5 Objectives and Recommendations

5.1 Introduction

This chapter recommends strategies and improvements to address the infrastructure, land use, transit service, and other study area station access gaps and opportunities that were identified in the previous chapters of this report. Strategies and improvements are proposed to meet the existing and future needs. These recommendations are provided on a topic, station, and corridor basis as well as being arrayed by an implementation timeframe.

A supplementary strategy, related to transit-oriented development and its potential to fund parking infrastructure in the three study area municipalities, is provided in Section 5.8 of this chapter. This alternative strategy is intended to provide the study area stakeholders with a potential, conceptual vision of how transit-oriented development might be approached in this corridor to attract investment and fund additional parking infrastructure.

Many recommendations can be implemented by a single municipality while others would require the collaboration of multiple local, regional, and statewide organizations. Implementing a single strategy alone will not meet all of this study area's future access needs. Only a combination of solutions, with a partnership between the study area municipalities, could result in a lasting and well-managed approach to station access.

5.2 Summary of Needs

The previous report chapters identified the study area's needs (problems that require solutions) and opportunities (conditions that might enable solutions).

These were developed based upon field and other data collection, stakeholder outreach, and technical analyses. They are summarized in Table 5-1.

Table 5-1: Study Area Needs and Opportunities

Need (N) or Opportunity (O)	Item	Found in Previous Report(s) from Task	Technical Area
O	Chatham and Madison station areas are already Transit-Oriented Development (TOD) environments	4	Land Use
O	Corridor properties are not developed to their maximum land value indicating potential for "spot" redevelopment in a TOD manner	4	Land Use
O	The corridor real estate market shows traditional, strong demand	4	Land Use
N	Demographics indicate the apartment and condominium housing are needed for the growing young and senior age groups	4	Land Use
N	Existing ridership analyses show a deficit of 121 parking spaces in the corridor	5	Parking
N	Future ridership analyses show the potential for an additional deficit of 250-500 parking spaces in the corridor	5	Parking
N	Primary access mode is drive and park	3,5	Parking
N	Few non-residents park at the stations; highest demand is from Harding, Florham Park, and Whippany	3	Parking
N	Parking turnover at the stations is minimal; each space can only be used once per day	6	Parking
O	Convent Station currently has parking vacancy	6	Parking
N	Chatham and Madison station parking is utilized at capacity (permit and daily)	6	Parking
O	Non-official parking is used by 4% of the parkers at the stations	3	Parking
N	Satellite parking lots are not well used	6	Parking
N	Parking payment infrastructure is outdated	6	Parking
N	The existing bus and MAD shuttle service are not effective feeders to the train; there are currently no transit-based feeders at these stations	6	Transit
N	Forecast rail ridership growth is primarily for eastbound riders, though NJ TRANSIT has received increased requests for bus distributors for westbound riders.	3,5	Transit
N	Chatham, Madison, and Convent stations are each in a different rail fare zone which may affect parking choice	6	Transit
N	Students and staff at the study area universities are not well-informed about the rail system	3	Transit
N	There is no efficient location (or official Kiss and Ride) to drop off passengers at Chatham or Madison Station	6	Non-parking access

Table 5-1: Study Area Needs and Opportunities

Need (N) or Opportunity (O)	Item	Found in Previous Report(s) from Task	Technical Area
O	20 percent of train boarders access the three stations without parking	3	Non-parking access
N	Signals along NJ 124 are not coordinated	6	Roadway
N	Congestion on NJ 124 is exacerbated by parking maneuvers and discontinuous streets	6	Roadway
N	Queues behind vehicles waiting to make left turns from combined left/through lanes add to congestion on NJ 124	6	Roadway
N	Pedestrian-auto interface on NJ 124 contributes to congestion and delay	6	Roadway
N	Sight distance around the rail trestle at Punch Bowl Road near Convent Station is limited	6	Roadway
N	Unsignalized intersections create congestion on some side streets that intersect NJ 124	6	Roadway
N	Mid-block pedestrian crossings are needed in Chatham and Madison	6	Pedestrian
N	Lighting and sidewalk maintenance is insufficient in station areas	6	Pedestrian
N	Gaps exist in the walk paths to the stations	6	Pedestrian
O	Several traffic calming and pedestrian safety amenities exist in the corridor	6	Pedestrian
N	Traction Line trail does not provide good connectivity between municipalities	6	Pedestrian
N	Current bike facilities are worn or non-standard	6	Bicycle
N	Chatham does not have a bicycle plan	6	Bicycle
N	Bike lockers and racks at stations are fully utilized and there is unmet demand; some are poorly located	3, 6	Bicycle
N	NJ 124 is not well-marked as a bicycle facility	6	Bicycle
N	Current bicycle maps and information are not up to date or accurate	6	Bicycle
N	Gaps exist in the study area bicycle network	6	Bicycle
N	Some roadway, bicycle, and pedestrian signs in the corridor are not compliant with standards	6	Safety

Today, a deficit of approximately 125 spaces of available commuter parking exists in the NJ 124 study corridor (Chatham, Madison, and Convent stations combined). This deficit is primarily attributed to commuters' preference to access the rail line in Chatham first, followed by Madison, and the increasing demand for transit service; parking is not filled to capacity at Convent Station. By 2020, if this current deficit is not addressed, and should NJ TRANSIT restore previously eliminated service and provide expanded service to Hoboken, there will be a significant deficit of approximately 500 available commuter parking spaces in the study area. The improvements described herein are therefore not only intended to provide for safer and more efficient access to the rail stations by all modes, they are also intended to reduce the existing and potential future parking deficit by encouraging access to the station by modes that do not require parking (pedestrian, bicycle, carpool, kiss and ride, transit) while also providing options for adding parking.

5.3 Recommended Improvements

Recommended improvements are provided on corridor-wide and station-specific levels. Table 5-2 lists all of the recommended improvements, numbered by location and implementation timeframe, and classified by improvement type. Table 5-2 corresponds with Figures 5-1 through 5-3. Corridor-wide improvements are not mapped on these figures. The following sections present a description of each improvement.

Table 5-2 - Summary of Recommended Improvements

Map Number	Improvement ID	Improvement	Specific Location	Associated NJ TRANSIT Station	Area of Improvement					Implementation Period	Cost
					Roadway	Parking	Bike/Ped	Safety	Transit	Short - <1 Year	Low - <$25,000 per item
										Medium - <3 Years	Medium $25,000 - $100,000 per item
										Long ->3 Years	Above $100,000 per item
N/A		Improve mapping for all modes			X	X	X		X	Short	Low
N/A		Enhance on-line information			X	X	X		X	Medium	Medium
N/A		Create Preferential parking strategies (carpools etc)				X			X	Medium	Medium
N/A		Create Transit information packages for colleges and universities							X	Short	Low
N/A		Consolidate NJ TRANSIT fare zones							X	Medium	Medium
N/A		Conduct Operation Lifesaver training at area universities and Convent station							X	Short	Low
N/A		Improve train station pedestrian access maintenance (snow removal, other maintenance issues)					X		X	Short	Low
N/A		Adopt a complete streets policy (Borough of Madison & Morris Township)			X	x	X	X	x	Short	Low
N/A		Create a bicycle sharing program with coordinated bicycle maintenance					X			Medium	Medium
N/A		Install enhanced wayfinding and bicycle route signage					X			Short	Low
N/A		Make signage and markings for pedestrians and bicyclists at all three stations consistent with MUTCD and AASHTO Bicycle Guide			X		X	X		Short	Low
N/A		Stripe advanced stop bars eight to ten feet from crosswalks in pedestrianized areas.		Corridor-Wide	X		X	X		Short	Low
N/A		Create bicycle markings and signage along the shoulders of NJ 124		Chatham Station			X			Medium	Low
N/A		Restripe all other bike routes and stencils that are faded and barely visible in Madison	Multiple Locations	Madison Station			X			Short	Low
N/A		Develop a bicycle master plan	Chatham Borough				X			Medium	Medium
Ch - 1	a	Restripe the eastbound and westbound approaches	NJ 124 & Hillside Ave.		X					Short	Low
	b	Modify the signal timing			X						
Ch - 2	a	Provide Signal Timing offsets to coordinate traffic signals	NJ 124 in Chatham		X					Short	Medium
Ch - 3	a	Restripe the eastbound and westbound approaches	NJ 124 & Passaic Ave.		X					Short	Low
	b	Modify the signal timing			X						
	c	Install signage to increase the “no turn on red restrictions”			X		X	X			
	d	Remove “State Law: stop for pedestrians in crosswalk sign”			X		X	X			
	e	Install “Turning Vehicles Yield to Pedestrians” sign			X		X	X			
	f	Install advanced pedestrian or school crosswalk signage on all approaches of the intersection			X		X	X			
	g	Install “Share the Road” bicycle signs			X		X				
Ch-4	a	Add a pedestrian crosswalk	NJ 124 & Washington Ave.				X			Short	Low
Ch-5	a	Restripe the westbound approach of the intersection	NJ 124 & Fairmount Ave.		X					Short	Low
	b	Modify the signal timing			X						
	c	Install signage to increase the “No Turn on Red” restrictions to all hours and days and add this restriction to westbound and southbound approaches of the intersection			X		X	X			
	d	Remove “State Law: stop for pedestrians in crosswalk sign”			X			X			
	e	Install “Turning Vehicles Yield to Pedestrians” sign			X			X			
	f	Install “Share the Road” bicycle signs			X		X				
Ch-6	a	Conduct a signal warrant study at this interesection, if signal is not warranted, repair pedestrian warning flashers and install “State Law: Stop for Pedestrians in Crosswalk” signage	NJ 124 & Coleman Ave./Railroad Plaza North		X		X	X		Short	Low
Ch-7	a	Conduct a signal warrant study	Fairmount Ave and Station Driveway	Chatham Station	X					Short	Low

