average queue of approximately 1,900 feet during the AM peak hour, and 1,800 feet during the PM peak hour.

East Hanover Avenue and Ridgedale Avenue

- The westbound approach would experience an average queue of approximately 1,932 feet during the PM peak hour.
- The southbound approach would experience an average queue of approximately 1,200 feet.

East Hanover Avenue and Whippany Road

- The eastbound approach would experience an average queue of approximately 1,700 feet during the AM peak hour. It should be noted that the average queue extends an additional 800 feet west of the Library Driveway intersection.

**EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY  
ALTERNATIVES ANALYSIS REPORT**

2015 AND 2035 NO BUILD CONDITIONS  
July 2013

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**3.2 2035 NO BUILD CONDITION TRAFFIC VOLUMES**

The background growth rate 0.50% per year was applied to the 2015 No Build Condition traffic and trips generated by the proposed developments were added to develop 2035 No Build Condition AM and PM peak hour volumes. The 2035 No Build Condition AM and PM peak hour volumes are shown in **EXHIBIT 12**.

**3.2.1 2035 No Build condition Capacity Analysis Results**

The results of the 2035 No Build Condition capacity analysis are shown in **EXHIBIT 7**. It should be noted that some movements at the study area intersections show a delay that is slightly lower in the 2035 No Build Condition than in the 2015 No Build Condition. This is due to the oversaturated nature of the roadway network, where the additional traffic volume exacerbates existing issues. Additional delay at upstream intersections and/or additional queue spillback affects the arrival patterns of vehicles to individual movements, resulting in an artificial decrease in delay for some movements. However, delays remain similar, or increase, at most study area intersections.

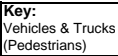
East Hanover Avenue and Speedwell Avenue (US 202)

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- All eastbound (EB) movements would operate at LOS F in the AM peak hour;
- The EB left-turn movement would operate at LOS F in the PM peak hour;
- The westbound (WB) through and left-turn movements would operate at LOS E and F in the AM peak hour, respectively;
- All WB movements would operate at LOS F in the PM peak hour;
- The northbound (NB) through and right-turn movements would operate at LOS F and E in the AM and PM peak hours, respectively;
- The southbound (SB) left-turn movement would operate at LOS F in both the AM and PM peak hours; and,
- The southbound through and right-turn movements would operate at LOS E in the PM peak hour.



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**EAST HANOVER AVENUE  
CORRIDOR TRAFFIC STUDY  
MORRIS COUNTY, NJ**

### EXHIBIT 12

#### 2035 Projected Traffic Volumes

**EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY  
ALTERNATIVES ANALYSIS REPORT**

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**East Hanover Avenue and The American Road**

Based on the analysis results, all lane groups at the study intersection would operate at LOS B or better, except:

- The WB through movement would operate at LOS F in the PM peak hour; and,
- The SB left and right-turn movements would operate at LOS F in the PM peak hour.

**East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road**

Based on the analysis results, all lane groups at the study intersection would operate at LOS C or better, except:

- The WB through and right-turn movements would operate at LOS F during the PM peak hour. This is due to the extension of the queue along WB East Hanover Avenue from the Speedwell Avenue intersection.
- The SB approach would operate at LOS F during the PM peak hour.

**East Hanover Avenue and Big Box Driveway**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The EB approach would operate at LOS F during the PM peak hour; and,
- The SB left-turn movement would operate at LOS F during the PM peak hour.

**East Hanover Avenue and Monroe Street**

Based on the analysis results, all lane groups at the study intersection would operate at LOS B or better, except:

- The WB left-turn movement would operate at LOS F in PM peak hour; and,
- The NB left and right-turn movements would operate at LOS F in the AM and PM peak hours.

**East Hanover Avenue and Ridgedale Avenue**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- All EB movements would operate at LOS F in both the AM and PM peak hour;

**EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY  
ALTERNATIVES ANALYSIS REPORT**

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- All WB movements would operate at LOS F in both the AM and PM peak hour;
- The WB right-turn movement would operate at LOS F and E in the AM and PM peak hour, respectively;
- The NB left-turn movement would operate at LOS F in the AM and PM peak hours;
- The NB through and right-turn movements would operate at LOS E and F in the AM and PM peak hours, respectively;
- The SB through and left-turn movements would operate at LOS F in the both the AM and PM peak hour.

**East Hanover Avenue and Morris County Library Driveway**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The EB approach would operate at LOS F in the AM peak hour; and,
- The WB approach would operate at LOS F in the PM peak hour. This queue is due to the extension of the queuing at the East Hanover Avenue and Ridgedale Avenue intersection.

**East Hanover Avenue and Whippany Road**

Based on the analysis results, all lane groups at the study intersection would operate at LOS D or better, except:

- The EB through and right-turn movements would operate at LOS F in both the AM and PM peak hour, respectively; and,
- The SB left-turn movement would operate at LOS F in the AM peak hour.

**3.2.2 2035 No Build Condition Queuing Results**

SimTraffic was utilized to measure queuing along the Corridor (**EXHIBIT 8**). Based on the results of the queuing analysis, several areas along the Corridor were identified as experiencing significant queuing during the AM and PM peak hours (average queue > 1,000 feet). These areas include:

**East Hanover Avenue and Speedwell Avenue (US 202)**

- The eastbound approach would experience an average queue exceeding 3,600 and 1,400 feet during the AM peak hour and PM peak hours, respectively.

**EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY  
ALTERNATIVES ANALYSIS REPORT**

2015 AND 2035 NO BUILD CONDITIONS  
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- The westbound approach would experience an average queue of approximately 1,900 feet during the PM peak hour.
- The northbound approach would experience an average queue exceeding 1,700 feet during the AM peak hour and 1,500 feet during the PM peak hour.
- The southbound approach would experience an average queue of approximately 2,900 feet during the AM peak hour, and 1,900 feet during the PM peak hour.

East Hanover Avenue and The American Road

- The westbound approach would experience an average queue exceeding 1,000 feet during the PM peak hour. This queue is an extension of the queue from the intersection of East Hanover Avenue and Speedwell Avenue.
- The southbound approach would experience an average queue exceeding 1,000 feet during the PM peak hour.

East Hanover Avenue and Martin Luther King Avenue/ Horse Hill Road

- The southbound approach would experience an average queue of approximately 1,800 feet during the PM peak hour. This is due to intersection blockage from the queue that extends from the Speedwell Avenue intersection.

East Hanover Avenue and Ridgedale Avenue

- The westbound approach would experience an average queue of approximately 1,500 feet during the AM peak hour, and 2,400 feet during the PM peak hour.
- The southbound approach would experience an average queue of approximately 1,200 feet during the PM peak hour.

East Hanover Avenue and Whippany Road

- The eastbound approach would experience an average queue of approximately 1,700 feet during the AM peak hour. It should be noted that the average queue extends an additional 800 feet west of the Library Driveway intersection.

## EXHIBIT 7

2011 Existing, 2015 No Build, 2035 No Build LOS Table  
CAPACITY ANALYSIS RESULTS

		2011 Existing						2015 No Build						2035 No Build					
Intersection	LANE GROUP	AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak		
		V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service
East Hanover Ave & US 202 Signalized	EB-L	0.70	354.3	F	0.56	88.2	F	0.88	316.1	F	0.60	90.5	F	1.06	381.2	F	0.66	231.9	F
	EB-T	0.89	82.2	F	0.41	25.9	C	1.08	87.6	F	0.49	25.9	C	1.20	84.9	F	0.60	39.0	D
	EB-R	0.89	51.1	D	0.41	1.8	A	1.08	53.5	F	0.49	2.7	A	1.20	41.4	F	0.60	11.8	B
	WB-L	0.49	60.5	E	0.45	109.5	F	0.58	120.1	F	0.60	156.5	F	0.64	146.1	F	0.83	168.3	F
	WB-T	0.61	43.8	D	1.00	131.0	F	0.71	55.7	E	1.21	158.4	F	0.80	75.4	E	1.46	167.0	F
	WB-R	0.61	23.1	C	1.00	146.2	F	0.71	27.9	C	1.21	161.1	F	0.80	41.0	D	1.46	216.1	F
	NB-L	0.18	33.0	C	0.57	28.4	C	0.21	36.7	D	0.69	43.7	D	0.26	38.5	D	0.88	47.5	D
	NB-T	0.78	98.6	F	0.72	26.1	C	0.91	110.3	F	0.80	57.8	E	1.02	108.3	F	0.92	75.1	E
	NB-R	0.78	95.6	F	0.72	22.1	C	0.91	110.4	F	0.80	53.5	D	1.02	108.0	F	0.92	68.5	E
	SB-L	0.87	118.7	F	0.79	55.8	E	1.08	175.5	F	1.12	405.6	F	1.22	186.2	F	1.33	390.8	F
	SB-T	0.56	25.4	C	0.71	30.4	C	0.61	41.9	D	0.77	65.0	E	0.68	38.6	D	0.85	70.0	E
	SB-R	0.56	21.7	C	0.71	29.6	C	0.61	37.7	D	0.77	63.8	E	0.68	34.9	C	0.85	72.5	E
Intersection	-	82.5	F	-	67.8	E	-	96.1	F	-	110.0	F	-	104.6	F	-	124.9	F	
East Hanover Ave & The American Rd Signalized	EB-L	0.32	4.6	A	0.18	10.7	B	0.42	5.8	A	0.27	9.5	A	0.48	6.2	A	0.31	10.5	B
	EB-T	0.41	0.1	A	0.20	0.0	A	0.48	0.0	A	0.24	0.0	A	0.54	0.0	A	0.30	0.0	A
	WB-T	0.57	1.8	A	0.65	20.3	C	0.65	2.7	A	0.77	57.0	E	0.69	3.0	A	0.92	74.4	E
	WB-R	0.15	0.0	A	0.04	2.2	A	0.18	0.0	A	0.06	6.5	A	0.20	0.0	A	0.06	13.2	B
	SB-L	0.09	17.2	B	0.51	45.4	D	0.14	17.9	B	0.62	277.6	F	0.16	17.3	B	0.78	320.9	F
	SB-R	0.02	0.0	A	0.11	50.8	D	0.03	0.0	A	0.14	384.6	F	0.04	0.0	A	0.16	325.4	F
	Intersection	-	1.2	A	-	17.9	B	-	1.7	A	-	63.4	E	-	1.8	A	-	75.0	E
East Hanover Ave & Horse Hill Rd/MLK Ave Signalized	EB-L	0.92	20.9	C	0.87	29.1	C	0.71	19.5	B	0.79	37.2	D	0.71	22.0	C	0.71	25.9	C
	EB-T	0.92	20.9	C	0.87	29.7	C	0.79	19.8	B	0.56	18.8	B	0.83	21.8	C	0.72	22.7	C
	EB-R	0.92	21.7	C	0.87	27.4	C	0.79	19.8	B	0.56	18.8	B	0.83	21.8	C	0.72	22.7	C
	WB-L	0.95	70.3	E	0.91	37.1	D	0.29	11.0	B	0.44	12.8	B	0.27	9.0	A	0.49	13.9	B
	WB-T	0.95	74.4	E	0.91	38.7	D	0.59	20.1	C	0.93	38.1	D	0.68	23.0	C	1.23	136.1	F
	WB-R	0.95	84.1	F	0.91	37.6	D	0.59	20.1	C	0.93	38.1	D	0.68	23.0	C	1.23	136.1	F
	NB-L	0.66	101.1	F	0.48	37.6	D	0.65	40.0	D	0.43	29.7	C	0.68	39.5	D	0.64	46.7	D
	NB-T	0.83	84.3	F	0.47	29.5	C	0.75	37.2	D	0.33	18.7	B	0.76	35.5	D	0.38	21.5	C
	NB-R	0.83	77.2	E	0.47	17.3	B	0.75	37.2	D	0.33	18.7	B	0.76	35.5	D	0.38	21.5	C
	SB-L	0.41	47.8	D	0.70	41.8	D	0.64	42.9	D	0.90	52.8	D	0.65	41.8	D	1.07	97.1	F
	SB-T	0.41	45.0	D	0.70	38.5	D	0.64	42.9	D	0.90	52.8	D	0.65	41.8	D	1.07	97.1	F
	SB-R	0.39	5.3	A	0.48	9.5	A	0.37	7.0	A	0.39	8.2	A	0.38	6.2	A	0.44	5.2	A
Intersection	-	47.7	D	-	32.2	C	-	22.7	C	-	30.4	C	-	24.1	C	-	72.6	E	
East Hanover Ave & Monroe St Unsignalized	EB-T	0.51	0.0	A	0.28	0	A	0.56	0.5	A	0.36	22.3	C	0.63	3.1	A	0.43	25	C
	EB-R	0.25	0.0	A	0.14	0.0	A	0.28	0.2	A	0.18	0.1	A	0.32	0.0	A	0.22	34.5	D
	WB-L	0.05	8.1	A	0.10	9.4	A	0.05	9.4	A	0.13	81.5	F	0.07	18.2	C	0.16	94.5	F
	WB-TR	0.32	0.0	A	0.44	0.0	A	0.38	0.5	A	0.58	13.1	B	0.42	1.0	A	0.69	15.5	C
	NB-L	0.29	64.8	F	0.11	16.9	C	0.22	**	F	0.12	**	F	0.31	**	F	0.19	**	F
	NB-R	0.29	29.4	D	0.11	9.1	A	0.22	**	F	0.12	**	F	0.31	**	F	0.19	**	F
	Intersection	-	2.8	A	-	1.2	A	-	1.7	A	-	42.8	E	-	16.8	C	-	59.3	F
East Hanover Ave & Ridgedale Ave Signalized	EB-L	0.98	61.0	E	0.87	48.3	D	1.14	97.1	F	1.11	148.9	F	1.26	149.7	F	1.31	139.8	F
	EB-T	0.98	67.8	E	0.87	47.4	D	1.14	115.9	F	1.11	133.7	F	1.26	128.4	F	1.31	146.3	F
	EB-R	0.98	74.7	E	0.87	54.6	D	1.14	109.9	F	1.11	174.9	F	1.26	150.6	F	1.31	155.5	F
	WB-L	0.88	57.5	E	0.83	33.1	C	1.06	202.9	F	1.06	128.4	F	1.18	289.8	F	1.23	131.1	F
	WB-T	0.88	54.8	D	0.83	31.3	C	1.06	200.2	F	1.06	129.5	F	1.18	284.0	F	1.23	132.4	F
	WB-R	0.03	1.0	A	0.06	2.3	A	0.03	101.6	F	0.07	74.0	E	0.04	158.6	F	0.08	80.2	F
	NB-L	0.90	46.7	D	0.79	50.9	D	1.06	117.3	F	1.04	141.5	F	1.19	128.9	F	1.13	155.6	F
	NB-T	0.53	33.7	C	0.82	57.5	E	0.61	48.4	D	0.98	99.4	F	0.85	73.7	E	1.05	102.0	F
	NB-R	0.53	31.7	C	0.82	54.7	D	0.61	38.7	D	0.98	97.8	F	0.85	70.1	E	1.05	97.8	F
	SB-L	0.35	45.6	D	0.59	89.5	F	0.43	105.1	F	0.69	154.1	F	0.54	116.5	F	0.72	145.9	F
	SB-T	0.85	132.9	F	1.00	181.5	F	0.96	224.7	F	1.26	272.8	F	1.05	225.2	F	1.34	261.0	F
	SB-R	0.26	4.2	A	0.43	17.3	B	0.28	7.9	A	0.47	40.7	D	0.31	12.7	B	0.52	40.9	D
Intersection	-	60.3	E	-	54.7	D	-	129.3	F	-	135.4	F	-	157.4	F	-	137.7	F	
East Hanover Ave & Library Driveway Signalized	EB-L	0.38	53.7	D	0.38	14.0	B	0.47	90.6	F	0.48	24.7	C	0.52	117.8	F	0.99	25.0	C
	EB-T	0.38	87.5	F	0.38	3.4	A	0.47	125.4	F	0.48	5.9	A	0.52	124.4	F	0.99	8.1	A
	WB-T	0.18	0.3	A	0.47	3.7	A	0.22	0.1	A	0.55	23.9	C	0.24	0.2	A	0.56	99.8	F
	WB-R	0.18	0.0	A	0.47	5.3	A	0.22	0.2	A	0.55	14.6	B	0.24	0.0	A	0.56	101.6	F
	SB-L	0.01	0.0	A	0.12	9.2	A	0.01	2.9	A	0.14	9.4	A	0.01	4.7	A	0.27	8.1	A
	SB-R	0.03	3.5	A	0.19	5.4	A	0.03	2.9	A	0.22	8.6	A	0.04	4.7	A	0.39	12.3	B
	Intersection	-	55.4	E	-	4.1	A	-	77.1	E	-	17.1	B	-	73.8	E	-	63.1	E
East Hanover Ave & Whippany Rd Signalized	EB-L	0.36	26.3	C	0.35	46.6	D	0.55	22.9	C	0.41	30.8	C	0.60	29.9	C	0.46	32.4	C
	EB-T	0.99	142.3	F	0.88	111.6	F	1.12	109.0	F	0.96	58.0	E	1.25	119.1	F	1.10	65.9	F
	EB-R	0.99	115.8	F	0.88	91.5	F	1.12	97.9	F	0.96	30.6	C	1.25	110.7	F	1.10	40.9	F
	NB-L	0.27	50.8	D	0.72	46.3	D	0.34	50.1	D	0.77	44.3	D	0.38	46.8	D	0.81	48.2	D
	NB-T	0.24	28.6	C	0.19	15.8	B	0.36	29.3	C	0.29	21.0	C	0.39	29.3	C	0.34	21.8	C
	NB-R	0.09	30.5	C	0.05	20.7	C	0.09	27.9	C	0.07	23.1	C	0.11	30.5	C	0.09	22.9	C
	SB-L	0.75	52.1	D	0.66	47.7	D	0.81	64.2	E	0.77	48.2	D	0.87	85.5	F	0.79	46.2	D
	SB-T	0.32	21.5	C	0.22	18.4	B	0.36	22.4	C	0.33	22.9	C	0.40	24.0	C	0.39	26.9	C
	SB-R	0.38	0.0	A	0.56	0.0	A	0.45	0.0	A	0.70	1.2	A	0.50	0.0	A	0.81	16.4	B
Intersection	-	47.5	D	-	42.4	D	-	44.9	D	-	24.1	C	-	49.1	D	-	32.1	C	
East Hanover Ave & Big Box Driveway Signalized	EB-L							0.07	3.1	A	0.11	67.9	E	0.06	6.7	A	0.11	138.0	F
	EB-T							0.47	0.9	A	0.31	100.9	F						

**EXHIBIT 8**
**QUEUEING RESULTS**

2011 Existing, 2015 No Build, 2035 No Build

Intersection	Approach	Existing				2015 No Build				2035 No Build			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
		Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue
<b>East Hanover Ave &amp; US 202</b> <i>Signalized</i>	<b>EB</b>	2,992	ESA	137	257	3,621	ESA	140	233	3,672	ESA	1,487	2,416
	<b>WB*</b>	222	336	1,413	2,343	329	499	1,813	2,327	438	712	1,879	2,379
	<b>NB</b>	1,255	2,055	274	451	1,648	2,061	689	1,334	1,752	2,140	1,520	1,824
	<b>SB</b>	1,000	2,560	273	437	1,939	ESA	1,826	2,510	2,859	ESA	1,845	2,583
<b>East Hanover Ave &amp; The American Rd</b> <i>Signalized</i>	<b>EB-L</b>	40	81	32	69	50	94	32	75	47	88	20	58
	<b>WB*</b>	53	132	312	1,090	63	122	654	1,485	67	130	1,004	1,748
	<b>SB</b>	28	59	205	754	36	65	891	1,800	35	74	1,061	1,821
<b>East Hanover Ave &amp; Horse Hill Rd/MLK Ave</b> <i>Signalized</i>	<b>EB</b>	295	495	242	363	158	260	133	227	134	229	145	248
	<b>WB</b>	360	555	351	554	165	271	236	314	163	264	234	338
	<b>NB</b>	387	755	82	147	480	910	88	164	377	715	89	167
	<b>SB</b>	59	117	119	208	91	198	867	1,811	89	169	1,891	2,682
<b>East Hanover Ave &amp; Ridgedale Ave</b> <i>Signalized</i>	<b>EB</b>	590	903	276	409	405	481	407	424	408	474	407	425
	<b>WB</b>	207	306	298	440	765	1,433	1,932	2,892	1,543	2,422	2,508	3,114
	<b>NB</b>	194	292	232	451	627	1,019	833	1,161	876	1,171	906	1,231
	<b>SB</b>	292	591	652	1,269	575	1,087	1,195	1,531	701	1,316	1,221	1,480
<b>East Hanover Ave &amp; Library Driveway</b> <i>Signalized</i>	<b>EB**</b>	534	1,439	78	152	786	1,739	98	181	836	2,033	556	1,089
	<b>WB</b>	9	49	111	209	9	39	325	1,221	7	40	1,318	2,750
	<b>SB</b>	5	22	27	60	7	27	35	71	5	23	51	106
<b>East Hanover Ave &amp; Whippany Rd</b> <i>Signalized</i>	<b>EB**</b>	1,684	2,410	425	715	1,707	2,392	393	617	1,726	2,378	407	616
	<b>NB</b>	45	87	127	212	61	112	140	233	69	113	183	291
	<b>SB</b>	123	199	78	142	132	263	128	300	198	390	538	1,421
<b>East Hanover Ave &amp; Big Box Driveway</b> <i>Signalized</i>	<b>EB</b>					39	133	441	944	104	261	628	1,258
	<b>WB</b>					37	100	75	134	48	116	73	138
	<b>SB</b>					14	41	34	94	16	43	39	92

Approach queues represent the highest queue of all the movements for that approach.

Source: SimTraffic

ESA - Exceeds Study Area (&gt;4,000) Adjacent intersections that are not included in the study area may affect arrivals and queuing.

\* WB PM Queue from Speedwell Ave intersection extends past The American Road

\*\* EB AM Queue from Whippany Road intersection extends past Library Driveway

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### 3.3 DEMAND VOLUME VERSUS ACTUAL VOLUME

The future traffic volumes utilized in this study represent the demand that would be generated by the background traffic growth and trips generated by the proposed developments. The results of the No Build analyses show that queuing and delay would increase from the Existing condition under these demand volumes. However, if no improvements are provided to the corridor it is likely that, as queuing and delay increases, drivers will find alternate routes. Therefore, the actual queuing and delay experienced on the Corridor in the future No Build condition may be lower than that which is a result of the demand volumes that are utilized in this study.

Since this is a corridor study, and not a regional study, the effects of the No Build condition on the larger regional roadway network were not analyzed. The alternative scenarios that are developed and evaluated in the subsequent sections of this report will attempt to address the demand volumes, in order to minimize the diversion of traffic to other regional roadways, which are most likely also congested during the peak hours.

### 3.4 SUMMARY OF ADDITIONAL FUTURE NEEDS

The anticipated developments in the study area would increase the amount of traffic passing through the East Hanover Avenue Corridor. This analysis has shown that the anticipated growth in traffic would result in failing movements at several intersections, thus causing additional delay and queuing along East Hanover Avenue.

The results of Existing Condition traffic analysis identified several locations that will need improvements to mitigate the anticipated increase in traffic along the Corridor. In addition to the areas identified in the Existing Condition analysis (**Section 2.7**), the following needs should be addressed in the alternatives analysis:

- Reducing queuing at the intersection of East Hanover Avenue and Ridgedale Avenue;
- Providing pedestrian and bicycle connections to the proposed retail sites; and,
- Improving transit amenities along the Corridor to provide improved service to transit users accessing the new retail sites.



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## **4.0 IMPROVEMENT ALTERNATIVE SCENARIOS ANALYSIS**

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Several mitigation measures could be employed to address the existing and future needs identified in **Sections 2.7** and **3.4**, respectively. The circulation and safety needs identified in these sections can be addressed with three main types of mitigation strategies: vehicular infrastructure (signal timing adjustments, turn lanes, etc.), bicycle/pedestrian infrastructure (pedestrian crosswalks, signal heads, sidewalk, etc.), and transit infrastructure (bus shelters, benches, bus pull-outs, etc.). The mitigation strategies are compiled into three improvement alternative scenarios, each of which were analyzed with projected 2015 and 2035 volumes. The three alternative scenarios are described as follows:

- **Alternative Scenario 1** (Low-Level Improvements): Maintain/improve existing vehicular, transit and pedestrian infrastructure, and adjust signal timings.
- **Alternative Scenario 2** (Moderate Improvements): Provide some additional vehicular infrastructure, but only improve existing transit and pedestrian infrastructure.
- **Alternative Scenario 3** (Significant Improvements): Provide additional vehicular, pedestrian, and transit infrastructure.

A description of each Alternative Scenario, including an operational analysis and cost estimate, is provided in the following subsections.

### **4.1 LAND USE AND ZONING CONSIDERATIONS**

Many of the redevelopment proposals along the Corridor would result in an increase in peak hour trips greater than the trips that were generated by the industrial uses that previously occupied the same sites, particularly an increase in PM and Saturday peak hour trips for the proposed retail sites. This increase in trip generation provided the impetus for the County to initiate the Corridor Study for a coordinated approach to improvements to the County roadway. Due to both physical and fiscal constraints, there are limits to the improvements that can be made to East Hanover Avenue. Therefore, all municipalities should consider the cumulative traffic impacts of any future changes to their respective land use plans and zoning along the Corridor that were not anticipated at the time of this study. In addition, the municipalities should encourage future applicants to consider mixed-use or lower-intensity uses for the available sites along the corridor.

However, land use and zoning considerations would only help to reduce future degradation in traffic operations along the Corridor. The Existing Conditions Analysis shows several operational issues, including failing movements, at many of the study area intersections and long peak hour queues that would continue to exist regardless of the redevelopment proposed along the Corridor.

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**4.2 ALTERNATIVE SCENARIO 1**

Alternative Scenario 1 would optimize use of existing physical roadway infrastructure by providing minor improvements that would not require the construction of additional lanes, sidewalks, or transit facilities (**APPENDIX A**).