Table 5-2 - Summary of Recommended Improvements

Map Number	Improvement ID	Improvement	Specific Location	Associated NJ TRANSIT Station	Area of Improvement					Implementation Period	Cost
					Roadway	Parking	Bike/Ped	Safety	Transit	Short - <1 Year	Low - <$25,000 per item
										Medium - <3 Years	Medium $25,000 - $100,000 per item
										Long ->3 Years	Above $100,000 per item
	a	Install a “No Turn on Red” sign			X		X	X		Short	Low
	b	Remove "Stop for pedestrians in crosswalk sign" and replace with "Turning Vehicles Yield to Pedestrians"			X		X	X			
Ch-8	c	Install a "Share the Road" sign at this intersection	Lafayette and Van Doren Avenues		X		X	X			
	a	Replace “Stop for Pedestrians in Crosswalk” sign with “Turning Vehicles Yield to Pedestrians”			X		X	X		Short	Low
	b	Install “Share the Road” bicycle signage on all approaches of the intersection			X		X	X			
	c	Install new crosswalks on north and south legs of the intersection			X		X				
Ch-9	d	Install "State Law: Stop for Pedestrians in Crosswalk" at intersection	Fairmount Ave and Watchung Ave		X		X				
Ch - 10	a	Install ped ramps on the north and south legs of the intersection	Fairmount Ave and Watchung Ave		X		X			Medium	Medium
Ch - 11	a	Install shared lane markings/sharrows	Fairmount Ave and Red Road		X		X			Short	Low
Ch - 12	a	Install a street-light	Fairmount Ave and Red Road		X		X			Medium	Medium
	a	Install a crosswalk at the south leg of the intersection			X		X	X		Short	Low
	b	Install an advanced pedestrian or school crosswalk signal on all approaches of the intersection			X		X	X			
	c	Install an advanced pedestrian or school crosswalk signal on all approaches of the intersection			X		X	X			
Ch - 13	d	Install shared lane markings/sharrows or parking lane stripes	Fairmount Avenue and 2nd Street		X		X	X			
Ch - 14	a	Install pedestrian ramps at all four corners of the intersection	Fairmount Avenue and 2nd Street				X	X		Medium	Medium
	a	Repair the speed feedback sign			X			X			
Ch - 15	b	Install shared lane markings/sharrows	North Passaic Avenue and Weston Avenue		X		X			Short	Low
Ch - 16	a	Implementation of the Morris County bike map, which includes Fairmount and Watchung Avenues as shared facilities and NJ 124 as a bicycle route	Fairmount and Watchung Avenues				X			Medium	Medium
Ch - 17	a	Develop bicycle facilities	Kings Road and Woodland Road				X			Medium	Medium
Ch - 18	a	Monitor bike facilities to ensure adequate supply	Chatham Station				X			Short	Low
Ch - 19	a	Create a pedestrian and bicycle connection across the sports field south of the station to the driveway to connect to Lum Avenue	Chatham Station				X		X	Medium	Medium
Ch - 20	a	Add coordinated pedestrian signal and lighted crosswalks under the railroad trestle	Various Locations				X			Medium	Medium
Ch - 21	a	Install two additional electronic pay parking stations	Chatham Station Parking Lot			X				Medium	Medium
Ch - 22	a	Provide additional signage to highlight commuter parking availability at nearby municipal lots for Chatham permit holders	Chatham Station Parking Lot			X				Short	Low
Ch - 23	a	Create a new parking lot adjacent to Lot 1 on the site of the athletic field	Chatham Station Parking Lot			X				Long	High
Ch - 24	a	Construct a three-level parking structure on the site of existing lot 1	Chatham Station Parking Lot			X				Long	High
Ch - 25	a	Create two shuttle bus routes at Chatham Station, serving the northern and southern part of the town	Various Locations	Chatham Station					X	Medium	High
	a	Restripe the eastbound and westbound approaches of the intersection			X						
	b	Modify the intersection signal timing			X						
	c	Install pedestrian signals or school crosswalk			X		X	X			
	d	Install “Turning Vehicles Yield to Pedestrians” and "No Turn on Red" at all approaches			X		X	X			
Ma - 1	e	Install “Share the Road” signage on all approaches of the intersection	NJ 124 and Rosedale Avenue/Cross Street	Madison Station	X		X	X		Short	Low

Table 5-2 - Summary of Recommended Improvements

Map Number	Improvement ID	Improvement	Specific Location	Associated NJ TRANSIT Station	Area of Improvement					Implementation Period	Cost
					Roadway	Parking	Bike/Ped	Safety	Transit	Short - <1 Year	Low - <$25,000 per item
										Medium - <3 Years	Medium $25,000 - $100,000 per item
										Long ->3 Years	Above $100,000 per item
	a	Create eastbound and westbound turn lanes			X						
	b	Add southbound left turn signal phase			X						
Ma - 2	c	Add signal actuation for left-turn movements with pedestrian projection	NJ 124 and Greenwood Avenue/Prospect Street		X					Short	Low
Ma - 3	a	Add pedestrian crosswalk and signal across NJ 124	NJ 124 between Greenwood Avenue and Waverly Place		X		X	X		Medium	Medium
	a	Create eastbound and westbound turn lanes			X						
	d	Install “Turning Vehicles Yield to Pedestrians” and advanced pedestrian signage at all approaches of the intersection			X		X	X			
Ma - 4	e	Install “Share the Road” signage at all approaches of the intersection	NJ 124 and Central Avenue/Waverly Place		X		X	X		Short	Low
Ma - 5	a	Add mid-block pedestrian crossing including crosswalk and signage	NJ 124 between Waverly Place/Central Avenue and Green Village Road		X		X	X		Medium	Medium
Ma - 6	a	Add signal actuation for left turn movements with pedestrian protection at intersection	NJ 124 and Central Avenue/Waverly Place		X					Medium	Medium
Ma - 7	a	Modify the intersection signal timing	NJ 124 and Park Avenue		X					Short	Low
	a	Modify the intersection signal timing			X						
	b	Install a west crosswalk advanced pedestrian or school crosswalks and “Turning Vehicles Yield to Pedestrians” signage on all approaches of the intersection			X		X	X			
Ma - 8	c	Install “No turn on red” restrictions on eastbound and northbound approaches of the intersection	NJ 124 and Kings Road		X		X	X		Short	Low
	a	Install pedestrian signals and ramps on all approaches of the intersection									
Ma - 9	b	Extend the bike lanes on NJ 124 through the intersection of the intersection	NJ 124 and Kings Road				X			Medium	Medium
	a	Install crosswalks on the east and west legs with advanced pedestrian or school crosswalk signage on all approaches of the intersection			X		X	X			
Ma - 10	b	Install “State Law: Stop for Pedestrians in Crosswalk”	NJ 124 and Alexander Avenue		X		X	X		Short	Low
	a	Install bike lanes			X		X			Medium	Medium
Ma - 11	b	Install pedestrian signals and ramps on all approaches of the intersection	NJ 124 and Alexander Avenue		X		X			Medium	Medium
	a	Install a north crosswalk			X		X	X			
	b	Install an advanced school crosswalk sign			X		X	X			
	c	Install a “State Law: Stop for Pedestrians in Crosswalk” on the southbound approach			X		X	X			
Ma - 12	d	Install a “share the Road” sign on all approaches of the intersection	Central Avenue and Brittin Street		X		X	X		Short	Low
	a	Install a north crosswalk	Greenwood Avenue and Brittin Street		X		X	X		Short	Low
Ma - 13	b	Remove bike lane markings and install “Share the Road” signs or sharrows. On Street parking should also be prohibited.	Greenwood Avenue and Brittin Street		X		X	X		Short	Low
Ma - 14	a	Install pedestrian ramps on the north side								Medium	Medium
Ma - 15	a	Relocate the share the road sign to improve its visibility	Greenwood Avenue north of NJ 124				X	X		Short	Low
Ma - 16	a	Install a bicycle actuated signal	Danforth Road and NJ 124				X			Medium	Medium
	a	Remove the “State Law: Stop for Pedestrians in Crosswalk” sign and replace with “Turning Vehicles Yield to Pedestrians in Crosswalk”					X	X			
	b	Implement “No Turn on Red” restrictions on the northbound, southbound, and westbound approaches of the intersection			X		X	X			
	c	Install a “Share the Road” sign at all approaches of the intersection			X		X	X			
Ma -17	d	Install advanced pedestrian or school crosswalk on all approaches	Kings Road and Waverly Place	Madison Station	X		X	X		Short	Low

Table 5-2 - Summary of Recommended Improvements

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					Roadway	Parking	Bike/Ped	Safety	Transit	Short - <1 Year	Low - <$25,000 per item
										Medium - <3 Years	Medium $25,000 - $100,000 per item
										Long ->3 Years	Above $100,000 per item
	a	Install streetlights at the north, east and west crosswalks	Kings Road and Waverly Place				X			Medium	Medium
Ma - 18	b	Install a west pedestrian ramp	Kings Road and Maple Avenue				X			Medium	Medium
	a	Install a west crosswalk			X		X	X			
	b	Install a "State Law: Stop for Pedestrians in Crosswalk"			X		X	X			
Ma - 19	c	Move the pedestrian crossing across Kings Road to improve connectivity	Kings Road and Maple Avenue		X		X			Short	Low
	a	Remove "Yield to Pedestrians in Crosswalk"			X		X	X			
	b	Install a west crosswalk			X		X				
	c	Install "Turning Vehicles Yield to Pedestrians"			X		X	X			
	d	Install advanced pedestrian or school crosswalk signage			X		X	X			
	e	Add "No Turn on Red" restrictions on all approaches			X		X	X			
Ma - 20	f	Install "Share the Road" signs on all approaches	Park Avenue and Ridgedale Avenue		X		X	X		Short	Low
Ma - 21	a	Install west pedestrian ramps and signals	Park Avenue and Ridgedale Avenue		X		X			Medium	Medium
Ma - 22	a	Install crosswalks, and advanced pedestrian signage on all approaches	Park Avenue and Kinney Street		X		X	X		Short	Low
Ma - 23	a	Install pedestrian ramps on all approaches	Park Avenue and Kinney Street		X		X			Medium	Medium
Ma - 24	a	Extend existing bike routes on Kings Road, Green Village Road, Green Avenue, Prospect Street, Central Avenue, and Greenwood Avenue to the NJ Transit Station	Multiple Locations				X			Medium	Medium
	a	Replace bike markings east of downtown	NJ 124				X				
Ma - 25	b	Restripe all bike stencils and install "Share the Road" signs west of downtown	NJ 124				X			Short	Low
Ma - 26	a	Extend the Traction Line recreation trail to Madison	Multiple Locations				X			Long	High
Ma - 27	a	Improve pedestrian lighting on NJ 124 between Madison Station and Drew University	Multiple Locations				X	X		Medium	Medium
	a	Reduce Speed Limit to 25 MPH						X			
	b	Install advance pedestrian or school crosswalk signage on all approaches			X		X				
	c	Add: "State Law: Stop for Pedestrians in Crosswalk" signage			X		X				
Ma - 28	d	Install "Share the Road signage on all approaches	Central Avenue and Elmer Street/Cook Avenue		X		X			Short	Low
Ma - 29	a	Relocate the station bicycle lockers from their remote location	Madison Station				X			Short	Low
	a	Improve the pedestrian experience along Kings Road from the parking lot, including wider sidewalks and additional pedestrian lighting	Madison Station				X				
Ma - 30	b	Install three to four electronic pay parking stations at Lot 3	Madison Station			X				Medium	Medium
	a	Construct a multi-level parking facility on the site of existing Lot 3	Madison Station			X					
Ma - 31	b	Create a formal kiss-and-ride location on the eastbound side of the station	Madison Station			X				Long	High
Ma - 32	a	Create four shuttle bus route serving Madison Station	Various Locations	Madison Station				X		Medium	High

Table 5-2 - Summary of Recommended Improvements

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										Medium - <3 Years	Medium $25,000 - $100,000 per item
										Long ->3 Years	Above $100,000 per item
	a	Modify the intersection signal timing	NJ 124 and Convent Road		X						
Co - 1	b	Correct and clarify the mismatched sidewalks and crosswalks	NJ 124 and Convent Road		X		X	X		Short	Low
Co - 2	a	Install new pedestrian signals with countdown timers	NJ 124 and Convent Road		X					Medium	Medium
	a	Conduct a signal warrant study and safety assessment			X						
	b	Assess the effect of restricting left turns from westbound Old Turnpike Road to southbound Punch Bowl Road			X						
	c	Relocate the existing south crosswalk to the intersection			X		X				
Co - 3	d	Install bike lanes or “Share the Road” signage	Old Turnpike Road and Punch Bowl Road		X		X	X		Short	Low
Co - 4	a	Install new traffic signal, realign the northbound approach, and reconstruct the bus turnouts	NJ 124 and Punch Bowl Road		X				X	Long	High
Co - 5	a	Install a pedestrian ramp on the south leg of the southwest corner and install crosswalk	Old Turnpike Road and Punch Bowl Road		X		X	X		Medium	Medium
	a	Install sidewalk on the east side of the south and north legs, on the west side of the north leg, and on the north and south sides of the west leg of the intersection			X		X	X			
	b	Install pedestrian ramps on all approaches			X		X	X			
Co - 6	c	Install sidewalks and other pedestrian amenities	Old Turnpike Road and Convent Road				X			Medium	Medium
	a	Install crosswalks on all four legs			X		X	X			
	b	Install advanced pedestrian signage on all approaches									
	c	Place the eastbound approach under stop control			X			X			
Co - 7	d	Install “Share the Road” signs on all approaches	Old Turnpike Road and Convent Road		X		X	X		Short	Low
Co - 8	a	Extend the bike lane beyond the border of Madison Borough and Morris Township	NJ 124				X			Medium	Medium
Co - 9	a	Create a bike route between the Traction Line Recreation Trail and NJ 124	Convent Road				X			Medium	Medium
Co - 10	a	Implement a bike connection from NJ 124 to Woodlawn Avenue and the Loantaka Reservation	Various Locations				X			Medium	Medium
Co - 11	a	Install bike markings and signage	Old Turnpike Road				X			Short	Low
Co - 12	a	Install a bike route and sidewalks	Punchbowl Road				X			Long	High
Co - 13	a	Provide a direct connection between Convent Station and Park Avenue through the College of St. Elizabeth	Various Locations				X			Long	High
Co - 14	a	Restripe the bike stencils south of Convent Station	Woodlawn Avenue				X			Short	Low
Co - 15	a	Eliminate the stairs along the trail	Traction Line Recreation Trail and Normandy Parkway				X			Medium	Medium
Co - 16	a	Add additional bike lockers	Convent Station				X			Short	Low
Co - 17	a	Create an additional bike/ped connection	Traction Line Recreation Trail and Pilgrim Court/Constitution Way	Convent Station			X			Medium	Medium

Table 5-2 - Summary of Recommended Improvements

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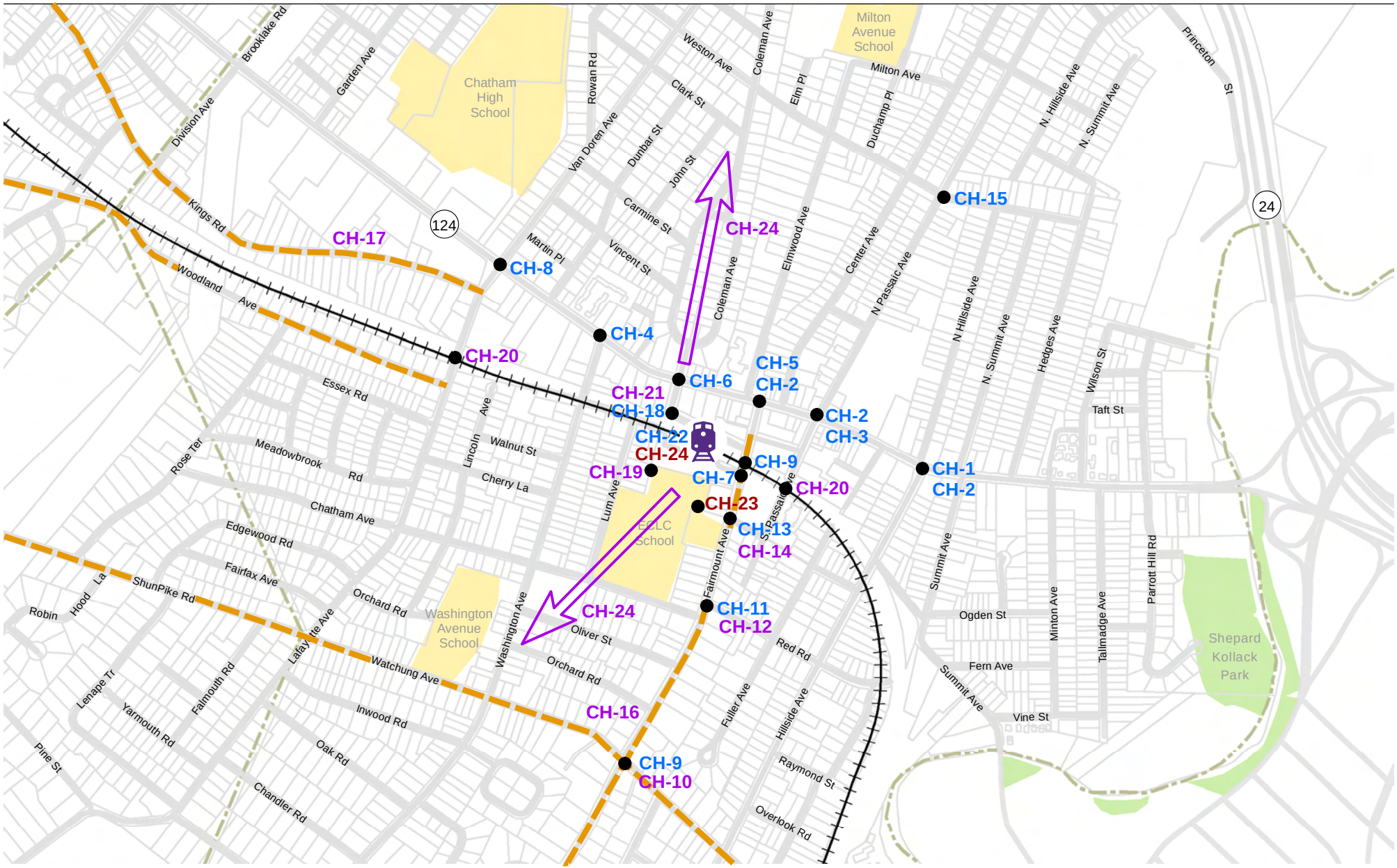
					Roadway	Parking	Bike/Ped	Safety	Transit	Short - <1 Year	Low - <$25,000 per item
										Medium - <3 Years	Medium $25,000 - $100,000 per item
										Long ->3 Years	Above $100,000 per item
Co - 18	b	Improve lighting between the station and the Fairleigh Dickinson campus	Convent Station				X			Medium	Medium
	a	Connect the two segments of the sidewalk at the west end of the parking lot.	Convent Station				X				
Co - 19	b	Review and simplify parking regulations	Convent Station			X				Short	Low
Co - 20	a	Conduct a review of resident and non-resident waiting lists to possibly re-allocate spaces	Convent Station			X				Medium	Medium
Co - 21	a	Construct a multi-level parking structure on the site of Lot 1	Convent Station			X				Long	High
Co - 22	a	Create two shuttle bus routes at Convent Station, serving the northern and southern part of the town	Various Locations	Convent Station					X	Medium	High



Morris County NJ 124
Transit Access Study

Chatham Station
Proposed Improvements

FIGURE **5-1**

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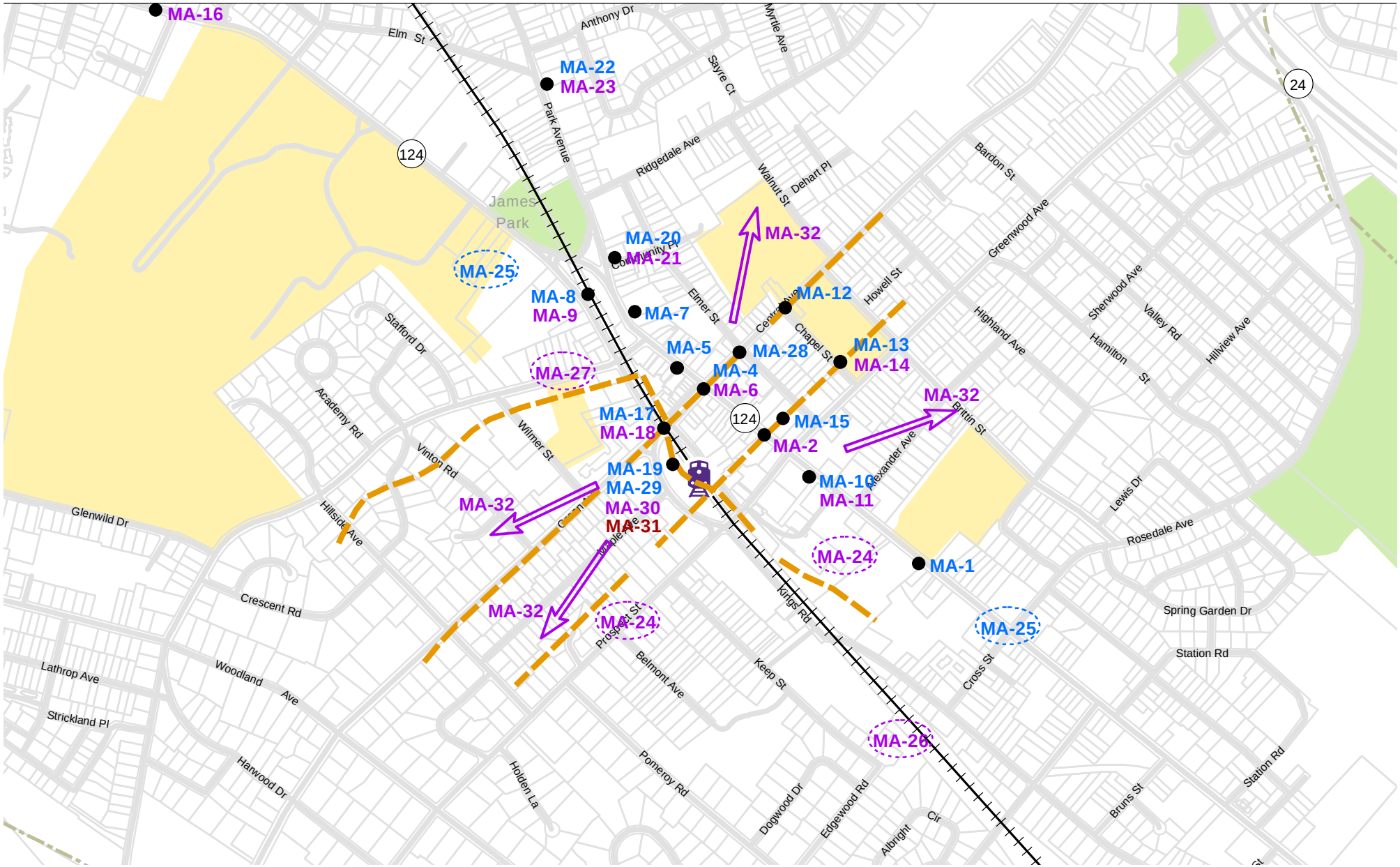

Town Line
Railroad Line
Train Station
School, College or University
Parks

Implementation Period
MA-# Short
MA-# Medium
MA-# Long

New Shuttle Route
New Bike Route
Generalized Area of Improvement
Specific Improvement Location