**Vehicular Infrastructure**

Alternative Scenario 1 would consist of signal timing/coordination improvements to optimize the operation of the existing infrastructure. The proposed left-turn lanes on the Corridor in the area of the proposed ShopRite shopping center, as well as the new signal near the County garage, are assumed to be completed, as they were planned by developers and the County at the time of this study.

**Pedestrian/Bicycle Infrastructure**

Similar to the vehicular infrastructure, the pedestrian and bicycle infrastructure would be optimized through the implementation of minor improvements to the existing infrastructure. Currently, there is a sidewalk along the north side of the Corridor, with a 500-foot gap of sidewalk coverage just east of Horse Hill Road. Therefore, Alternative Scenario 1 includes the construction of approximately 500 feet of new sidewalk to fill in that gap. In addition, the condition of the existing sidewalk segments is poor in many areas, with overgrowth, spalling, cracking, and displacement. It is recommended that all existing sidewalk along the Corridor be improved by reconstructing broken segments and clearing brush. It is also recommended that crosswalk striping be provided where sidewalks cross side streets, major driveways, and all of the study area intersections.

A new sidewalk is also recommended to be constructed along the south side of the Corridor between The American Road and Monroe Street. This sidewalk would provide a much needed pedestrian connection to Mennen Arena and the Colgate/Palmolive property, as well as providing a safe pedestrian area for residents that live between Martin Luther King Avenue and Monroe Street. In addition, a small segment is recommended to be constructed along the east side of Martin Luther King Avenue to connect the existing sidewalk, just south of the gas station, to the intersection with East Hanover Avenue. This segment would provide a formal sidewalk connection between the residential area, south of the corridor, and the proposed ShopRite shopping center.

Installation of pedestrian countdown signal heads are recommended for all signalized crosswalks. ADA curb ramps are also recommended for crossings that do not currently comply with ADA standards.

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### **Transit Infrastructure**

No transit improvements are recommended as part of this Alternative.

#### **4.2.1 Alternative Scenario 1 Traffic Operational Analysis**

The results of the 2015 Alternative Scenario 1 Build Condition capacity and queue analyses are shown in **EXHIBITS 13** and **14**, respectively. The results of the 2035 Alternative Scenario 1 Build Condition capacity and queue analyses are shown in **EXHIBITS 15** and **16**, respectively. Based on the results of the analyses, Alternative Scenario 1 would provide minimal improvements to the operation of the Corridor when compared to the No Build Condition. Significant queuing and delay would continue to be experienced at the Speedwell Avenue, Ridgedale Avenue, and Whippany Road intersections, all of which would negatively impact the other study areas intersections along the corridor.

Six movements at the intersection of East Hanover Avenue and Speedwell Avenue would fail in the 2015 Build condition, and seven would fail in 2035. This is due to the limited capacity of the intersection, which is far exceeded by the demand in the AM and PM peak hours. The signal timing adjustments proposed as part of Alternative Scenario 1 would not provide enough additional capacity to improve the operation of the intersection because at least two opposing movements would experience volumes that exceed the capacity of the approach during both peak hours. Even with signal timing adjustments, queuing at this intersection is anticipated to be excessive, with queues exceeding one-half mile in the AM and PM peak hours.

Vehicles would also experience significant queuing and delay at the intersection of East Hanover Avenue and Ridgedale Avenue due to the split-phase operation of the eastbound and westbound approaches. The signal timing adjustments proposed in Alternative Scenario 1 would not overcome the limitation in capacity at the intersection due to the split-phase operation. Therefore, the eastbound and westbound approaches would continue to operate at LOS F in the 2015 and 2035 analysis years. Average PM peak hour queues of over 1,800 feet on the eastbound approach and 4,000 feet on the westbound approach would occur in the 2035 analysis year.

These queues would significantly influence arrival patterns to other intersections along the Corridor. The eastbound queues would extend through the proposed signalized intersection at the County garage to the intersection with Martin Luther King Avenue/Horse Hill Road, resulting in queuing along the northbound and southbound approaches during the AM peak hour (**EXHIBIT 16**). Similarly, queuing along the westbound East Hanover Avenue approach would extend through the intersection with Whippany Road during the PM peak hour.

The capacity analysis results also show a reduction in delay and queuing at some intersections when compared to Alternative Scenario 2. However, this reduction is due to metered flow from congestion experienced at adjacent intersections. The significant queuing and delay issues at

EXHIBIT 13  
2015 Alternative Scenarios  
CAPACITY ANALYSIS RESULTS

Intersection	LANE GROUP	Alternative 1						Alternative 2						Alternative 3					
		AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak		
		V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service
East Hanover Ave & US 202 <i>Signalized*</i>	EB-L	0.85	200.9	F	0.58	23.0	C	0.56	65.3	E	0.60	26.9	C	0.51	19.3	B	0.61	25.4	C
	EB-TR	1.04	92.8	F	0.48	25.0	C	0.90	93.0	F	0.45	26.4	C	0.81	32.7	C	0.39	22.6	C
	WB-L	0.55	77.2	E	0.50	89.9	F	0.52	75.0	E	0.51	8.9	A	0.60	27.6	C	0.46	7.2	A
	WB-TR	0.69	39.4	D	1.05	135.0	F												
	WB-T							0.44	21.6	C	0.83	120.7	F	0.46	16.3	B	0.68	11.1	B
	WB-R							0.31	8.0	A	0.42	78.1	E	0.32	5.4	A	0.35	1.7	A
	NB-L	0.20	37.5	D	0.76	53.1	D	0.28	34.3	C	0.86	157.5	F	0.23	17.8	B	0.68	31.4	C
	NB-TR	0.99	131.4	F	0.97	114.8	F							0.57	26.6	C	0.62	32.4	C
	NB-T							0.73	82.8	F	0.84	81.8	F						
	NB-R							0.49	41.4	D	0.22	43.1	D						
	SB-L	0.95	188.6	F	0.88	301.8	F	0.92	139.7	F	0.77	135.3	F	0.75	46.8	D	0.83	65.7	E
	SB-TR	0.61	41.0	D	0.82	75.4	E	0.68	43.0	D	0.85	94.3	F						
	SB-T													0.55	26.3	C	0.73	42.1	D
	SB-R													0.21	23.1	C	0.54	38.5	D
	Intersection	-	96.0	F	-	109.1	F	-	71.3	E	-	95.7	F	-	27.8	C	-	25.1	C
East Hanover Ave & The American Rd <i>Signalized</i>	EB-L	0.40	5.3	A	0.32	7.2	A	0.44	3.9	A	0.32	4.9	A	0.38	3.4	A	0.32	7.9	A
	EB-T	0.48	0.5	A	0.24	0.2	A	0.47	0.5	A	0.24	0.1	A	0.48	0.3	A	0.24	0.2	A
	WB-L	0.56	13.8	B	0.74	17.7	B	0.44	15.8	B	0.61	4.2	A	0.34	4.4	A	0.61	5.5	A
	WB-R	0.18	0.3	A	0.06	0.1	A	0.18	0.3	A	0.06	0.1	A	0.18	0.2	A	0.06	0.1	A
	SB-L	0.20	19.7	B	0.57	34.5	C	0.15	27.3	C	0.65	46.1	D	0.27	43.5	D	0.65	46.1	D
	SB-R	0.03	0.0	A	0.14	0.2	A	0.03	0.0	A	0.14	0.2	A	0.03	0.0	A	0.14	0.2	A
	Intersection	-	4.6	A	-	11.6	B	-	5.2	A	-	6.1	A	-	2.5	A	-	6.8	A
	EB-L	0.65	15.4	B	0.88	52.8	D	0.67	18.2	B	0.81	38.1	D	0.63	12.1	B	0.68	19.9	B
	EB-TR	0.75	21.6	C	0.56	21.5	C	0.75	23.7	C	0.90	13.9	B	0.72	12.4	B	0.47	12.5	B
East Hanover Ave & Horse Hill Rd/MLK Ave <i>Signalized</i>	WB-L	0.28	18.2	B	0.43	11.2	B	0.31	14.3	B	0.36	6.2	A	0.30	13.5	B	0.37	6.9	A
	WB-TR	0.56	13.9	B	0.91	21.4	C	0.58	22.3	C	0.79	13.5	B	0.37	12.8	B	0.56	8.3	A
	NB-L	0.48	26.8	C	0.33	22.3	C	0.41	26.2	C	0.28	26.5	C	0.43	28.0	C	0.29	26.5	C
	NB-TR	0.65	29.9	C	0.31	19.7	B	0.80	47.6	D	0.60	39.6	D	0.80	46.8	D	0.62	40.9	D
	SB-LT	0.60	43.4	D	0.92	62.3	E												
	SB-L							0.27	23.4	C	0.59	34.8	C	0.31	25.3	C	0.56	33.2	C
	SB-T							0.19	30.6	C	0.57	42.0	D	0.18	30.0	C	0.52	38.7	D
	SB-R	0.45	8.5	A	0.42	7.4	A	0.40	7.6	A	0.51	8.4	A	0.40	7.3	A	0.49	7.5	A
	Intersection	-	20.3	C	-	26.5	C	-	24.5	C	-	19.2	B	-	17.1	B	-	15.3	B
	EB-T	0.56	0.0	A	0.36	0.0	A	0.56	0.0	A	0.36	0.0	A	0.56	0.0	A	0.36	0.0	A
	EB-R	0.28	0.0	A	0.18	0.0	A	0.28	0.0	A	0.18	0.0	A	0.28	0.0	A	0.18	0.0	A
	WB-L	0.05	1.7	A	0.13	3.2	A	0.05	1.7	A	0.13	3.2	A	0.05	1.7	A	0.13	3.2	A
	WB-T	0.38	0.0	A	0.58	0.0	A	0.38	0.0	A	0.58	0.0	A	0.38	0.0	A	0.58	0.0	A
	NB	0.23	13.9	B	0.12	11.8	B	0.24	14.5	B	0.12	11.8	B	0.24	14.3	B	0.11	11.3	B
	Intersection	-	0.9	A	-	1.1	A	-	0.9	A	-	1.1	A	-	0.9	A	-	1.1	A
East Hanover Ave & Ridgedale Ave <i>Signalized</i>	EB-LTR	1.22	127.9	F	1.08	83.2	F												
	EB-TR							0.20	4.2	A	0.58	27.1	C	0.20	5.2	A	0.64	32.8	C
	WB-LT	1.36	206.4	F	1.17	119.6	F	0.97	30.9	C	0.59	22.0	C	0.91	23.1	C	0.56	17.9	B
	WB-L							0.47	19.7	B	0.55	15.2	B	0.57	25.3	C	0.51	13.3	B
	WB-TR							0.39	16.6	B	0.88	30.2	C						
	WB-T													0.35	14.6	B	0.80	24.7	C
	WB-R	0.03	0.0	A	0.07	0.1	A							0.35	14.6	B	0.80	24.7	C
	NB-L	1.05	89.2	F	1.47	258.5	F	0.97	70.2	E	0.85	44.5	D	0.78	53.9	D	0.71	50.2	D
	NB-TR	0.48	28.2	C	0.68	37.2	D	0.54	34.9	C	0.71	39.4	D	0.62	39.0	D	0.76	42.1	D
	SB-L	0.41	22.6	C	0.86	58.5	E	0.43	27.5	C	0.60	27.7	C	0.41	26.4	C	0.66	32.3	C
	SB-TR							0.62	40.0	D	0.80	43.2	D						
	SB-T	0.67	42.2	D	0.80	50.2	D							0.51	43.2	D	0.57	41.4	D
	SB-R	0.22	8.1	A	0.36	6.7	A							0.05	0.1	A	0.12	0.2	A
	Intersection	-	113.5	F	-	92.5	F	-	32.3	C	-	31.6	C	-	27.0	C	-	28.2	C
	EB-LT	0.47	2.0	A	0.42	0.9	A	0.47	0.5	A	0.42	1.5	A	0.47	0.8	A	0.42	1.7	A
East Hanover Ave & Library Driveway <i>Signalized</i>	WB-TR	0.22	0.6	A	0.47	2.9	A	0.22	0.6	A	0.47	2.4	A	0.22	0.6	A	0.47	2.4	A
	SB-L	0.01	37.0	D	0.28	44.3	D	0.01	42.0	D	0.28	44.3	D	0.01	42.0	D	0.28	44.3	D
	SB-R	0.04	23.8	C	0.38	18.8	B	0.03	26.2	C	0.38	18.8	B	0.03	26.2	C	0.38	18.8	B
	Intersection	-	1.6	A	-	3.5	A	-	0.6	A	-	3.5	A	-	0.8	A	-	3.5	A
	EB-LTR													0.76	6.1	A	0.49	8.6	A
East Hanover Ave & Whippary Rd <i>Signalized</i>	EB-L	0.53	6.9	A	0.29	6.5	A	0.45	3.2	A	0.26	6.2	A						
	EB-TR	1.09	69.3	F	0.71	12.4	B	0.91	17.7	B	0.64	12.4	B						
	NB-L	0.16	18.9	B	0.57	26.3	C	0.23	28.3	C	0.65	32.3	C	0.21	25.0	C	0.61	29.4	C
	NB-T	0.34	31.7	C	0.37	34.6	C	0.62	49.0	D	0.51	40.6	D	0.52	43.4	D	0.51	40.6	D
	NB-R	0.09	29.5	C	0.09	32.1	C	0.16	42.0	D	0.13	35.2	D	0.14	38.2	D	0.13	35.2	D
	SB-L	0.48	23.2	C	0.53	274.8	F	0.63	37.2	D	0.61	30.6	C	0.57	31.5	C	0.57	28.1	C
	SB-T	0.35	27.4	C	0.39	33.4	C	0.50	38.7	D	0.57	41.8	D	0.43	34.6	C	0.57	41.8	D
	SB-R	0.45	0.9	A	0.70	2.6	A	0.45	0.9	A	0.70	2.6	A	0.45	0.9	A	0.70	2.6	A
	Intersection	-	31.8	C	-	15.0	B	-	18.3	B	-	17.4	B	-	13.6	B	-	16.4	B
	EB-L	0.07	2.5	A	0.11	2.4	A	0.07	0.7	A	0.11	2.1	A	0.07	0.7	A	0.11	3.4	A
East Hanover Ave & Big Box Driveway <i>Signalized</i>	EB-T	0.46	3.6	A	0.30	2.9	A	0.46	0.8	A	0.30	2.2	A	0.46	0.9	A	0.30	4.2	A
	WB-TR	0.35	0.9	A	0.54	1.8	A	0.34	2.3	A	0.50	3.3	A	0.34	3.6	A	0.55	1.4	A
	SB-L	0.08	37.1	D	0.13	43.1	D	0.09	42.3	D	0.13	43.1	D	0.09	42.3	D	0.13	43.1	D
	SB-R	0.05	20.2	C	0.17	16.9	B	0.06	22.4	C	0.17	16.9	B	0.06	22.4	C	0.17	16.9	B
	Intersection	-	2.8	A	-	2.8	A	-	1.7	A	-	3.4	A	-	2.3	A	-	3.0	A