Morris County NJ 124
Transit Access Study

Madison Station
Proposed Improvements

FIGURE **5-2**

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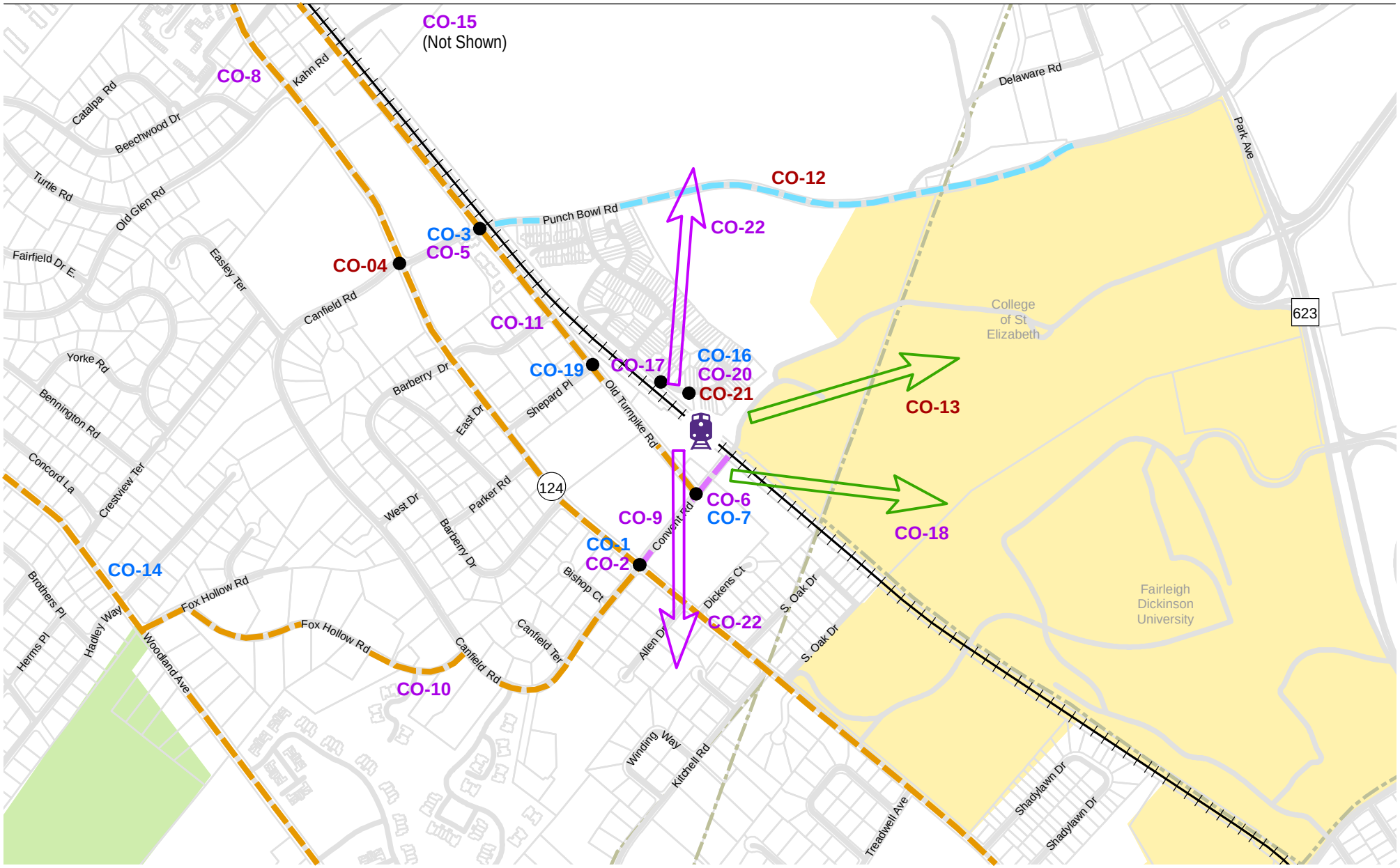


Morris County NJ 124
Transit Access Study

Convent Station
Proposed Improvments

FIGURE **5-3**

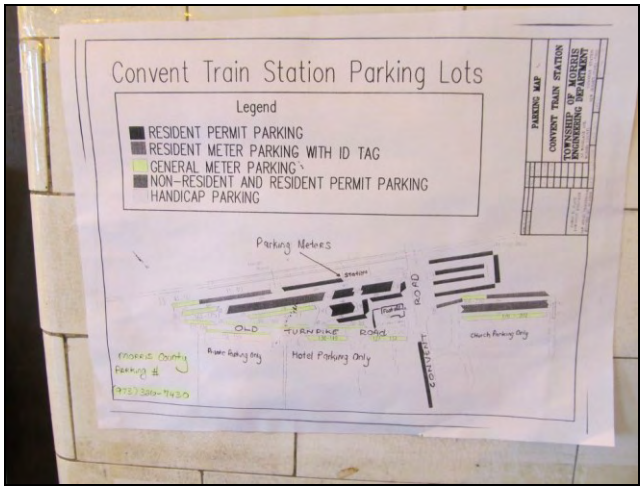
5.3.1 Corridor-wide Improvements

Within the study corridor there is a significant lack of information about the transit system as well as information about system access. It is recommended that the following steps be taken to improve awareness of the transit system and also encourage non-automotive access to the stations.

5.3.1.1 Mapping at Chatham, Madison, and Convent Stations

To improve access by non-automotive modes it is recommended that each station display professional and accurate maps that show safe and designated pedestrian and bicycle routes in the station area. Resource phone numbers and web links should be displayed so patrons can gain information on parking permits, bicycle locker rental, and carpool formation. Maps and schedules of connecting bus routes should also be displayed in areas of the station that are accessible even when the station building is closed. In addition, a permanent and official parking lot layout map should be provided at each station to convey guidance as to where permit, daily, and other parking are permitted. These maps should be coordinated with the County, municipalities, and TransOptions (the Transportation Management Association for Morris County), so that they are also available on-line. Figure 5-4 displays the current approach to conveying station parking information at Convent Station.

Figure 5-4: Temporary Parking Map at Convent Station

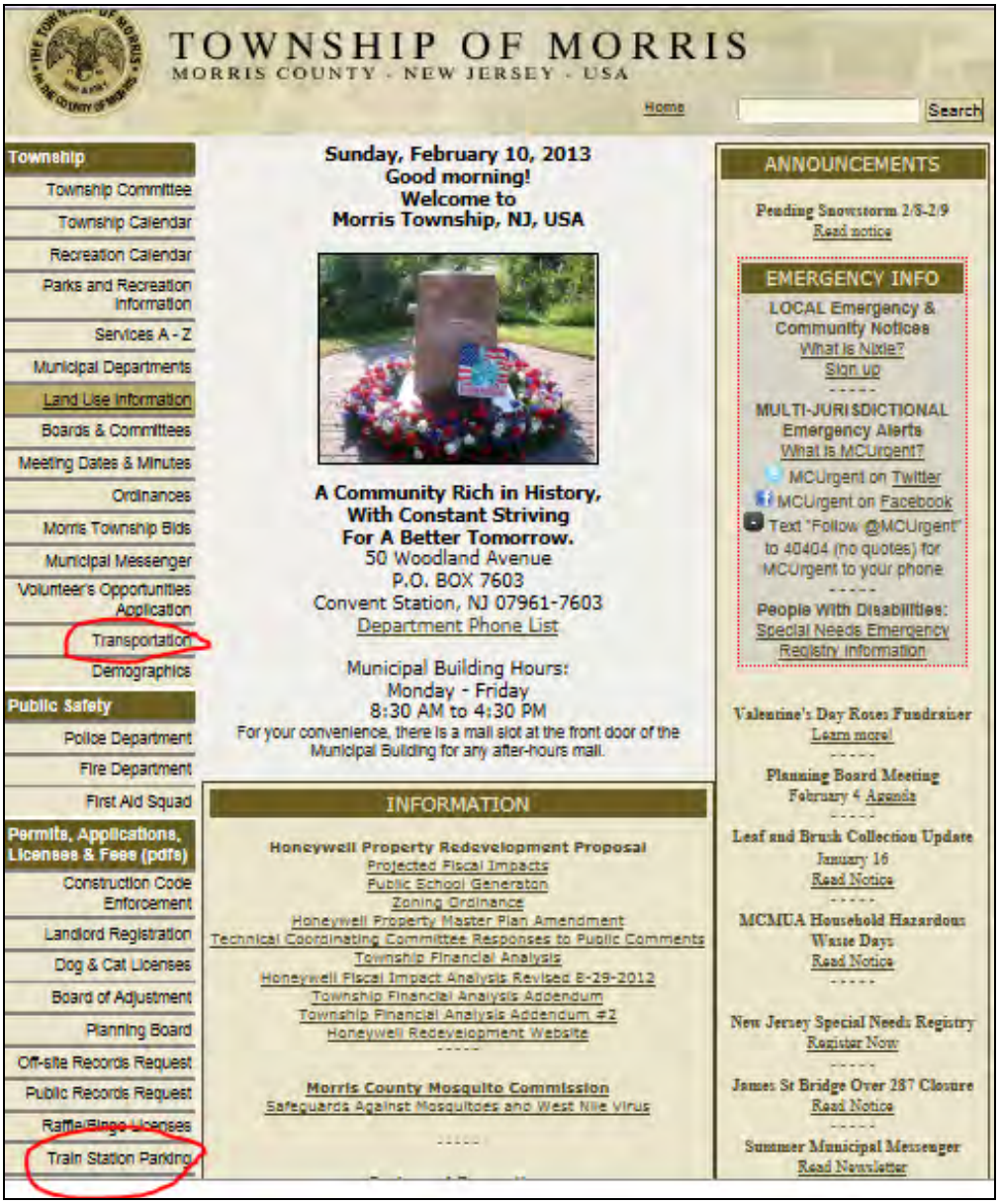


5.3.1.2 Enhanced On-Line Information

It is recommended that Chatham and Madison Boroughs improve on-line access of transit and parking permit data. Of the three municipalities, Morris Township currently has the most comprehensive information available on-line, including how to get a parking permit, links to transit schedules, and other information directly accessible via their municipal home page (Figure 5-5). Some information is provided on Chatham and Madison Boroughs' websites, but finding the data is not intuitive or comprehensive. While links are provided to the TransOptions website, direct links to carpool and bicycle/ pedestrian resources should be provided on the municipal websites.

Reverse peak riders alighting at Convent Station have the ability to park overnight at Convent Station (the station with the most reverse commuters; though NJ TRANSIT notes that peak commuters represent the vast majority of rail riders in this corridor). Reverse peak commuters can purchase a non-resident monthly parking permit at Convent Station, if non-resident permits are available, and park their automobiles overnight at the station (overnight parking is permitted). These commuters can ride the train to the station daily and use their personal automobiles to complete the last segment of their commutes to work. Improved communication about this policy is encouraged.

Figure 5-5: Township of Morris Home Page with Direct Transportation and Parking Links



5.3.1.3 Preferential Parking Strategies

As described in Chapter 2, all of the permit and daily parking spaces are filled daily at Chatham and Madison stations. This indicates strong demand for both permit and daily parking at these stations and therefore no recommendations are provided to change the mix of permit versus daily parking. Per information gathered through this study's surveys, station parkers typically arrive in single-occupant vehicles, though some carpool activity was reported. To encourage station access by alternative (non-single occupant automobile) modes, it is recommended that each municipality (including Morris Township) reserve a few permit spaces for carpools of two or more people, or for bicyclists and pedestrians who may need to drive to the station one day of the week. Commuters eligible for the daily permits for these preferred spots (located closer to the station entrance) would be required to register their carpool/ bicycle/ pedestrian usage with the municipality or TransOptions, and display their permit when parked (carpoolers would be required to display at least two or more carpool parking permits, bicyclists may need to be bicycle locker renters, pedestrians could be required to have permits for a specific day of the week). This flexibility to park at the station once per week could attract more people to bicycle and rent lockers at the stations, for instance. Consideration could also be given to providing lower fees (for daily permits) to parkers who primarily commute by carpool or non-automotive modes.

5.3.1.4 Transit Information Package for Colleges and Universities

Interviews with representatives of the three study area's colleges and universities, Fairleigh Dickinson University, Drew University, and the College of Saint Elizabeth, revealed that the majority of their commuting students and staff arrive at their campuses by automobile. Minimal transit usage by this population was reported and a potential cause is the lack of accessible information and the timing of information sharing. Information should be shared at the beginning of the school year when new students arrive. Each college representative recommended that NJ TRANSIT prepare a student guide for accessing transit that could be provided during new student orientation. In addition, they encouraged NJ TRANSIT to be present on campus with a booth during move-in days, parent's weekends, and orientation events so that the parents of the students could become knowledgeable about transit access to campus, and even purchase transit tickets or passes for the students. In addition, it was recommended that NJ TRANSIT reinstitute their previous "free trial week" program for students to give the students an opportunity to experience how simple it is to use transit. Reduction of single-

occupancy vehicle travel to the local educational institutions would improve mobility throughout the study area.

5.3.1.5 Consolidation of NJ TRANSIT Fare Zones

This study's surveys and analyses have shown that Chatham Station is the most popular of the three stations to park and access the Morristown Line. Eastbound commuters, those typically traveling to Newark and New York City, generally prefer boarding at the eastern-most station if access to more than one station is relatively equal. However, the preference for Chatham Station could also be influenced by the fact that NJ TRANSIT Chatham fares are lower than fares at Madison and Convent Stations. Each station within this study area is in a different NJ TRANSIT fare zone, despite the fact that they are all within a few miles of each other. Of the three stations, Convent Station currently has available parking while complaints accumulate over the lack of daily parking at Chatham or Madison stations. Treating the stations equally in terms of fare would help to encourage more even usage of the three stations by residents in the study area. It is recommended that NJ TRANSIT study the effect of Chatham, Madison, and Convent station fare zone consolidation.