v/c ratio = volume/capacity ratio

\*Intersection results obtained from Sim Traffic for Alts 1 and 2 due to intersection being over saturated.

**EXHIBIT 14**  
**QUEUEING RESULTS**  
**2015 Alternative Scenarios**

Intersection	Approach	Alternative 1				Alternative 2				Alternative 3			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
		Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue
<b>East Hanover Ave &amp; US 202</b> <i>Signalized</i>	<b>EB</b>	3,671	ESA	178	505	2,656	ESA	189	356	364	523	425	910
	<b>WB</b>	196	288	1,156	1,905	188	658	1,720	2,303	169	308	341	578
	<b>NB</b>	1,712	2,039	1,488	1,942	621	798	1,127	1,862	155	226	180	302
	<b>SB</b>	2,910	3,127	1,397	2,639	1,495	1,495	636	1,209	234	403	298	488
<b>East Hanover Ave &amp; The American Rd</b> <i>Signalized</i>	<b>EB-L</b>	38	67	44	82	71	270	30	66	66	118	43	85
	<b>WB</b>	70	128	121	236	73	187	790	1,723	24	65	69	125
	<b>SB</b>	33	60	103	169	49	97	126	200	37	66	135	242
<b>East Hanover Ave &amp; Horse Hill Rd/MLK Ave</b> <i>Signalized</i>	<b>EB</b>	244	299	168	272	199	293	150	243	198	293	112	190
	<b>WB</b>	140	256	199	301	196	264	267	366	136	212	167	235
	<b>NB</b>	189	351	107	195	303	520	137	243	204	328	119	205
	<b>SB</b>	106	253	486	1,173	60	115	114	183	59	130	135	180
<b>East Hanover Ave &amp; Ridgedale Ave</b> <i>Signalized</i>	<b>EB</b>	421	453	410	424	323	456	231	323	355	481	172	288
	<b>WB</b>	1,520	2,341	2,030	3,126	99	153	370	535	130	235	246	390
	<b>NB</b>	931	1,188	876	1,076	809	1,129	232	404	164	256	170	255
	<b>SB</b>	113	185	208	352	99	155	182	263	78	121	137	230
<b>East Hanover Ave &amp; Library Driveway</b> <i>Signalized</i>	<b>EB</b>	9	44	37	94	9	36	90	203	18	73	81	202
	<b>WB</b>	148	575	376	1,224	2	17	55	132	0	0	66	107
	<b>SB</b>	6	27	45	88	5	24	49	100	4	20	45	92
<b>East Hanover Ave &amp; Whippany Rd</b> <i>Signalized</i>	<b>EB</b>	426	867	114	218	862	1,546	145	275	221	316	118	215
	<b>NB</b>	61	95	120	179	98	155	120	232	67	107	106	190
	<b>SB</b>	77	147	96	177	140	255	95	162	96	165	101	210
<b>East Hanover Ave &amp; Big Box Driveway</b> <i>Signalized</i>	<b>EB</b>	361	706	927	1,585	17	45	51	126	12	37	54	160
	<b>WB</b>	20	57	70	124	36	101	50	106	28	93	31	85
	<b>SB</b>	51	114	139	316	14	39	27	55	14	44	19	54

Approach queues represent the highest queue of all the movements for that approach.

Source: SimTraffic

ESA - Exceeds Study Area (>4,000) Adjacent intersections that are not included in the study area may affect arrivals and queuing.



EXHIBIT 15  
2035 Alternative Scenarios  
CAPACITY ANALYSIS RESULTS

Intersection	LANE GROUP	Alternative 1						Alternative 2						Alternative 3					
		AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak		
		V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service	V/C Ratio	Delay	Level of Service
East Hanover Ave & US 202 <i>Signalized*</i>	EB-L	0.84	117.1	F	0.82	440.6	F	0.62	56.3	E	0.71	434.1	F	0.54	17.4	B	0.71	34.5	C
	EB-TR	1.13	91.8	F	0.66	58.8	E	0.97	89.5	F	0.59	48.9	D	0.82	30.4	C	0.49	23.9	C
	WB-L	0.68	116.3	F	0.67	99.8	F	0.67	40.5	D	0.69	112.4	F	0.68	42.8	D	0.65	17.3	B
	WB-TR	0.85	88.0	F	1.24	116.2	F												
	WB-T							0.57	39.0	D	1.00	153.6	F	0.48	15.2	B	0.85	13.2	B
	WB-R							0.37	3.9	A	0.50	102.7	F	0.33	4.3	A	0.44	2.7	A
	NB-L	0.29	46.2	D	1.15	61.6	E	0.35	62.5	E	1.02	114.8	F	0.34	22.4	C	0.70	32.2	C
	NB-TR	1.03	133.5	F	0.96	92.4	F							0.76	36.3	D	0.80	41.2	D
	NB-T							0.87	122.3	F	0.89	94.6	F						
	NB-R							0.58	70.1	E	0.27	49.6	D						
	SB-L	1.25	190.3	F	1.42	464.0	F	0.97	139.5	F	0.99	215.4	F	0.80	48.1	D	0.63	45.4	D
	SB-TR	0.66	51.5	D	0.83	84.5	F	0.74	64.3	E	0.90	123.0	F						
	SB-T													0.67	32.6	C	0.76	43.3	D
	SB-R													0.26	26.6	C	0.14	0.2	A
	Intersection	-	103.1	F	-	121.6	F	-	89.2	F	-	130.7	F	-	29.8	C	-	24.7	C
East Hanover Ave & The American Rd <i>Signalized</i>	EB-L	0.48	6.4	A	0.29	5.8	A	0.45	4.1	A	0.49	18.4	B	0.45	3.9	A	0.47	15.4	B
	EB-T	0.54	0.6	A	0.30	0.2	A	0.54	0.7	A	0.30	0.2	A	0.54	0.4	A	0.30	0.2	A
	WB-L	0.64	15.3	B	1.01	43.8	F	0.39	3.3	A	0.82	82.4	F	0.39	3.2	A	0.83	14.2	B
	WB-R	0.20	0.3	A	0.06	0.1	A	0.20	0.2	A	0.06	0.0	A	0.20	3.0	A	0.06	0.1	A
	SB-L	0.23	20.4	C	0.75	37.1	D	0.31	44.2	D	0.63	40.3	D	0.31	44.2	D	0.62	39.0	D
	SB-R	0.04	0.0	A	0.15	0.2	A	0.04	0.0	A	0.15	0.2	A	0.04	0.0	A	0.15	0.2	A
	Intersection	-	5.2	A	-	24.6	C	-	2.4	A	-	41.3	D	-	2.2	A	-	10.6	B
	EB-L	0.76	27.5	C	0.91	56.0	E	0.81	30.8	C	0.87	49.3	D	0.74	20.3	C	0.84	39.5	D
	EB-TR	0.85	26.6	C	0.75	27.8	C	0.88	26.2	C	0.62	17.2	B	0.84	19.6	B	0.61	18.5	B
East Hanover Ave & Horse Hill Rd/MLK Ave <i>Signalized</i>	WB-L	0.31	19.4	B	0.61	31.1	C	0.35	16.9	B	0.48	12.8	B	0.35	20.9	C	0.49	13.9	B
	WB-TR	0.69	21.2	C	1.24	135.7	F	0.73	30.0	C	1.01	39.6	F	0.46	19.4	B	0.71	11.4	B
	NB-L	0.55	27.9	C	0.37	22.1	C	0.44	25.2	C	0.34	27.1	C	0.46	27.0	C	0.33	26.2	C
	NB-TR	0.70	31.4	C	0.33	19.3	B	0.82	46.5	D	0.63	40.2	D	0.86	53.0	D	0.61	38.7	D
	SB-LT	0.70	50.2	D	0.96	69.7	E												
	SB-L							0.29	22.0	C	0.61	35.3	D	0.30	23.9	C	0.60	33.8	C
	SB-T							0.18	28.7	C	0.59	42.1	D	0.20	30.6	C	0.58	40.7	D
	SB-R	0.47	8.1	A	0.48	8.0	A	0.41	6.8	A	0.62	14.1	B	0.43	7.4	A	0.58	10.8	B
	Intersection	-	25.6	C	-	73.5	E	-	28.3	C	-	31.4	C	-	23.0	C	-	19.7	B
East Hanover Ave & Monroe St <i>Unsignalized</i>	EB-T	0.63	0.0	A	0.43	0.0	A	0.63	0.0	A	0.43	0.0	A	0.63	0.0	A	0.43	0.0	A
	EB-R	0.32	0.0	A	0.22	0.0	A	0.32	0.0	A	0.22	0.0	A	0.32	0.0	A	0.22	0.0	A
	WB-L	0.07	2.2	A	0.16	4.2	A	0.07	2.2	A	0.16	4.2	A	0.06	2.0	A	0.16	4.2	A
	WB-T	0.42	0.0	A	0.69	0.0	A	0.42	0.0	A	0.69	0.0	A	0.42	0.0	A	0.69	0.0	A
	NB	0.30	16.4	C	0.20	15.9	C	0.32	17.6	C	0.19	15.0	B	0.18	11.0	B	0.15	12.6	B
	Intersection	-	1.1	A	-	1.4	A	-	1.1	A	-	1.4	A	-	0.8	A	-	1.3	A
	EB-LTR	1.72	350.7	F	1.29	163.1	F												
East Hanover Ave & Ridgedale Ave <i>Signalized</i>	EB-L							0.24	4.6	A	0.81	51.2	D	0.25	3.3	A	0.77	45.0	D
	EB-TR							1.03	44.4	F	0.68	20.3	C	0.99	28.6	C	0.68	17.9	B
	WB-LT	1.09	96.7	F	1.51	265.1	F												
	WB-L							0.55	22.4	C	0.75	29.7	C	0.71	39.0	D	0.66	22.1	C
	WB-TR							0.42	16.9	B	0.98	40.4	D						
	WB-T													0.39	14.9	B	0.95	36.2	D
	WB-R	0.04	0.0	A	0.08	0.1	A							0.39	14.9	B	0.95	36.2	D
	NB-L	0.98	62.7	E	1.81	404.0	F	1.07	94.1	F	1.02	78.0	E	0.85	60.1	E	0.85	61.5	E
	NB-TR	0.53	22.1	C	0.72	37.7	D	0.65	31.2	C	0.77	41.9	D	0.73	35.8	D	0.84	47.5	D
	SB-L	0.51	24.8	C	0.99	84.3	F	0.56	31.0	C	0.70	33.1	C	0.59	33.6	C	0.73	36.0	D
	SB-TR							0.65	40.6	D	0.87	47.4	D						
	SB-T	0.81	55.3	E	0.83	52.4	D							0.57	45.0	D	0.58	40.8	D
	SB-R	0.26	9.1	A	0.40	6.5	A							0.09	0.1	A	0.14	0.2	A
	Intersection	-	185.9	F	-	174.4	F	-	40.2	D	-	39.8	D	-	30.6	C	-	34.2	C
	EB-LT	0.53	4.5	A	0.51	4.5	A	0.52	0.3	A	0.99	33.8	C	0.52	0.3	A	0.51	1.5	A
	WB-TR	0.24	0.7	A	0.55	4.5	A	0.24	0.3	A	0.55	3.0	A	0.24	0.6	A	0.55	3.1	A
	SB-L	0.01	37.0	D	0.26	39.0	D	0.01	42.0	D	0.28	43.1	D	0.01	42.0	D	0.28	43.1	D
	SB-R	0.04	22.8	C	0.42	28.7	C	0.04	25.5	C	0.44	29.3	C	0.04	25.5	C	0.44	29.3	C
	Intersection	-	3.3	A	-	6.0	A	-	0.5	A	-	16.7	B	-	0.5	A	-	4.2	A
East Hanover Ave & Whippary Rd <i>Signalized</i>	EB-LTR	1.72	350.7	F	1.29	163.1	F							0.85	10.4	B	0.59	16.0	B
	EB-L	0.58	9.6	A	0.34	14.7	B	0.51	6.3	A	0.31	6.6	A						
	EB-TR	1.22	124.6	F	0.83	29.4	C	1.06	53.9	F	0.76	13.2	B						
	NB-L	0.20	19.3	B	0.67	30.4	C	0.26	26.6	C	0.75	36.7	D	0.25	25.5	C	0.68	30.2	C
	NB-T	0.37	32.1	C	0.41	35.2	D	0.56	44.7	D	0.52	40.1	D	0.54	43.8	D	0.50	38.9	D
	NB-R	0.10	29.7	C	0.11	32.3	C	0.15	39.0	D	0.14	34.7	C	0.15	38.3	D	0.13	33.8	C
	SB-L	0.54	24.6	C	0.58	26.1	C	0.66	36.2	D	0.65	31.4	C	0.63	33.4	C	0.60	27.4	C
	SB-T	0.39	27.9	C	0.43	34.1	C	0.50	36.5	D	0.59	41.6	D	0.47	34.9	C	0.59	41.5	D
	SB-R	0.50	1.1	A	0.81	4.6	A	0.50	1.1	A	0.81	4.6	A	0.50	1.1	A	0.81	4.6	A
	Intersection	-	50.9	D	-	20.3	C	-	30.0	C	-	18.3	B	-	15.8	B	-	18.8	B
East Hanover Ave & Big Box Driveway <i>Signalized</i>	EB-L	0.06	1.5	A	0.12	2.0	A	0.06	0.4	A	0.12	3.2	A	0.09	2.4	A	0.12	3.4	A
	EB-T	0.51	3.1	A	0.36	2.3	A	0.50	1.0	A	0.36	4.6	A	0.67	4.9	A	0.36	5.4	A
	WB-TR	0.38	0.6	A	0.64	4.3	A	0.37	2.1	A	0.64	3.8	A	0.50	9.4	A	0.63	1.5	A
	SB-L	0.07	35.0	C	0.11	40.8	D	0.07	40.1	D	0.11	40.8	D	0.04	30.4	C	0.11	40.8	D
	SB-R	0.05	19.0	B	0.15	15.7	B	0.05	21.3	C	0.15	15.7	B	0.03	16.1	B	0.15	15.7	B
	Intersection	-	2.3	A	-	4.0	A	-	1.7	A	-	4.5	A	-	6.9	A	-	3.4	A

v/c ratio = volume/capacity ratio

\*Intersection results obtained from Sim Traffic for Alts 1 and 2 due to intersection being over saturated.

**EXHIBIT 16**  
**QUEUEING RESULTS**  
**2035 Alternative Scenarios**

Intersection	Approach	Alternative 1				Alternative 2				Alternative 3			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
		Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue	Avg Queue	95% Queue
East Hanover Ave & US 202 <i>Signalized</i>	EB	3,679	ESA	1,309	2,512	3,538	ESA	1,442	2,343	959	2,094	240	737
	WB	558	916	1,409	2,474	494	834	1,823	2,265	306	409	663	1,314
	NB	1,777	1,796	1,568	1,747	1,604	2,117	1,350	2,019	240	425	680	1,475
	SB	2,881	3,214	1,770	2,530	1,067	1,995	1,828	2,337	477	943	1,212	1,717
East Hanover Ave & The American Rd <i>Signalized</i>	EB-L	46	79	21	49	78	295	27	58	59	116	44	110
	WB	73	142	204	455	40	95	953	1,750	45	116	176	266
	SB	40	71	155	155	50	85	134	215	53	100	170	275
East Hanover Ave & Horse Hill Rd/MLK Ave <i>Signalized</i>	EB	257	316	188	283	174	256	176	312	268	317	174	310
	WB	191	245	252	321	219	305	317	333	162	221	198	273
	NB	1,274	2,106	107	210	638	1,304	124	213	966	1,751	155	250
	SB	1,467	3,093	720	1,100	60	108	130	234	51	131	125	218
East Hanover Ave & Ridgedale Ave <i>Signalized</i>	EB	420	421	408	415	372	482	212	331	391	494	190	293
	WB	1,591	2,662	2,547	3,126	120	197	1,633	2,237	90	155	936	1,552
	NB	747	945	906	1,097	904	1,158	904	1,195	278	556	224	353
	SB	878	1,221	460	798	130	202	250	842	104	214	345	425
East Hanover Ave & Library Driveway <i>Signalized</i>	EB	4	23	98	218	770	1,806	180	305	33	132	92	196
	WB	1	9	1,515	2,883	2	18	81	152	2	13	96	189
	SB	8	30	122	198	8	29	43	74	7	28	50	90
East Hanover Ave & Whippany Rd <i>Signalized</i>	EB	189	331	137	297	1,803	2,178	212	386	313	415	197	373
	NB	63	113	492	1,155	76	128	300	613	84	127	86	228
	SB	113	184	681	1,537	146	271	126	237	143	317	98	158
East Hanover Ave & Big Box Driveway <i>Signalized</i>	EB	1,207	1,400	735	1,499	25	56	54	136	199	275	44	131
	WB	36	64	53	105	48	112	60	131	89	117	54	122
	SB	158	315	171	341	14	39	26	67	13	38	19	44

Approach queues represent the highest queue of all the movements for that approach.

Source: SimTraffic

ESA - Exceeds Study Area (>4,000) Adjacent intersections that are not included in the study area may affect arrivals and queuing.

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the intersections of East Hanover Avenue and Speedwell Avenue and East Hanover Avenue and Ridgedale Avenue restrict flow and affect how vehicles arrive to the other study area intersections. If flow was improved at these congested intersections, it is likely that delay and queuing would increase at adjacent study area intersections.

Overall, the signal timing adjustments associated with Alternative Scenario 1 would not address the delay and queuing issues that would be experienced along the Corridor in the 2015 and 2035 future analysis years. Therefore, Alternative Scenario 1 does not meet the identified needs of reducing congestion and queuing within the study area. Additional capacity improvements, such as turn lanes, would be required to meet the needs identified in the previous sections.

#### 4.2.2 Alternative Scenario 1 Complete Streets Analysis

While the measures in Alternative Scenario 1 would improve pedestrian flow and safety along the Corridor when compared to the No Build Condition, they focus primarily on the rehabilitation of the existing pedestrian facilities with only minor additions at some locations, and do not enhance access to all of the cultural resources along the Corridor. The addition of crosswalks and pedestrian countdown signal heads would improve pedestrian operation and safety at intersections. However, the rehabilitation of existing sidewalks and the construction of a limited amount of new sidewalks would provide only the minimum level of access. No bicycle or enhanced transit facilities would be provided. Therefore, Alternative 1 does not meet the needs of the Corridor and additional measures should be considered.

#### 4.2.3 Order of Magnitude Cost Estimate

An order of magnitude cost estimate was developed for this alternative scenario (**TABLE 6**). The cost estimate includes construction of the proposed sidewalk, and assumes that one-third of the existing sidewalk would need to be replaced/repared. Signal upgrade costs are also included, and a 30% contingency is applied to the entire estimate. Therefore, the final cost estimate for Alternative Scenario 1 is \$400,000.

**TABLE 6: Order of Magnitude Cost Estimate: Alternative Scenario 1**

ITEM/INTERSECTION	COST
Sidewalk Construction/Repair	\$200,000
Intersection Signal Upgrades	\$100,000
<b>SUBTOTAL</b>	\$300,000
Contingency (30%)	\$90,000
<b>TOTAL</b>	\$390,000
<b>USE</b>	<b>\$400,000</b>

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### 4.2.4 Conclusions

Alternative Scenario 1 would not significantly reduce queuing or improve traffic operations for the Corridor and therefore, would not meet all of the needs identified in **Sections 2.7** and **3.4**. In particular, average queues exceeding 1,000 feet would still be experienced at the Speedwell Avenue (US 202), Ridgedale Avenue, and Whippany Road intersections. In addition, five of the study area intersections would experience failing movements (LOS E or worse) during the peak hours in the 2015 and 2035 analysis years. Furthermore, Alternative Scenario 1 would not fully meet Complete Streets guidelines or the needs within the study area because no additional bicycle or transit facilities would be provided.

### 4.3 ALTERNATIVE SCENARIO 2

Alternative Scenario 2 improves upon some of the deficiencies of Alternative Scenario 1 by incorporating additional turn lanes at some of the study area intersections, providing improved pedestrian connections, and providing additional transit infrastructure (**APPENDIX A**).

#### Vehicular Infrastructure

The following intersection improvements, along with upgraded signal timing, are incorporated into Alternative Scenario 2:

#### East Hanover Avenue and Speedwell Avenue (US 202)

- Channelize the westbound and northbound right-turn movements and provide right-turn lanes. This improvement would require full acquisition of the gas stations on the northeast and southeast corners of the intersection, aerial utility relocations, and traffic signal pole relocations.

#### East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road

- Restripe southbound Horse Hill Road to incorporate one right-turn only lane, one through lane, and one left-turn only lane. It is anticipated that these improvements can be provided within the existing ROW and not require roadway widening.
- The additional left-turn lanes on East Hanover Avenue, proposed as part of the ShopRite development, are also incorporated into this alternative.

#### East Hanover Avenue and Ridgedale Avenue

- Provide left-turn only lanes on the eastbound and westbound East Hanover Avenue approaches. This would require aerial utility and traffic signal relocations, and minor ROW acquisition and easements along the north side of the Corridor.

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- Eliminate the auxiliary lane along westbound East Hanover Avenue between the office building driveway and Ridgedale Avenue to accommodate the proposed left-turn lane without the need to widen the westbound approach.
- Provide an additional through lane on the southbound Ridgedale Avenue approach. This would require widening the roadway along the frontage of the Garden Center to match the existing two-lane section on Ridgedale Avenue, south of the intersection. These improvements would require aerial utility relocations and ROW acquisition or easements.
- Design for larger turning radii or relocated stop bars to better-accommodate truck traffic.

#### East Hanover Avenue and Whippany Road

- Modify the AM peak hour signal timing to provide more green time for East Hanover Avenue by reducing the green time for Whippany Road. Detectors would be required for the Whippany Road through movements.

#### Pedestrian/Bicycle Infrastructure

Alternative Scenario 2 includes all of the Alternative Scenario 1 improvements: rehabilitation of the existing sidewalk; closing the existing sidewalk gap on the north side of the Corridor; providing a new sidewalk along the south side of the Corridor between The American Road and Monroe Street; and, providing a new sidewalk connection along the east side of Martin Luther King Avenue. Pedestrian countdown signal heads, striped crosswalks, and ADA-compliant pedestrian ramps are also incorporated. In addition to those improvements, Alternative Scenario 2 calls for the installation of a sidewalk along the west side of Martin Luther King Avenue, as well as a small section of sidewalk to provide a pedestrian connection from East Hanover Avenue to the Mennen Arena. A sidewalk connecting the existing sidewalk along Monroe Street to the proposed signalized intersection with the Big Box/County Driveway is also recommended to connect south side of the Corridor to the sidewalk on the continuous sidewalk on the north side.

Improved crosswalks at the intersection of East Hanover Avenue and Speedwell Avenue are also incorporated into Alternative Scenario 2. Given the relatively high number of pedestrians utilizing this intersection and the surrounding land uses, colorized crosswalks would enhance the visibility of the crosswalks and provide drivers with the sense that they are entering into a higher-pedestrian commercial corridor. **FIGURE 1** shows an example of the application of a colorized crosswalk that utilizes thermoplastic materials to create the appearance of brick.

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**FIGURE 1: Colorized Crosswalk (Source: ennisflint.com)**



### **Transit Infrastructure**

Alternative Scenario 2 includes the installation of bus shelters at two existing bus stop locations along eastbound and westbound East Hanover Avenue: in front of the proposed ShopRite shopping center, and at the Mennen Arena. Grocery stores and shopping centers tend to generate additional transit ridership by employees, as well as patrons, that do not have access to a vehicle. Therefore, providing amenities, such as a bus shelter, would provide a covered waiting area for transit patrons. Placing bus shelters near Mennen Arena would promote the use of transit to and from the Arena, and potentially reduce the amount of vehicular trips.

Concrete pads with benches are recommended for all other bus stops along the Corridor. The concrete pads would provide a level and dry waiting area for pedestrians. In addition, all new transit features must be ADA compliant, including bus stops on Speedwell Avenue that may be impacted by the proposed improvements at the intersection.