5.3.1.6 Operation LifeSaver at Study Area Universities and Convent Station

The presence of an at-grade rail/ roadway crossing at Convent Station represents a potential safety concern. Public feedback gathered during this study indicates that commuters and students duck under lowered crossing gates to access the other side of the rail line at Convent Station. Operation Lifesaver is a non-profit organization that provides public information on safety at and around rail lines. Their network of certified volunteers could be engaged to provide safety materials and education workshops at the study area's educational institutions and at Convent Station. In addition, each municipality should provide a link to Operation Lifesaver's website and Facebook page on their municipal websites.

5.3.1.7 Improved Train Station Pedestrian Access Maintenance

Pedestrian access and amenities at the NJ TRANSIT stations are in good condition. To ensure pedestrian comfort and access, attention to maintenance is important, such as snow removal along sidewalks leading to the station and ensuring lighting fixtures are working at all nighttime hours. Public feedback has indicated that the lack of attention to such maintenance discourages pedestrian access.

5.3.1.8 Complete Streets Policy Development

One overarching recommendation would be for the Borough of Madison and the Township of Morris to adopt a Complete Streets policy (Chatham Borough has already adopted one) that could support the development of increased multi-modalism. Instituting a Complete Streets policy formalizes a community's intent to plan, design, and maintain streets that are safe for all users of all ages and abilities – including bicyclists, transit vehicles and riders, and pedestrians, as well as vehicles. Complete Streets can be achieved in a variety of ways: adoption of resolutions or ordinances; rewriting design manuals; inclusion in comprehensive plans. Adopting a policy, for example, would set a direction for the community by stating that planners and engineers will build (and reconstruct) roads that are safer for everyone. It is important to note that Complete Streets does not mean that all streets have to accommodate all modes (one size does not fit all), but that all users will be equally considered. More information on Complete Streets can be found at www.smartgrowthamerica.org/ complete-streets. In 2009, the New Jersey Department of Transportation adopted a Complete Streets policy and, according to Smart Growth America, there are over 40 boroughs, towns, and counties in New Jersey that have adopted policies, including the Borough of Chatham and the Town of Morristown.

5.3.1.9 Bike Share Program potentially coordinated with Bicycle Maintenance

Bike share programs are becoming increasingly popular in urban areas and at transit stations. A bike share program provides bicycles for individuals who do not own them. Bike share can be a low-cost community service or a higher-cost public-private venture with a bicycle shop where private bicycle maintenance could also be provided. With the bike share program, bicycles would be provided for free or for an affordable fee for short-distance trips as an

alternative to automobile usage, thereby reducing traffic congestion, noise, and air pollution. Bike share systems have also been cited as a way to solve the "last mile" problem and connect users to public transit networks from their places of employment. Figure 5-6 depicts the popular Capital Bikeshare Program in Washington, D.C. While a bike share program would not reduce parking demand it would improve accessibility from the corridor rail stations to the employment centers located in and adjacent to the study area. It is recommended that a study be conducted to assess the possibility of a bike share program at one of the three stations.

Figure 5-6: Capital Bikeshare in Washington, D.C.

5.3.1.10 Wayfinding and Bicycle Route Signage

Wayfinding signage should be added throughout the study area and along the bicycle routes leading to the station to direct bicyclists, pedestrians, and drivers to the train stations. Wayfinding signage will encourage easier station access and heighten visibility of the transit service. While some NJ TRANSIT signage does exist, it is sparse. This improvement should be coordinated with NJDOT and NJ TRANSIT. Figure 5-7 depicts bike route wayfinding signage.

Figure 5-7: Bicycle Route Wayfinding in Bethlehem, NY

5.3.1.11 Bicycle Lane Markings and Bike Boxes

Pedestrian and bicycle markings on roadways throughout the study area are in need of attention because they are non-existent, faded, or incorrect. Bicycle markings and signage along shoulders of NJ 124 should be created, after a feasibility evaluation, and in compliance with the AASHTO Bicycle Guide and MUTCD (Figure 5-8). A general recommendation to improve pedestrian safety is to stripe advanced stop bars eight to ten feet from crosswalks, at signalized intersections and on the stop-controlled approaches of unsignalized intersections. At the pedestrian and bicycle crash study locations identified in Chapter 2, there are no advanced stop bars. Advanced stop bars are recommended at each location discussed below. Advanced stop bars provide room for bike boxes, which could be added to increase cyclist safety along bicycle routes near stations. See Figure 5-9.

Figure 5-8: Example of a Shared Lane Marking (Class III Bicycle Facility)

Figure 5-9: Bike Box Treatment

5.4 Overview of Station Area Improvements

Site-specific, multi-modal improvements targeted to meet the access and station-based needs in the study area are included in this section. These improvements include recommendations to traffic, pedestrian, and bicycle facilities, as well as transit services along the roadways leading to the stations and recommended improvements to the stations themselves. These proposed improvements are presented by station to facilitate local implementation.

All improvements within this section respond to gaps identified in the existing study area conditions including existing stations, roadways, transit service, and surrounding land uses. An alternate land use scenario has been developed that offers additional opportunities to address the identified station area needs. This Transit-Oriented Development (TOD) scenario is addressed in Section 5.8 of this chapter.

Three of the categories of improvements – Roadway and Intersection, Road Safety Analysis, and Bicycle and Pedestrian – are recommendations targeted to roads and intersections. Each category is introduced separately because there are conditions, general information, and caveats for each. Recommendations, however, have been consolidated as much as possible so that, for example, a single intersection's proposed improvements are presented once in the report.

5.4.1 Roadway and Intersection Improvements

Proposed roadway improvement measures have been developed to address station access constraints for the three rail stations in the study corridor. Most of the proposed improvements are either directly on NJ 124 or are at intersections adjacent to NJ 124 where queuing and signal progression will require considerations for NJ 124. It is presumed that approvals from the New Jersey Department of Transportation (NJDOT) would ultimately be required, regardless of funding sources for the proposed improvements.

Most of the proposed intersection improvements listed herein have been proposed in previous circulation studies conducted on and around NJ 124 within the study area. Those previously recommended measures were assessed for relevance in improving overall mobility and access in the NJ 124 study area. A comparison of the different studies (as well as the other recommendations for this study) was performed to ensure that proposed

intersection improvements do not present conflicts with other recommendations being proposed as part of this study, such as bicycle and pedestrian improvements. In some cases, the roadway or operational improvements identified in other studies are intended to address weekend traffic circulation. These were not considered as part of this NJ 124 study since weekends are not peak periods for rail transit access in this corridor. However, in some cases, those weekend-based improvements were listed as recommendations for this study since the proposed changes in lane configurations and roadway geometry would be in place for all time periods.

The following proposed measures would address roadway mobility and accessibility constraints identified in Chapter 2. However, two mobility impediments/ constraints identified in that report could not be mitigated without additional study due to the potential impacts that would result to surrounding land uses. The first issue identified is the discontinuity of major north-south streets in the center of Chatham Borough which constrains roadway access to Chatham Station for some motorists. Reconfiguration of those intersections would require significant street alterations and use of adjacent private properties. The second issue is the interruption of traffic circulation by motorists parking in the Chatham and Madison village centers during periods of peak commercial activity. While the on-street parking conflicts affect overall study area mobility they do not significantly impact access to the train stations since the majority of station access occurs during the non-peak commercial times.

5.4.2 Road Safety Analysis Improvements

Crash analyses and field investigations presented in Chapter 2 describe roadway safety issues. Although the crash analyses concluded that there are no locations with an average crash rate exceeding one pedestrian or bicycle crash per year, which would indicate a trend of unsafe conditions, signage in the study was found to be inconsistent with the standards in the Manual on Uniform Traffic Control Devices (MUTCD) at the identified pedestrian and bicycle crash locations in the study area. To maintain a high level of pedestrian and biking activity and safety along NJ 124 to and from Chatham and Madison stations, and to grow non-motorized access mode share at Convent Station, improvements to pedestrian and bicycle signage, markings, and infrastructure are recommended.

Specific safety issues and suggested improvements are presented below, along with the implementation time (short, medium, or long-term) and relative cost (low, medium, or high). Costs for specific physical improvements are

discussed in Section 5.6, and potential funding for medium or high cost improvements are discussed in Section 5.7.

5.4.3 Bicycle and Pedestrian improvements

The following recommended improvements address the bicycle and pedestrian station access needs that were identified in Task 6. The implementation of all bicycle routes and infrastructure improvements should be done in compliance with AASHTO's Guide for the Development of Bicycle Facilities (4th edition, 2012), referred to herein as the "AASHTO Bicycle Guide," and the MUTCD. These provide guidance for the implementation of bicycle routes, whether done as bicycle lanes, paved shoulders, or shared with vehicular traffic. The design of bicycle facilities, both along the route and particularly at intersections, must be done carefully with attention to detail, to provide for the safest and most usable routes possible.

5.4.4 Parking Improvements

The recommendations presented herein include short-term parking management strategies, intermediate-term parking capacity expansion proposals, and long-term measures to build parking structures at any of the three stations to accommodate the projected long-term parking shortfall identified for this study corridor in the NJ TRANSIT ridership forecast used in this study. The long-term parking shortfall is projected at approximately 250 to 500 spaces in the combined three-station area.

The proposed parking expansion measures described in this report assess each station's ability to absorb a net gain of the maximum number of potentially needed parking spaces (500) to the extent possible, even though the forecasted demand is distributed across the three stations. The analysis was intended to show what would be required financially in order to have the cost of the entire 500 space corridor parking need captured by a private developer as part of a TOD. The analysis is intended to show that if each individual station could absorb the entire forecasted parking demand, strategies that would result in a shared distribution of the new parking amongst the three stations would therefore also be feasible and result in fewer parking space additions and less of an impact at any individual station. However, structured parking economies of scale (i.e. it is more cost-effective to build a multi-storied garage than several shorter garages) should be considered if strategies are employed to add parking at multiple stations. While the proposed parking improvements are intended to fulfill the entire parking deficit for the corridor, it is likely that this deficit would be partially diminished by implementation of the improvements

to facilitate non-automotive or shared access to the stations that are presented in this report. Considering that each structured parking space costs $20,000,[21] concerted efforts should be made to encourage access by other modes. Ultimately, it is unlikely that high end of the deficit (500 spaces) would need to be met and that the burden would fall to only one municipality.