#### **4.3.1 Alternative Scenario 2 Traffic Operational Analysis**

The results of the 2015 Alternative Scenario 2 Build Condition capacity and queue analyses are shown in **EXHIBITS 13** and **14**, respectively. The results of the 2035 Alternative Scenario 2 Build Condition capacity and queue analyses are shown in **EXHIBITS 15** and **16**, respectively. Based on the results of the capacity and queue analyses, Alternative Scenario 2 would provide significant improvement in delay and queuing when compared to the No Build and Alternative Scenario 1 conditions.

When compared to the No Build and Alternative Scenario 1, the overall delay at the intersection of East Hanover Avenue and Speedwell Avenue would be reduced in Alternative Scenario 2.



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However, the majority of movements would still operate at LOS E or F during the AM and PM peak hours in both the 2015 and 2035 analysis years. In addition, the Alternative Scenario 2 queue analysis results show that the westbound queue would be higher in Alternative Scenario 2 than in Alternative Scenario 1 for both analysis years, and would extend back to the proposed ShopRite center. This increase is due to the improvement in operation at the Ridgedale Avenue intersection, which allows for more throughput volume and increases westbound traffic that would arrive at the Speedwell Avenue intersection during the peak hour. Furthermore, the eastbound queue would continue to exceed the limits of the study area. While Alternative Scenario 2 would increase the capacity of the Speedwell Avenue intersection, it does not provide enough additional capacity to mitigate the deficiencies. The remaining study area intersections would operate at LOS D or better in the 2015 analysis year, which represents a significant improvement when compared to the No Build and Alternative Scenario 1 conditions. The addition of the left-turn lanes at the intersection of East Hanover Avenue and Ridgedale Avenue would provide the ability to eliminate the split-phase operation for the East Hanover Avenue approaches, which would result in a significant reduction in queuing and delay.

As discussed in Alternative Scenario 1, the capacity analysis results also show that some movements would experience an increase in delay in Alternative Scenario 2 when compared to Alternative Scenario 1. However, the reduction in delay shown in Alternative Scenario 1 is due to traffic flow being metered by congestion at the Speedwell Avenue and Ridgedale Avenue intersections. The improvements associated with Alternative Scenario 2 would result in improved operation of congested intersections, which would result in an increase in throughput volume to adjacent intersections.

The results of the 2035 capacity and queue analyses, however, still show an improvement from Alternative Scenario 1 in operation at most study area intersections. Yet, several intersections would still have movements that operate at LOS E or F. The westbound queue during the PM peak hour would extend from the Speedwell Avenue intersection to the area of the proposed ShopRite Center, which would result in the westbound approach to The American Road intersection operating at LOS F. The westbound approach at the Martin Luther King Avenue/Horse Hill Road intersection would also operate at LOS F during the PM peak hour due to volume that exceeds the capacity of that movement ( $V/C$  ratio  $> 1.0$ ). A similar issue would be experienced during the AM peak hour on the eastbound approach at the Ridgedale Avenue intersection.

Finally, the 2035 capacity analysis results show that the eastbound approach to the intersection of East Hanover Avenue and Whippany Road would operate at LOS F and experience significant queuing during the AM peak hour. This demonstrates that the signal timing improvements proposed in Alternative Scenario 2 would provide adequate capacity in the 2015 condition, but would not provide enough capacity for the projected 2035 traffic volumes. Therefore, additional improvements would need to be considered in the future for the long-term operation of the intersection at acceptable levels of service.

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### 4.3.2 Alternative Scenario 2 Complete Streets Analysis

Alternative Scenario 2 would provide a slight improvement from Alternative Scenario 1 with the additional sidewalk connections to Mennen Arena, Monroe Street, and Martin Luther King Avenue. Crosswalks and pedestrian countdown signals would be provided at signalized intersections; however, the additional turn lanes at the Ridgedale Avenue and Speedwell Avenue intersections would result in an average increase of approximately 3.5 seconds in pedestrian crossing times. While the additional crossing time was incorporated into the proposed signal timings used in the analysis, the additional crossing distance may be seen as a disadvantage to this Alternative Scenario. However, notable impacts to pedestrian flow and operations are not anticipated and the addition of pedestrian countdown signal heads would assist pedestrians with navigating the crosswalks. Furthermore, the proposed colorized crosswalks at the intersection of East Hanover Avenue and Speedwell Avenue would help to enhance the visibility and perception of pedestrians within the intersection.

Transit facilities would be enhanced through the installation of bus shelters at major bus stops, such as at the proposed ShopRite Center, and concrete pads at minor bus stops. These facilities would increase the visibility and attractiveness of the transit services along the Corridor. The proposed sidewalks would provide pedestrian access to the transit stops.

While Alternative Scenario 2 would enhance pedestrian and transit access, it would not provide any additional bicycle facilities. Therefore, additional improvements to incorporate bicycles should be considered.

### 4.3.3 Order of Magnitude Cost Estimate

An order of magnitude cost estimate was developed for this Alternative Scenario (**TABLE 7**). The estimate includes all improvements broken down per intersection, and includes a 30% contingency within each construction cost line item. Costs for storm water management were not estimated and are not included. It is recommended that the County coordinate storm water management with the developers along the Corridor to provide additional capacity where needed.

The anticipated construction and ROW costs for the improvements contained in Alternative Scenario 2 are approximately \$2.78 million and \$3.46 million, respectively, for a total cost of \$6.23 million. Supporting ROW descriptions and cost calculations are provided in **APPENDIX E**. It should be noted that ROW was estimated utilizing tax map boundaries on aerials to provide an order of magnitude estimate. ROW costs may change during the design phase.

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**TABLE 7: Order of Magnitude Cost Estimate: Alternative Scenario 2**

ITEM/INTERSECTION		COST
Transit Enhancements		\$30,000
Whippany Road Signal Upgrades		*N/A
Sidewalk Improvements		\$210,720
Speedwell Avenue Intersection	Construction	\$340,000
	ROW	\$3,400,000
Martin Luther King/Horse Hill Intersection	Construction	\$1,075,000
	ROW	\$0
Monroe Street/County Garage Proposed Signal	Construction	\$425,000
	ROW	\$0
Ridgedale Avenue Intersection	Construction	\$685,000
	ROW	\$60,000
<b>SUBTOTAL CONSTRUCTION</b>		<b>\$2,765,720</b>
<b>SUBTOTAL ROW</b>		<b>\$3,460,000</b>
<b>TOTAL</b>		<b>\$6,225,720</b>

\*Signal enhancements to be completed by NJDOT.

### 4.3.4 Conclusions

Alternative Scenario 2 would result in a reduction in queuing and an improvement in traffic operations when compared to the No Build Condition and Alternative Scenario 1. All study area intersections would operate at LOS D or better in the 2015 analysis year, except for the intersection of East Hanover Avenue and Speedwell Avenue, which would still experience significant queuing and delay. Alternative Scenario 2 would not meet the queue reduction and operational improvement needs in the 2035 analysis year, and several study area intersections would contain movements that would operate at LOS E or F. However, it is important to note that actual 2035 volumes may be restricted by the regional roadway network, or reduced by the construction of other facilities in the region. Therefore, improvements associated with Alternative Scenario 2 could be considered for some study area intersections, and then monitored in the future to determine if additional improvements are needed by 2035. In addition, the three municipalities should assess the traffic impacts of any land use changes to reduce overall Corridor traffic growth and increase the long-term effectiveness of the proposed improvements.

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#### **4.4 ALTERNATIVE SCENARIO 3**

Alternative Scenario 3 improves on Alternative Scenario 2 by providing additional improvements at the study area intersections (**APPENDIX A**) that would provide for longer-term operational benefits. In addition, Alternative Scenario 3 incorporates more extensive pedestrian and bicycle improvements.

##### **Vehicular Infrastructure**

Along with upgraded signal timing, Alternative Scenario 3 incorporates the following intersection improvements:

##### **East Hanover Avenue and Speedwell Avenue (US 202)**

- Provide two left-turn lanes, one through lane, and one right-turn lane along southbound Speedwell Avenue. ROW acquisition would be required on both the east and west sides of Speedwell Avenue, along with aerial utility and signal pole relocations.
- Provide one northbound left-turn only lane, one through lane, and one shared through-right lane (with a channelized right-turn). This would require widening northbound Speedwell Avenue for a short distance north of East Hanover Avenue. Full ROW acquisition of the gas station on the southeast corner of the intersection may be required, along with aerial utility and signal pole relocations.
- Extend the eastbound left-turn lane to 400 feet. This can be provided within the existing pavement.
- Provide a channelized right-turn lane along the westbound approach. Full ROW acquisition of the gas station on northeast corner of the intersection may be required.

Two additional alternatives were developed for this intersection in Alternative Scenario 3 to reduce the location and amount of ROW acquisitions required to construct the above improvements (**APPENDIX A**). Intersection Alternative 3A would shift the intersection to the south and west, avoiding the partial acquisition of the gas stations on the northwest and northeast corners of the intersection. However, this would require the full acquisition of the gas station on the southeast corner of the intersection, and partial ROW acquisitions of the frontage of some of the properties on the south side of East Hanover Avenue. Intersection Alternative 3B would shift the intersection slightly north and east which would avoid the ROW acquisitions along East Hanover Avenue shown in Intersection Alternative 3A, and would eliminate the need to acquire the gas station on the southeast corner of the intersection. However, partial ROW acquisition from the gas station on the northeast corner and full acquisition of the gas station on the northwest corner of the intersection would be required.

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East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road

- Provide an auxiliary lane with a through-right movement at the westbound approach that becomes a right-turn only lane into the existing driveway west of the proposed ShopRite center site. The additional lane would be capable of accommodating the right-turns into and out of the ShopRite center. The auxiliary lane is beyond the improvements proposed by the developer of the ShopRite center and would require additional ROW.
- Provide a right-turn only lane, a through lane, and a left-turn only lane along the southbound approach of Horse Hill Road. It is anticipated that this improvement can be provided within the existing ROW.
- The additional left-turn lanes on East Hanover Avenue, proposed as part of the ShopRite development, are also incorporated into this alternative.

East Hanover Avenue and Ridgedale Avenue

- Provide a two-way left-turn (TWLT) lane along eastbound East Hanover Avenue, with provisions for a left-turn only lane at Ridgedale Avenue. The two-way left-turn lane would provide access to the existing driveways on the south side of East Hanover Avenue.
- Provide a dedicated right-turn lane on the southbound Ridgedale Avenue approach, which would require ROW acquisition.
- Provide left-turn only lanes on the eastbound and westbound East Hanover Avenue approaches. These lanes would require aerial utility and traffic signal relocations and minor ROW acquisition and easements along the north side of the Corridor.
- Eliminate the auxiliary lane along westbound East Hanover Avenue between the office building driveway and Ridgedale Avenue to accommodate the proposed left-turn lane without the need to widen the westbound approach.
- Provide two left-turn lanes, one through lane, and one shared through/right lane along the northbound approach. These lanes would require ROW acquisition along the east and west sides of Ridgedale Avenue, aerial utility relocations, and traffic signal relocations.
- Provide an additional southbound through lane on Ridgedale Avenue to connect to the existing two-lane section south of the East Hanover Avenue intersection. This additional lane would require ROW acquisition along the west side of Ridgedale Avenue.
- Design for larger turning radii or relocated stop bars to better-accommodate truck traffic.

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Many of the recommendations in this alternative scenario require ROW acquisition or easements. To minimize ROW acquisition from existing occupied properties, the County should consider acquiring ROW from the former Berlex site.

### East Hanover Avenue and Whippany Road

- Change the eastbound left turn only lane to a shared through-left turn lane.
- Add a receiving lane to the NJ Route 24 on-ramp to accommodate the added eastbound through movement.

### Pedestrian/Bicycle Infrastructure

In addition to all sidewalks and crosswalks proposed in the previous alternative scenarios, Alternative Scenario 3 would also incorporate a 10-foot wide multi-use path along the north side of the Corridor. As an alternative to widening the Corridor to incorporate bike lanes in the roadway, the multi-use path would provide a facility for bicycles and pedestrians alongside the roadway. As a safer and more convenient means of travel, the multi-use path would most likely attract additional shopping, commuting, and recreational pedestrian and bicycle trips. **FIGURE 2** shows an example a roadside multi-use path, while **FIGURE 3** shows a sample concept cross-section of the proposed multi-use path on the corridor.

The proposed path would begin along the south side of the Corridor at Whippany Road, providing access to the Arboretum. It would then cross to the north side of the roadway at the Library Driveway intersection and run along the north side of the Corridor to The American Road. A potential connection could be provided to a path currently proposed to provide access to the Morris Plains NJ TRANSIT rail station via The American Road. A 10-foot wide multi-use path connector is also recommended to connect the main path with the YMCA on Horse Hill Road. This would provide a complete connection to all the recreational and cultural resources in and near the study area. Larger crosswalks with additional pedestrian/bicycle signal heads would also be required at signalized intersections.