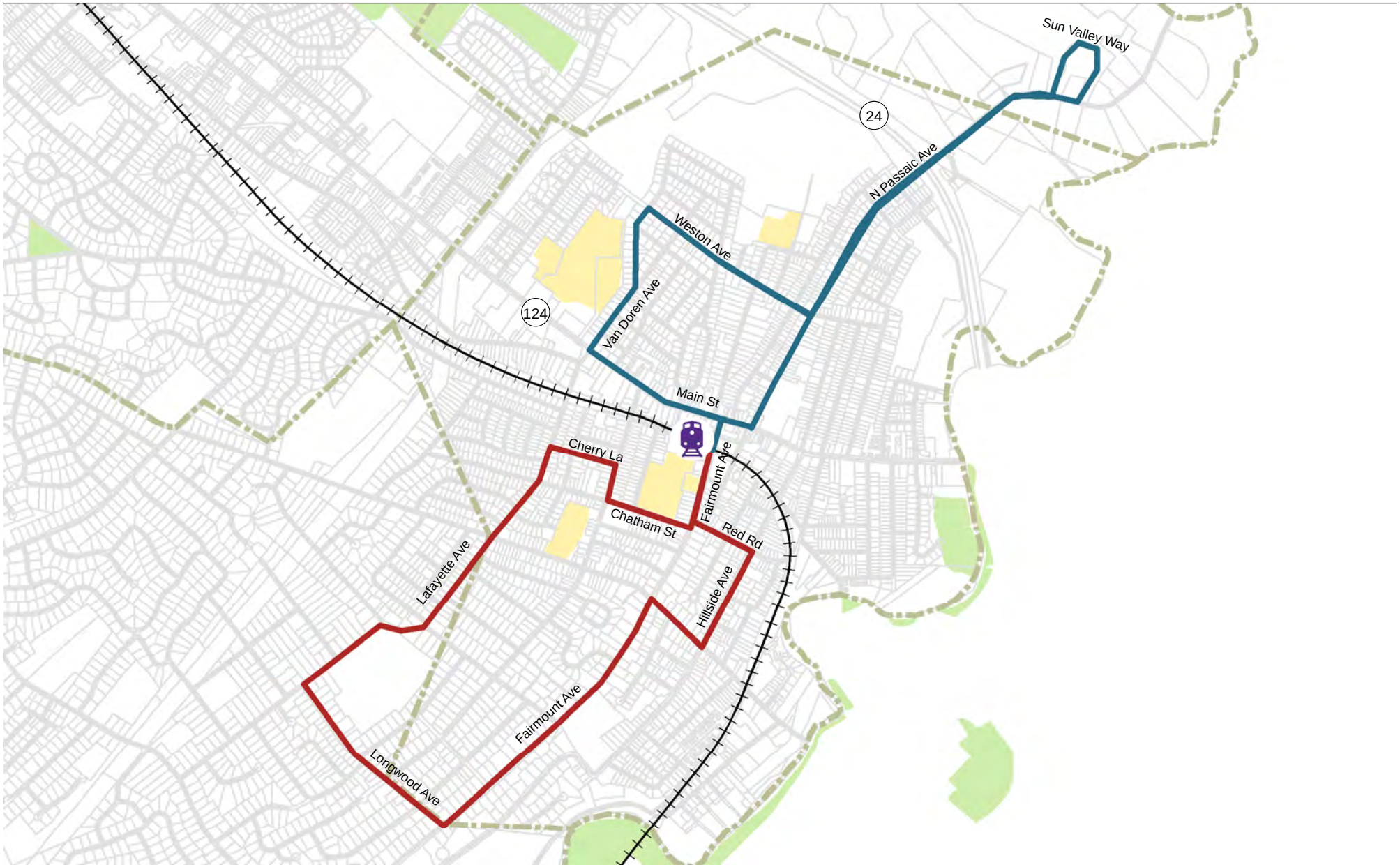
For the purpose of this study, parking capacity in new surface lots was computed based on a ratio of 300 square feet per parking space, which includes access driveways and circulation aisles. For structured parking where additional space is needed to accommodate columns and internal ramps, a ratio of 400 square feet per space was used.[22]

5.4.5 Potential Shuttle Bus Routes Improvements

Recommendations for shuttle bus routings were developed to serve each of the three railroad stations in the study area. Routings were created using information from the US Census on the concentration of railroad users as well as information on existing shuttles/ NJ TRANSIT bus service. Routes were designed to be short in order to limit the total fleet requirements and to enable a higher degree of reliability and customer accessibility. Further research should be conducted through surveys and public involvement to determine the optimum number of routes to operate and the stopping pattern. Each route is described below and is shown on Figures 5-10 through 5-12.

[21] TimHaahs Engineers and Architects, "Parking Strategies for Transit Oriented Development and Smart Growth" presentation, Rail~Volution DC Conference, 2011.

[22] This is consistent with the ratio used in Section 5.8 which was based on 100 spaces in parking structured for every 40,000 square feet in land area.



Morris County NJ 124
Transit Access Study

Proposed Shuttle Routes
Chatham Station Area

FIGURE **5-10**

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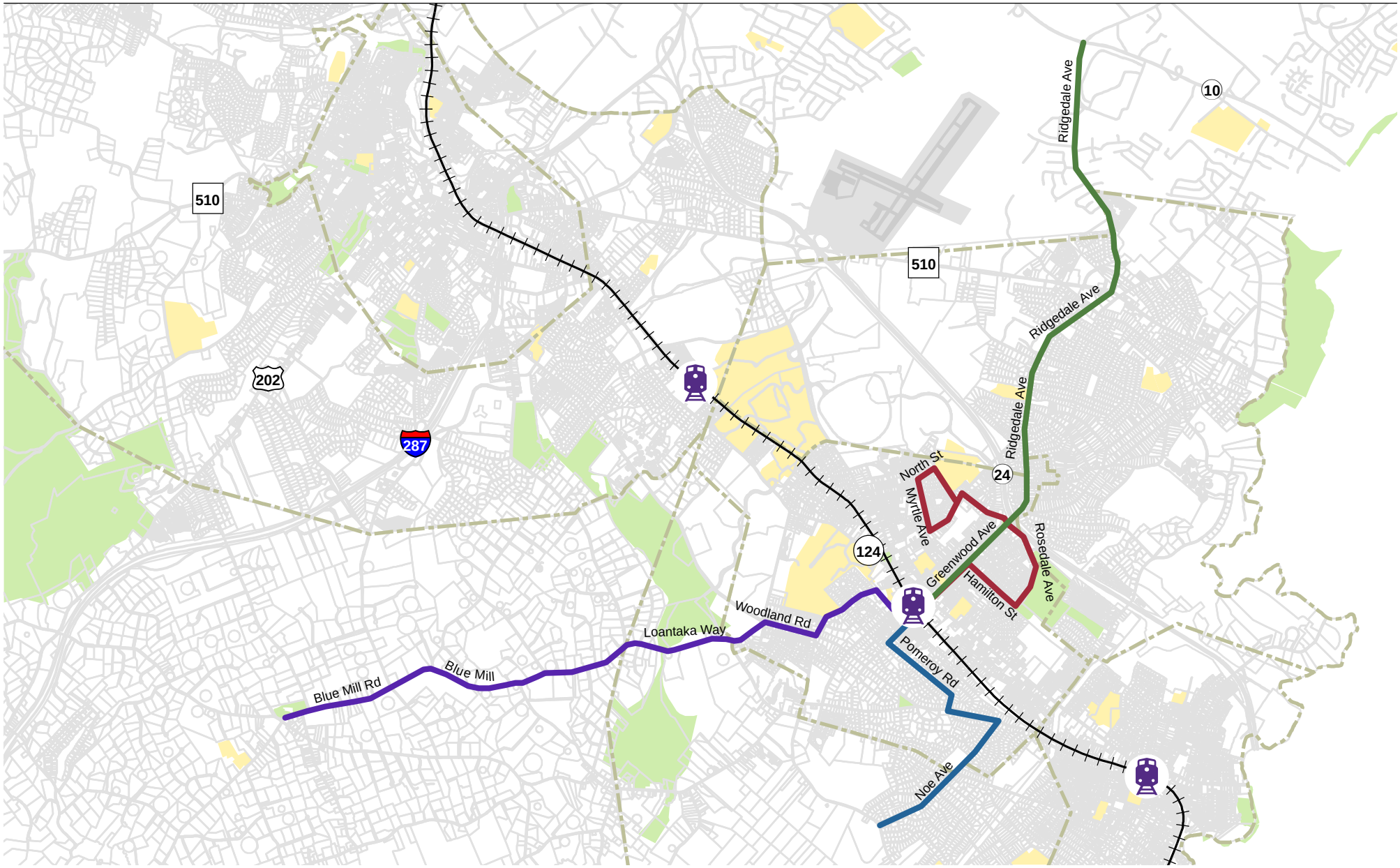

VHB

Morris County NJ 124
Transit Access Study

Proposed Shuttle Routes
Madison Station Area

FIGURE **5-11**

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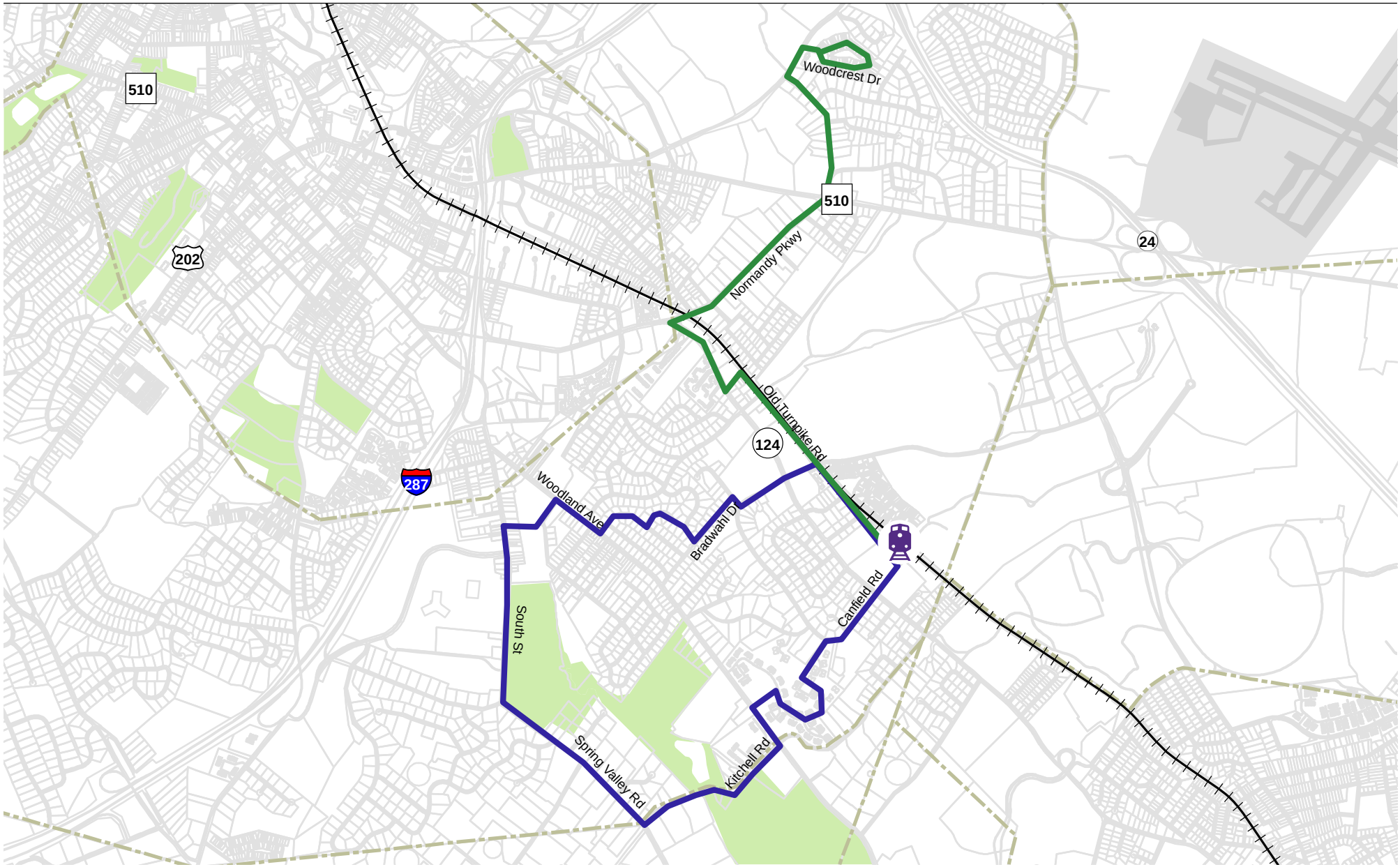


VHB

Morris County NJ 124
Transit Access Study

Proposed Shuttle Routes
Convent Station Area

FIGURE **5-12**

5.5 Improvements by Station Area

The following improvements are recommended at the individual station areas or on the roadways providing access to those stations. The map coding (Ch-1, Ma-1, Co-1, etc.) from Table 5-2 and Figures 5-1 through 5-3 are presented next to the improvement name.

5.5.1 Chatham Train Station

The proposed intersection improvements in downtown Chatham that were included in the 2010 regional traffic study for the potential redevelopment of the former Exxon Research Facility in Florham Park (referred to as the 2010 Exxon Site Report) should be implemented to enhance circulation along NJ 124 and its intersecting streets. The 2010 Exxon Site Report also includes recommendations for corridor-wide signal system improvements that include intersections outside the station area. These improvements would include the upgrade of all signals, video detection, countdown pedestrian signals, and traffic signal coordination. While the corridor-wide signal system upgrade is aimed primarily at addressing regional mobility needs along the NJ 124 corridor rather than access to local sites (including rail stations) within the corridor, the improvements at individual intersections would provide benefits for local access across the corridor.

The area around Chatham Station is a highly walkable, pleasant pedestrian environment. Most streets have sidewalks, and those that do not are residential streets with low traffic volumes that are consistent with a lack of sidewalks. Chatham Borough has already employed many pedestrian safety measures, such as flashing pedestrian-activated signals, Safe Routes to School programs, and crosswalks at all key intersections. The short block lengths create easy connectivity from and between each major street for pedestrians, drivers, and bicyclists. Nevertheless, incremental improvements in the pedestrian environment would enhance station access and safety.

Bicyclists have few amenities within Chatham Borough. There are no signs or markings for any bicycle routes, no bicycle racks except at the NJ TRANSIT station, and no connectivity to the surrounding bicycle routes in adjacent communities. It is notable that the designated bicycle routes in the Borough of Madison along NJ 124 and Woodland Avenue abruptly end at the border of Chatham Borough.

In March 2012, however, Chatham Borough adopted a Complete Streets policy which recommends considering bicycle facilities in all roadway projects.

Importantly, it sets the priority and intention of Chatham Borough to implement future bicycle and pedestrian amenities. The proposed recommendations presented here should be reviewed for consistency with the Complete Streets policy by the Chatham Borough engineering staff prior to implementation.

Roadway Improvements were identified at several intersections, and road safety analysis improvements were identified at eight intersections in Chatham, along with limited additional pedestrian improvements. These recommendations are integrated in the list below. General bicycle recommendations follow the list of intersections, followed by parking and shuttle route recommendations.

- NJ 124 & Hillside Avenue (Ch-1)
  - Restripe the eastbound and westbound approaches from one (1) to two (2) lanes: provide an exclusive left-turn lane and a shared through/ right-turn lane. Although the traffic analysis from a prior study showed that these approaches are operating at acceptable levels of service, field investigations showed that queuing and unsafe maneuvers are occurring at this location. The proposed change may require the displacement of one or two parking spaces on the northern side of NJ 124.
  - Modify signal timing to allow more green time on the northbound and southbound approaches.

- Chatham Borough Intersections (Ch-2)
  - Provide signal timing offsets to coordinate the traffic signals at Fairmount Avenue, Passaic Avenue, and Hillside Avenue to improve traffic flow on Main Street.

- NJ 124 & Passaic Avenue (Ch-3)
  - Restripe eastbound and westbound approaches from a shared left/ through/ right-turn lane to provide one exclusive left-turn lane and one through/ right turn lane. Some parking spaces may be affected on each approach with this improvement.
  - Modify signal timing to decrease overall intersection delay.
  - Install signage to increase the "No Turn on Red" restrictions to all hours and days on the northbound and southbound approaches, remove the "State Law: Stop for Pedestrians in Crosswalk" sign (which is intended for unsignalized locations), and place "Turning Vehicles Yield to Pedestrians" signage and advanced pedestrian or school crosswalk signage on all approaches to potentially improve safety for pedestrians. To address a bicycle crash that occurred at this

location, it is recommended to install "Share the Road" bicycle signs with sharrows approaching Passaic Avenue to potentially increase safety for cyclists on NJ 124. Even when sharrows are placed, there should still be signage included in some locations, particularly along a route like NJ 124. The signs are more visible, especially when moving at higher speeds.

- NJ 124 at Washington Avenue (Ch-4)
  - Add a pedestrian crosswalk across to enable connectivity to the station.

- NJ 124 & Fairmount Avenue (Ch-5)
  - Restripe the westbound NJ 124 approach to provide a left turn lane.
  - Modify signal timing to decrease overall intersection delay.
  - Install signage to increase the "No Turn on Red" restrictions to all hours and days and add this restriction and signage to the westbound and southbound approaches, remove the "State Law: Stop for Pedestrians in Crosswalk" sign (which is intended for unsignalized locations), and place "Turning Vehicles Yield to Pedestrians" signs on all approaches to potentially improve safety for pedestrians. To address a bicycle crash that occurred at this location, it is recommended to install "Share the Road" bicycle signs approaching Fairmount Avenue to potentially increase safety for cyclists on NJ 124.

- NJ 124 & Coleman Avenue / Railroad Plaza North (Ch-6)
  - This is a key intersection for automobile and pedestrian access to the north side of Chatham Station. Considerable traffic queues and delays were observed at this location during the evening peak period after large numbers of passengers disembark from a train and drive or walk through this intersection.
  - Conduct a signal warrant study at this location to potentially upgrade the flashing pedestrian signal and traffic operations. If a traffic signal is not warranted at this intersection, the existing flashers that warn drivers of the presence of the crosswalk should be repaired, "State Law: Stop for Pedestrians in Crosswalk" signs must be placed on the centerline, and advanced school crosswalk signs should be installed to potentially increase pedestrian safety.

- Fairmount Ave & Chatham Station Parking Lot 1 Driveway (Ch-7)

  - Conduct a signal warrant study at this location where pedestrian safety is a concern due to the number of turning conflicts at the driveway during peak access and egress periods. This condition would likely be exacerbated if drop-off ("kiss & ride") activity at the station increases due to constrained parking capacity and increased transit demand. Since the circulation issues at this location are heavily tied to station activity that occurs primarily during morning and evening peak periods, consideration should be given to a traffic signal that operates during peak periods but functions in a flashing operation (stop-controlled) during off-peak periods.

- NJ 124 at Lafayette/ Van Doren Avenues (Ch-8)
  - Install "No Turn on Red" signs to extend restrictions to all hours and days on all approaches.
  - Remove the "Stop for Pedestrians in Crosswalk" sign (which is intended for unsignalized locations) and replace it with "Turning Vehicles Yield to Pedestrians" signage on all approaches to potentially improve safety for pedestrians.
  - To address a bicycle crash that occurred at this location, placing "Share the Road" bicycle signs with sharrows at the transition from a shoulder to no shoulder would potentially increase safety for bicyclists on NJ 124.

- Fairmont Avenue at Watchung Avenue (Ch-9)
  - Remove the "Yield to Pedestrians in Crosswalk" sign (which is not consistent with state law) and place "Turning Vehicles Yield to Pedestrians" signage.
  - Install "Share the Road" bicycle signs on all approaches to potentially increase safety for bicyclists.
  - Install new crosswalks on the north and south legs.
  - Install "State Law: Stop for Pedestrians in Crosswalk" signage on the centerline of Fairmount Avenue.

- Fairmont Avenue at Watchung Avenue (Ch-10)
  - Install ADA compliant pedestrian ramps on the north and south legs of the intersection.

- Fairmount Avenue at Red Road (Ch-11)
  - Install shared lane markings/ sharrows or parking lane stripes to provide a safe riding area for bicyclists next to parked cars.

- Fairmount Avenue at Red Road (Ch-12)
  - Add a streetlight.

- Fairmount Avenue at 2nd Street (Ch-13)
  - Install a crosswalk on the south leg.
  - Install advanced pedestrian or school crosswalk signage on all approaches.
  - Install "State Law: Stop for Pedestrians in Crosswalk" signage on the centerline of Fairmount Avenue.
  - Install shared lane markings/ sharrows or parking lane stripes to provide a safe riding area for bicyclists next to parked cars.

- Fairmount Avenue at 2nd Street (Ch-14)
  - Install ADA compliant pedestrian ramps on all corners.

- North Passaic Avenue and Weston Avenue (Ch-15)
  - Repair the speed feedback sign.
  - Install shared lane markings/ sharrows or parking lane stripes.

5.5.1.1 Bicycle Recommendations

Because Chatham Borough does not have any designated bicycle routes, it is recommended that Chatham examine bicycle access in detail, including access to Chatham Station, and develop a Bicycle Master Plan. Many municipalities have formalized bicycle plans, such as Morristown, NJ and Providence, RI as shown in Figure 5-13. At a minimum, bicycle routes should be investigated and considered for implementation on key north/ south and east/ west routes near the train station. These roadways, shown on Figure 5-1, could include the following:

- East/ West Roadways (starting from the south): Watchung Avenue, Chatham Avenue/ Red Road, Woodland Avenue, Kings Road, NJ 124/ Main Street, and Weston Avenue.
- North/ South Roadways (starting from the west): Van Doren/ Lafayette Avenues, Washington Avenue, Coleman Avenue, Elmwood Avenue, Fairmount Avenue, North Passaic/ South Passaic Avenues, and North Hillside/ Hillside Avenue.

Figure 5-13: Developing a Bicycle Master Plan

The development of a complete bicycle master plan would typically include at least the following elements:

- Evaluation of existing roadway conditions.
- Public outreach.
- Assessment of potential bicycle routes and location of bicycle amenities (racks).
- Recommendations for implementation of bicycle route type: shared, designated lane, separated bikeway, or trail.
- Recommendations for implementation of route and wayfinding signs and amenities.
- Development of a map and possible public education recommendations.
- Implementation plan including cost estimate and schedule.

Other steps that Chatham Borough should consider include:

- Implementation of the Morris County bicycle map, which shows Fairmount and Watchung Avenues as shared facilities and NJ 124 as a bicycle route (Ch-16).
- Develop bicycle facilities along Kings Road and Woodland Road, after evaluation, to provide continuous bicycle facilities along these roads from Chatham Borough to Madison Township (Ch-17).
- Monitor usage of bicycle lockers and racks (Ch-18). Comments received from stakeholders and the public included requests for additional bicycle lockers and racks. Observations in July 2012 showed

21 of the 44 bicycle parking spaces being used, and TransOptions has reported, in January 2012, that 10 of the 16 bicycle lockers were rented. Based on these numbers, additional bicycle racks and lockers do not appear to be needed at this time, however, with improvements to bicycle facilities within Chatham Borough, bicycling to the station would likely increase. This increase should be carefully monitored and racks and lockers added as appropriate. In addition, with the forecasted increase in ridership by 2020, additional racks and lockers will be needed.

5.5.1.2 Pedestrian Recommendations

As stated above, the pedestrian network in Chatham is very complete. Nevertheless, there are improvements that would enhance connectivity to the station and walkability within the study area.

- Create a pedestrian and bicycle connection across the sports field south of the station to connect with Lum Avenue (Ch-19). This would allow those living to the west a more direct connection to the station. If a portion of this property is reconsidered for parking expansion, the pedestrian accessway should be incorporated in the site design.
- Add coordinated pedestrian activated signals and lighted crosswalks under the railroad trestle to improve pedestrian visibility (Ch-20), as shown in Figures 5-14 and 5-15.