In addition, Alternative Scenario 3 incorporates trailblazing signs along the multi-use path to help direct users to the main destinations along the Corridor (see **APPENDIX A**). The trailblazers could be specific to the multi-use trail, or larger to communicate to drivers on East Hanover Avenue. Furthermore, adding streetscape along the multi-use path would likely further enhance user experience and change the feel of the Corridor, increasing driver awareness of pedestrian and bicycle traffic.



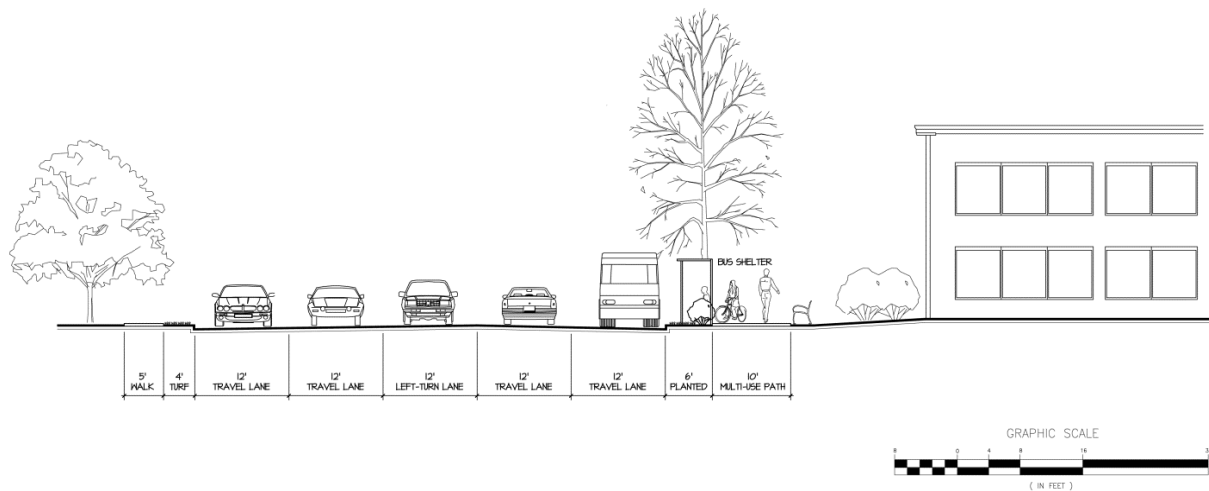
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**FIGURE 2: Example of a Roadside Multi-Use Trail**



**FIGURE 3: Conceptual Cross-Section of Multi-Use Path along East Hanover Avenue**



It should be noted that the proposed multi-use trail would be constructed outside the County ROW in most areas, and therefore, ROW acquisitions and/or easements will be required to construct the path. A fee of \$100,000 per acre was assumed for ROW/easement acquisition for the path, based on an assessment of the frontage of the properties that the path would pass through. The total cost of ROW for the path would be approximately \$250,000. However, it is

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recommended that the County work with developers and property owners along the Corridor to provide easements for the multi-use path.

It should also be noted that a retaining wall would most likely be required where the path crosses along the frontage of the County maintenance building. In addition, the path would be narrowed at all bridges in order to avoid the need for expensive structure widening.

**Transit Infrastructure**

Alternative Scenario 3 incorporates the concrete pads and bus shelters recommended in Alternative Scenario 2, but would add bus pull-offs at three locations along the Corridor, including eastbound East Hanover Avenue across from the proposed ShopRite center, and eastbound and westbound East Hanover Avenue at the Mennen Arena. Providing the bus pull-off lanes would allow buses to exit the roadway at major stops, thereby maintaining the capacity of both lanes in the eastbound and westbound directions. A bus pull-off is not recommended for westbound East Hanover Avenue in front of the proposed ShopRite center because of the recommended additional through lane that carries over as an auxiliary lane. This lane would have a lower volume and would serve as an area where buses would be removed from the direct flow of traffic.

In addition, all new transit facilities, including the bus stops on Speedwell Avenue that would be impacted by the proposed intersection improvements, should be ADA compliant.

**4.4.1 Alternative Scenario 3 Traffic Operational Analysis**

The results of the 2015 Alternative Scenario 3 Build Condition capacity and queue analyses are shown in **EXHIBITS 13** and **14**, respectively. The results of the 2035 Alternative Scenario 3 Build Condition capacity and queue analyses are shown in **EXHIBITS 15** and **16**, respectively. The results of the capacity and queue analyses show that Alternative Scenario 3 would provide further reduction in delay and queuing when compared to the No Build, Alternative Scenario 1, and Alternative Scenario 2 conditions, and would provide longer-term improvements that would better accommodate the 2035 analysis year traffic volumes.

Based on the results of the 2015 capacity analysis, all movements at the study area intersections would operate at LOS D or better, except for the intersection of East Hanover Avenue and Speedwell Avenue, where the southbound left-turn movement would operate at LOS E during the PM peak hour. The additional turn lanes at the intersection of East Hanover Avenue and Speedwell Avenue would increase the capacity of the Speedwell Avenue approaches. This scenario would allow green time to be taken from the Speedwell Avenue approaches and added to the East Hanover Avenue approaches, while maintaining acceptable traffic operation on all legs of the intersection.

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In addition to the reduction in delay, this alternative would reduce queuing. The average westbound queues would be reduced to approximately 340 feet in the PM peak hour, while eastbound queues in the AM peak hour would be reduced to approximately 360 feet in the 2015 analysis year. Queuing would also be reduced along the eastbound approach to the intersection of East Hanover Avenue and Whippany Road during the 2015 AM peak hour from a maximum of approximately 1,500 feet in Alternative Scenario 2 to approximately 300 feet in Alternative Scenario 3.

However, other than the Speedwell Avenue and Whippany Road intersections, the improvements associated with Alternative Scenario 3 do not provide additional improvement in operation over Alternative Scenario 2 in the 2015 analysis year. Rather, the additional improvements were incorporated in order to improve operations through the 2035 analysis year. Average and maximum queues at study area intersections, particularly Speedwell Avenue, would be reduced by approximately one-half in the 2035 analysis year. This is significant, particularly for the westbound approach of East Hanover Avenue at the Speedwell Avenue intersection where the PM peak hour queue would no longer extend through The American Road.

In addition to the Speedwell Avenue intersection, the westbound through movement at the intersection of East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road would operate at LOS F during the 2035 PM peak hour in Alternative Scenario 2. In order to address the failing movement, Alternative Scenario 3 proposes an additional through lane that would extend as an auxiliary lane along the Shop Rite Center frontage, resulting in an LOS B in the 2035 PM peak hour. Similarly, the eastbound through/right and northbound left-turn movements at the intersection of East Hanover Avenue and Ridgedale Avenue would operate at LOS F in the 2035 Alternative Scenario 2 AM peak hour. The additional turn lanes added as part of Alternative Scenario 3 would result in an AM peak hour improvement in LOS from F to C for the eastbound through movement, and F to E for the northbound left turn.

Finally, Alternative Scenario 3 also incorporates a two-way left-turn (TWLT) lane between Ridgedale Avenue and Monroe Street. This TWLT lane would enhance access to the businesses on the south side of the Corridor by providing an area for vehicles to pull out of the main traffic flow along westbound East Hanover Avenue in order to make a left turn.

**4.4.2 Alternative Scenario 3 Complete Streets Analysis**

Alternative Scenario 3 contains the only multi-modal improvements that address all components of NJDOT's complete street principles by providing accommodations for bicycles. The proposed multi-use path would provide an area for bicycles to operate without the need to widen the full length of the Corridor to provide bicycle lanes in both directions. The path would also provide full interconnectivity to all the cultural resources along the Corridor as well as regional trails, paths and the YMCA on Horse Hill Road. This interconnectivity would likely increase pedestrian and bicycle trips along the Corridor, particularly recreational trips. Connecting the multi-use path to

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the Morris Plains rail station would also likely increase the number of pedestrian and bicycle commuter trips.

In addition to improving pedestrian and bicycle access, the multi-use path, with an improved streetscape and trailblazing, would change the perception of the Corridor from a high-speed commuter route used to access Route 24, to a community travel route with a variety of land uses and transportation modes. These improvements would enhance pedestrian and bicycle safety by increasing driver awareness and reducing travel speeds.

The proposed transit enhancements would also provide for an improved level of access to the existing bus routes. The shelters and pads would increase the attractiveness and visibility of the service, while the proposed bus pull-offs would increase safety and improve flow along the Corridor by removing stopped buses from the travel lanes.

While the multi-use path and transit enhancements would enable the Corridor to accommodate all users, the roadway improvements would result in an increase in crossing distance at some of the study area intersections, which may be perceived as a disadvantage by pedestrians. Long crossing distances can sometimes discourage pedestrian activity along a corridor. In order to mitigate the increase in crossing distances, channelization islands for right-turn movements implemented with pedestrian countdown signal heads would need to be incorporated at many of the study area intersections.

The study area intersections in which pedestrian crossing distances would be most impacted by an increase in intersection width are Speedwell Avenue, Martin Luther King Avenue/Horse Hill Road, and Ridgedale Avenue. The additional turn lanes on the southbound approach of Speedwell Avenue would increase the crossing distance from 70 feet to approximately 106 feet in Alternative Scenario 3, and 96 feet for Alternative Scenarios 3A and 3B. This would result in an increase in crossing time of 11 seconds in Alternative Scenarios 3, and 8 seconds for Alternative Scenarios 3A and 3B. Similarly, the additional auxiliary lane westbound on East Hanover Avenue at the Martin Luther King Drive/Horse Hill Road intersection would increase the crossing distance by 15 feet, or 5 seconds.

Alternative Scenario 3 also calls for additional turn lanes at the Ridgedale Avenue approaches to East Hanover Avenue. There is currently no crosswalk across the northbound approach, and Alternative Scenario 3 does not provide a crosswalk for this movement due to the potentially long crossing distance and the lack of sidewalks along the south side of East Hanover Avenue. The existing crosswalk across the southbound approach has a length of approximately 96 feet. Even though Alternative Scenario 3 provides for additional lanes, the addition of channelization islands in this scenario would reduce the crossing distance to 66 feet.

To account for the increase in crossing distance and time at the two intersections, the operation of the signal would incorporate additional green time to allow for sufficient clearance when there is pedestrian actuation. Pedestrian countdown signals would make the longer crosswalks more

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pedestrian-friendly. The Speedwell Avenue intersection would be most adversely affected by the additional crosswalk travel distance. In this case, the proposed colorized crosswalks (**FIGURE 1**) would create a formalized crossing, which would also help to mitigate the perceived distance.

#### **4.4.3 Order of Magnitude Cost Estimate**

An order of magnitude cost estimate was developed for this Alternative Scenario (**TABLE 8**). The estimate includes all improvements broken down per intersection, and includes a 30% contingency within each construction cost line item. Costs for storm water management were not estimated and are not included. It is recommended that the County pursue storm water management with the developers so that additional capacity can be provided in their facilities.

The anticipated construction and ROW costs of the improvements contained in Alternative Scenario 3 are approximately \$4.03 - \$4.67 million and \$2.34 - \$6.44 million, respectively, for a total cost of \$6.37 - \$11.11 million. The range of costs is due to the various options for the Speedwell Avenue intersection. Supporting ROW descriptions and cost calculations are provided in **APPENDIX E**. It should be noted that ROW was estimated utilizing tax map boundaries on aeriels to provide an order of magnitude estimate. ROW costs may change during the design phase. ROW was also not included for the construction of the multi-use path. It is anticipated that the County would work to obtain easements for the multi-use path from the property owners.

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**TABLE 8: Order of Magnitude Cost Estimate: Alternative Scenario 3**

ITEM/INTERSECTION		COST
Transit Enhancements		\$50,000
Pedestrian/Bicycle	Construction	\$420,000
	ROW	\$100,000/acre
Trailblazing/Streetscaping		\$50,000
Speedwell Avenue Intersection – Alt 3	Construction	\$760,000
	ROW	\$1,900,000
Speedwell Avenue Intersection – Alt 3A	Construction	\$1,400,000
	ROW	\$2,100,000
Speedwell Avenue Intersection – Alt 3B	Construction	\$1,100,000
	ROW	\$6,000,000
Martin Luther King/Horse Hill Intersection	Construction	\$1,300,000
	ROW	\$0
Monroe Street/County Garage Proposed Signal	Construction	\$650,000
	ROW	\$0
Ridgedale Avenue Intersection	Construction	\$800,000
	ROW	\$440,000
<b>SUBTOTAL COUNTY CONSTRUCTION</b>		\$4,030,000 - \$4,670,000
<b>SUBTOTAL ROW</b>		\$2,340,000 - \$6,440,000
<b>TOTAL</b>		<b>\$6,370,000 - \$11,110,000</b>

### 4.4.4 Conclusions

Alternative Scenario 3 would provide the most significant operational improvements of the three alternative scenarios; however, it does so at the highest cost and greatest impact to the community. The additional lanes added at the study area intersections would provide the greatest operational and queuing improvements through the 2035 analysis year. Alternative Scenario 3 would significantly reduce queuing and improve LOS at the Speedwell Avenue and Whippany Road intersections in the 2015 and 2035 analysis years. However, the majority of the other benefits of Alternative Scenario 3 would not be experienced until 2035. Alternative 2 would be capable of addressing the majority of the Corridor needs in the interim.

Alternative Scenario 3 also provides the most significant pedestrian, bicycle, and transit improvements. It is the only alternative to provide for full complete streets compliance, by providing a multi-use path that can accommodate bicycles along the Corridor, but does not require Corridor-wide roadway widening to incorporate bicycle lanes. The proposed multi-use path with the recommended streetscape and trailblazing would provide an improved level of access to the Corridor equal to that of vehicles and would be an enhancement to the surrounding communities.



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## **4.5 RECOMMENDATIONS**

Each of the alternative scenarios was developed in a manner that would allow the individual components from each scenario to be implemented over time. This was necessary given the scale of the study area, public and stakeholder needs/feedback, funding, and phasing of future development. Careful consideration of costs and impacts to the surrounding community, in addition to traffic operations, was needed when selecting the recommended improvements.

A public information session was held for the East Hanover Avenue corridor study in December 2012. During the meeting, several attendees expressed concern over impacts that significant roadway improvements would have on residents and businesses adjacent to the corridor, vehicle speeds and safety, and traffic operations of downstream intersections. Meeting attendees requested that any improvements made to the roadway to address traffic issues were done so in a context-sensitive manner. In addition to the public, representatives from the municipalities expressed the same desire to keep improvements context sensitive to their communities throughout the study process.

If the only consideration in developing a recommendation were the results of the 2035 traffic analysis, then Alternative Scenario 3 would be selected corridor-wide. However, concern was expressed by the public, municipalities, and County regarding the scale of the proposed improvements associated with Scenario 3. While Alternative Scenario 2 would not meet the operational needs on some approaches in 2035, the results of the capacity analysis show that it would satisfy the traffic volumes that consist of 2011 Existing Condition volumes grown at a 2% per year, in addition to site-generated traffic from seven of the eight development sites.

A phased implementation strategy was developed as the preferred strategy based on the stakeholder feedback, and was determined to be feasible based on the results of the traffic analysis. Therefore, the recommendations for improvements along the Corridor are as follows:

- East Hanover Avenue and Speedwell Avenue: Alternative Scenario 1

While Alternative 3 is the only scenario that resulted in a measureable improvement to traffic operations at this intersection, it did so by widening the intersection on the Speedwell Avenue approaches. The widening would require significant ROW acquisitions, increase pedestrian crossing distances, and would alter the feel of the community in that area. Furthermore, attendees at the public information expressed resistance to the proposed improvements because of the community and business impacts, as well as the perception that it would only push additional traffic to downstream choke points along West Hanover Avenue and Speedwell Avenue.

In addition, NJDOT is currently planning to enhance traffic signal operations along the Speedwell Avenue corridor, and have no plans for the large-scale improvements recommended as part of Alternative Scenario. Therefore, it is recommended that

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Alternative 1 would be implemented, with the potential to implement Alternative Scenario 3 in the future if conditions warrant.

It should also be noted that any future enhancements to the intersection, such as those proposed in Alternative Scenarios 2 and 3, would affect adjacent intersections on Speedwell Avenue (US 202) and West Hanover Avenue, which were not included in this study. These intersections would have to be included in any future analysis of improvements at this location.

- East Hanover Avenue and The American Way: Alternative Scenario 3
- East Hanover Avenue and Horse Hill Road/Martin Luther King Avenue: Alternative Scenario 2
- East Hanover Avenue and Monroe Street/County Driveway: Alternative Scenario 3
- East Hanover Avenue and Ridgedale Avenue: Alternative Scenario 2.

It should be noted that trucks currently experience difficulty when turning at this intersection. Measures to accommodate the large turning radii of trucks must be considered in the design phase of the proposed improvements.

- East Hanover Avenue and Whippany Road: Alternative Scenario 2 (coordinate with NJDOT).
- Pedestrian/Bicycle: Alternative Scenario 3
- Transit: Alternative Scenario 3
- Trailblazing/Streetscaping: Alternative Scenario 3

It is recommended that the County monitor the operation of the intersections in which Alternative Scenario 2 was applied, and ensure that future development along the corridor does not preclude the implementation of Alternative Scenario 3 at those intersections, if warranted.

**4.6 IMPLEMENTATION**

While the East Hanover Avenue corridor currently experiences significant traffic congestion during the AM and PM peak periods, the redevelopment of parcels along the corridor would exacerbate existing deficiencies if improvements are not implemented. In order to implement the recommended improvements, the County should continue to collaborate and coordinate with the municipalities along the corridor and require pro rata contributions from the developers based on the analysis and recommendations provided in this document. Pro rata contributions are typically calculated by determining the increase in delay at surrounding intersections caused by

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the projected increase in traffic generated by the redevelopment. However, pro rata share contributions for improvements could also be calculated based on number of new trips generated. The contributions could be satisfied through agreements from developers to construct their pro rata share of the roadway improvements recommended in this document.

In addition to roadway improvements, the County should work with developers to provide the proposed pedestrian/bicycle or transit improvements that are recommended along the frontage of their sites, and to accommodate pedestrian and bicycle traffic within their sites. However, in order to provide for a continuous corridor for the multi-use path, the County, and/or the affected municipalities, would likely need to construct some of the proposed improvements to complete the gaps in the multi-use path between the proposed redevelopment sites.

It is likely that proposed development along the corridor will happen in stages over the next five to ten years; therefore, pro rata contributions would be funded over time. However, improvements will likely need to be completed before all potential impact funds can be collected. The County will have to secure funding for the improvements prior to all developments being constructed. **TABLE 9**, below, provides a recommended implementation schedule for each improvement based on existing needs and proposed development timetables. Based on this table, it may be prudent for the County to utilize developer contributions from early developments directly to intersection-specific improvements at Horse Hill Road/Martin Luther King Avenue, Monroe Street, and Ridgedale Avenue. Contributions from later developers could then be used to help fund future improvements at Speedwell Avenue and Whippany Road, or to upgrade intersections to Alternative 3 improvements, if warranted.

# EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY ALTERNATIVES ANALYSIS REPORT

## IMPROVEMENT ALTERNATIVE SCENARIOS ANALYSIS

July 2013

### TABLE 9: Implementation Schedule

Improvement	Alternative	Implementation Strategy	Timeline
<b>Speedwell Ave Intersection</b>	1	Coordinate with DOT to implement.	2013 – 2015
<b>Martin Luther King Avenue/Horse Hill Road Intersection</b>	2	Improvements to be coordinated with development of ShopRite and office building sites.	2013 – 2015
<b>Monroe Street/County and Big Box Driveway</b>	3	Additional sidewalks and two-way left-turn lane coordinated with development of former Berlex site.	2013 - 2015
<b>Ridgedale Avenue</b>	2	Improvements to be coordinated with development of former Berlex site.	2013 - 2015
<b>Whippany Road</b>	2	Coordinate with DOT to implement signal timing changes.	2013 - 2015
<b>Pedestrian /Bicycle</b>	3	<p>Coordinate with developers and property owners along the Corridor.</p> <p><b>Phase 1:</b> Martin Luther King Ave sidewalk extensions, south side of corridor between The American Road and Martin Luther King Ave.</p> <p><b>Phase 2:</b> Construct the multi-use path.</p>	<p><b>Phase 1:</b> 2013 – 2015</p> <p><b>Phase 2:</b> 2015 – 2017</p>
<b>Transit</b>	3	<p><b>Phase 1:</b> ShopRite Center bus pull-outs and shelters. (Implement with development).</p> <p><b>Phase 2:</b> Remaining bus pull-outs, shelters, and pads.</p>	<p><b>Phase 1:</b> 2013 – 2015</p> <p><b>Phase 2:</b> 2015 - 2020</p>
<b>Trailblazing/ Streetscaping</b>	3	Pursue with Phase 1 of Multi-Use Path.	2013 – 2015

## EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY ALTERNATIVES ANALYSIS REPORT

### CONCLUSIONS AND RECOMMENDATIONS

July 2013

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## 5.0 CONCLUSIONS AND RECOMMENDATIONS

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Based on the analysis presented in **Section 4.0**, a combination of improvements associated with Alternative Scenarios 1, 2 and 3 are recommended for further consideration based on their ability to meet the needs identified in the Existing and No Build condition analyses, and public and stakeholder feedback (**TABLE 10**). The multi-modal and streetscape/trailblazing improvements associated with Alternative Scenario 3 are recommended for implementation along the Corridor, including the multi-use path. In addition, the intersection improvements at East Hanover Avenue and Monroe Street/County and Big Box Driveway identified in Alternative Scenario 3 are also recommended. Intersection improvements from Alternative Scenario 2 are recommended for the Horse Hill Road/Martin Luther King Drive, Ridgedale Avenue, and Whippany Road intersections. Alternative Scenario 1 is recommended for the intersection of East Hanover Avenue and Speedwell Avenue.

Unlike the pedestrian and bicycle improvements proposed for each alternative scenario, the operational improvements are provided by intersection. Based on the information available at the time of the study, the improvements were designed to accommodate the combination of the existing traffic volumes, and the additional traffic that would be generated by the proposed sites. Therefore, the recommended improvements could be implemented over time, when needed. It is recommended that if Alternative Scenario 2 improvements are constructed at the recommended intersections, those intersections should be monitored in the future to determine if the improvements associated with Alternative Scenario 3 are required.

As described in the above sections, and shown in **TABLE 10**, most of the intersection improvements are specific to intersections that would be impacted by proposed development. It is anticipated that the County will establish pro rata contributions from the developers in order to help fund the improvements. Furthermore, negotiations with NJDOT could also be conducted for the proposed improvements to Speedwell Avenue (US 202) and Whippany Road, reducing the County cost at these locations. Based on the assumptions contained in this report, the total construction and ROW cost associated with the recommended improvements are \$3.0 million and \$60,000 (not including multi-use path ROW), respectively.

In addition, the County should work with developers to provide the pedestrian/bicycle and transit improvements proposed along the frontages of their sites, and to provide a site design that accommodates pedestrian and bicycle flow from the Corridor into, and around, their sites. It is also recommended that the County fill in the gaps in the multi-use path in order to create a cohesive pedestrian and bicycle corridor. The ROW cost shown in **TABLE 10** does not reflect the ROW cost of \$100,000 per acre for portions of the multi-use path where public-private partnerships could not be established. The total cost of the multi-use path can only be calculated once all partnerships are established.

## EAST HANOVER AVENUE CORRIDOR TRAFFIC STUDY ALTERNATIVES ANALYSIS REPORT

### CONCLUSIONS AND RECOMMENDATIONS

July 2013

**TABLE 10: Recommendations**

Location	Needs	Alt	Cost Estimate
East Hanover Avenue and Speedwell Avenue (US 202)	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> <li>Improve safety by reducing the number of driveways adjacent to the intersection.</li> <li>Improve pedestrian access and safety.</li> </ul>	1	Construction: \$50,000 ROW: \$0
East Hanover Avenue and Martin Luther King Avenue/Horse Hill Road	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> <li>Eliminate split-phase operation.</li> <li>Improve pedestrian access and safety.</li> </ul>	2	Construction: \$1,075,000 ROW: \$0
East Hanover Avenue and Monroe Street/County and Big Box Driveway	<ul style="list-style-type: none"> <li>Improve access to properties on south side of the Corridor.</li> <li>Improve pedestrian connectivity.</li> </ul>	3	Construction: \$650,000 ROW: \$0
East Hanover Avenue and Ridgedale Avenue*	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> <li>Eliminate split-phase operation.</li> <li>Improve pedestrian access and safety.</li> </ul>	2	Construction: \$685,000 ROW: \$60,000
East Hanover Avenue and Whippany Road	<ul style="list-style-type: none"> <li>Reduce queuing and delays, and improve LOS.</li> </ul>	2	**N/A
Corridor-Wide: Pedestrian/Bicycle Facilities	<ul style="list-style-type: none"> <li>Improve safety along the Corridor by providing pedestrian and bicycle facilities, separating movements, and providing a more cohesive environment.</li> <li>Improve connectivity to cultural resources along the Corridor.</li> <li>Provide pedestrian and bicycle connections to all proposed retail sites along the Corridor.</li> </ul>	3	Construction: \$420,000 ROW: \$100,000/acre
Corridor-Wide: Transit	<ul style="list-style-type: none"> <li>Improve transit amenities along the Corridor to provide improved service to proposed redevelopment sites and existing cultural resources.</li> <li>Increase the attractiveness and usability of the existing transit system.</li> </ul>	3	Construction: \$50,000
Trailblazing/ Streetscaping	<ul style="list-style-type: none"> <li>Provide a more cohesive environment along the Corridor.</li> </ul>	3	Construction: \$50,000
<b>Total Order of Magnitude Cost Estimate</b>			Constr: \$3.0 mil ROW***: \$60,000

\*Accommodations for turning trucks must be considered during the design of the recommended improvements.

\*\*Signal timing enhancements from NJDOT. \*\*\* Does not include ROW/easements for multi-use path. ROW = Right-of-Way Cost; LOS = Level of Service