Figure 5-14: Pedestrian Activated Crosswalk Near New Brunswick, NJ Train Station

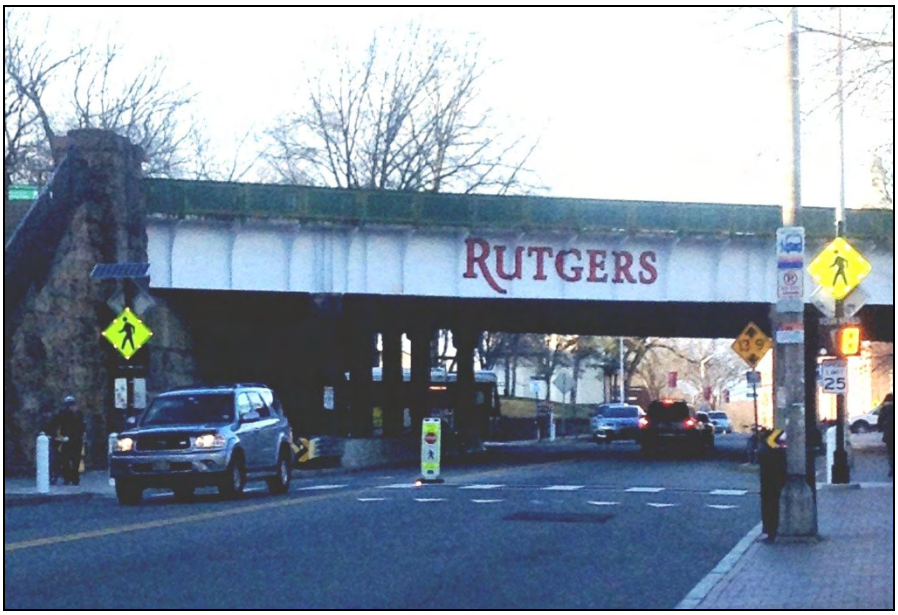


Figure 5-15: View from Above of New Brunswick, NJ Train Station Pedestrian Activated Crosswalk

5.5.1.3 Parking Improvements

Parking at Chatham is currently fully utilized and demand is expected to exceed the capacity of the existing lots. Although additional parking is available for resident permit holders in the municipal lots on Bowers Lane and Center Street East and West when the main commuter parking areas are full, these overflow parking facilities are not well advertised and accessible. A field investigation for this study indicated that those lots are not used heavily, so additional efforts to publicize the availability of those spaces may provide some relief for resident commuters who deal with the overflowing main lots on a regular basis. Information about those auxiliary lots should be included on a station-area parking map to be posted at the station and on the municipal website.

In addition, one of the most common complaints voiced by commuters at Chatham Station during the public outreach process for this study involved the electronic parking pay stations used for daily parking fees. These machines are a convenient and cost-effective way to collect parking fees, but long lines form at them when the equipment malfunctions, resulting in commuters missing their train when waiting on line in the morning. Additional parking machines would be helpful to address this and Chatham Borough is currently procuring new machines.

The athletic field south of Lot 1 has been considered for possible parking expansion in the past. Depending on the portion of the site to be used, this could provide approximately one acre of additional land for surface parking, either as a stand-alone lot or as an expansion of the existing Lot 1. Due to existing grades at the site, where the elevation of the athletic field is several feet higher than most of the adjoining parcel where Lot 1 is situated, construction costs would be lower if the additional capacity were to be constructed as a separate lot with a driveway connecting to Lot 1 at a point where the elevations are closest.

Proposed parking improvements at Chatham Station are as follows:

- Install two additional electronic parking pay stations (Ch-21) to minimize passenger queuing and delays, and to provide additional processing capacity for future parking expansion.
- Provide additional signage at the station to highlight overflow commuter parking availability at nearby municipal parking lots for Chatham permit holders (Ch-22). This could yield an estimated additional 25 spaces for permit holders, based on the size and proximity of these lots.

- Create a new parking lot adjacent to Lot 1 on site of athletic field (Ch-23). This improvement would yield an estimated 145 additional spaces if one full acre is used (43,560 square feet x 300 square feet per space). The site is not Green Acres-encumbered.
- Should the full deficit of 500 spaces be accommodated in Chatham it would require construction of a three-level parking structure on the site of the existing Lot 1 (Ch-24). Lot 1 covers an area of about two acres, and at a ratio of 400 square feet per space this site would yield about 218 spaces per parking level. This calculates to 654 spaces in a three-level facility, which yields more than 350 spaces beyond the existing capacity of Lot 1 (about 300 spaces). The new parking lot on the adjacent parcel, which is described above as an intermediate-term improvement, would remain as a surface lot and would be accessible through the new structure at the level in the structure (first or second level) most appropriate for the different grades at the site. This would allow the entire commuter parking at the station to be accessible through a single access point on Fairmount Avenue, which complements the potential improvements associated with the signal warrant study recommended at this intersection. The recommendations outlined above would provide sufficient parking in Chatham to more than meet the high end of the range of projected (2020) parking space deficit in the corridor (500 spaces). The Chatham Borough Council has indicated that inclusion of such a structure in the Borough is not in keeping with the character of their community and that the local roadway network could not absorb the additional traffic that would be associated with such a large facility.

5.5.1.4 Transit Improvements (Ch-25)

In order to diminish parking demand at Chatham Station and provide accessibility to the station from points outside of the immediate vicinity of the station, two potential shuttle bus routes were conceptualized. These routes would provide AM access to the station and PM access from the station, picking up residents along the route at defined shuttle stops. Figure 5-10 displays these routes.

Chatham North Route: This northern route would operate on the following path (PM):

- Start at Chatham Station
- North on Fairmount Avenue
- Right on Main Street
- Left on North Passaic Avenue
- Left on Sun Valley Way

- Right on North Passaic Avenue
- Right on Weston Avenue
- Left on Rowan Road
- Right on Van Doren Avenue
- Left on Main Street
- Right on Fairmount Avenue to turnaround at station

Chatham South Route: This southern route would operate on the following path (PM):

- Start at Chatham Station
- Left on Fairmount Avenue
- Right on Chatham Street
- Right on Washington Avenue
- Left on Cherry Lane
- Left on Lafayette Avenue
- Left on Longwood Avenue
- Left on Fairmount Avenue
- Right on Watchung Avenue
- Left on Hillside Avenue
- Left on Red Avenue
- Right on Fairmount Avenue to turnaround at station

Using assumed speeds (18 MPH), one way running times for each route were developed. These are shown in Table 5-3 below.

Table 5-3: Proposed Routes with Mileage and Running Time

Station	Route Number	Mileage (One Way)	Running Time (Minutes)
Chatham Station	Chatham North Route	4.51	15 minutes
	Chatham South Route	3.72	12 minutes

New vehicles, drivers, and a maintenance staff would be required to operate this service. A fare could be charged to offset operating costs. In order to minimize the number of vehicles required these routes could be initially operated on half hour headways, using three vehicles. These headways would

not result in each route meeting each train, but the service could be designed so that one bus an hour meets a Hoboken train and one bus an hour meets a New York City train. After an evaluation, those routes which are successful and attract a significant amount of ridership could be continued, with less popular routes being eliminated (allowing for an increase in the frequency in service to 15 minutes, which would meet every train in the peak on the resulting routes).

5.5.2 Madison Train Station

The proposed intersection improvements in downtown Madison that were included in the 2010 Exxon Site Report should be implemented to enhance circulation along NJ 124 and its intersecting streets. Some additional improvements in downtown Madison, which were originally proposed in a 2027 Transportation Needs Assessment Study for Florham Park (completed in 2007), are also listed here and are recommended for implementation. The 2010 Exxon Site Report also includes recommendations for corridor-wide signal system improvements that include intersections outside the station area. These improvements would include the upgrade of all signals, video detection capability, countdown pedestrian signals, and signal coordination between adjacent signalized intersections.

The half mile area around Madison Station is very accessible to pedestrians. Most roadways in the area have sidewalks, with crosswalks and pedestrian signals. Madison uses a variety of different traffic calming techniques to slow traffic such as pedestrian bollards, and traffic markings of the word “SLOW” with chevron markings to reinforce pedestrian crosswalks.

The Borough of Madison has a relatively robust bicycle facility network as compared with Chatham Borough and Morris Township. Madison’s bicycle route plan was completed in 2005 and many of the planned facilities have been implemented through striped bicycle lanes, shared lane markings, or “Share the Road” signs. Notable, however, is that designated bicycle routes do not continue to the NJ TRANSIT station, and there are no signs directing bicyclists to the location of the station, as shown in Figure 5-16.

Figure 5-16: Example of Bicycle Wayfinding Sign in Providence, RI

Even with a well-planned pedestrian and bicycling network, there are opportunities for improvements, and those recommendations are presented below. Additional and improved pedestrian crossings would help with access to the station. Currently, the condition of existing bicycle facilities and signage vary throughout the study area, which presents an opportunity for improvements in the network.

Roadway Improvements were identified at several intersections, and road safety analysis improvements were identified at 13 intersections, along with limited additional pedestrian improvements. These recommendations are integrated in the list below. General bicycle recommendations follow the list of intersections.

- NJ 124 & Rosedale Avenue / Cross Street (Ma-1)
  - Restripe the eastbound and westbound approaches from one (1) to two (2) shared lanes: provide a left/ through lane and a right/ through lane. Restripe receiving lanes to two (2) lanes, followed by a right lane merge.
  - Modify signal timing to decrease overall intersection delay.
  - Install pedestrian countdown signals and advanced pedestrian or school crosswalk.
  - Install "Turning Vehicles Yield to Pedestrians" signs, and "No Turn on Red" restrictions on all approaches to potentially increase safety for pedestrians.
  - Install "Share the Road" bicycle signs on all approaches.

- NJ 124 & Greenwood Avenue / Prospect Street (Ma-2)
  - Create eastbound and westbound left-turn lanes.

  - Add a southbound left-turn signal phase.
  - Add signal actuation for left-turn movements, with pedestrian protection included in the signal phasing as needed.

- NJ 124 between Greenwood Avenue/ Prospect Street and Waverly Place/ Central Avenue (Ma-3)
  - Add mid-block pedestrian crossing (crosswalk, signal) across NJ 124. Pedestrians crossing at midblock were observed at this location and formalizing the crossings is advised. Install a midblock crosswalk and "State Law: Stop for Pedestrians in Crosswalk" signage.

- NJ 124 & Central Avenue / Waverly Place (Ma-4)
  - Create eastbound and westbound left-turn lanes by removing some on-street parking.

- NJ 124 at Central Avenue/ Waverly Place: It is recommended to install "Turning Vehicles Yield to Pedestrians" and advanced pedestrian or school crosswalk signage on all approaches to potentially improve safety for pedestrians.
  - Install "Share the Road" bicycle signs on all approaches.

- NJ 124 between Waverly Place/ Central Avenue and Green Village Road (Ma-5)
  - Add mid-block pedestrian crossing (crosswalk, signal) across NJ 124. Pedestrians crossing at midblock were observed at this location and formalizing the crossings is advised. Install a midblock crosswalk and "State Law: Stop for Pedestrians in Crosswalk" signage.

- NJ 124 & Central Avenue / Waverly Place (Ma-6)
  - Add signal actuation for left-turn movements, with pedestrian phase protection as needed.

- NJ 124 & Park Avenue/ CR-623 (Ma-7)
  - Modify signal timing to decrease overall intersection delay.

- NJ 124 (Madison Avenue) & Kings Road (Ma-8)
  - Modify signal timing to decrease overall intersection delay.
  - Install a west crosswalk advanced pedestrian or school crosswalk and "Turning Vehicles Yield to Pedestrians" signage on all approaches.
  - Install "No Turn on Red" restrictions on the eastbound and northbound approaches.

- NJ 124 (Madison Avenue) & Kings Road (Ma-9)
  - Install pedestrian countdown signals and ramps on all approaches.
  - Continue bicycle lanes on NJ 124 through this intersection and underneath the railroad trestle.

- NJ 124 at Alexander Avenue (Ma-10)
  - Install crosswalks on the east and west legs, and advanced pedestrian or school crosswalk signage on all approaches.
  - Install "State Law: Stop for Pedestrians in Crosswalk" signage on the centerline of NJ 124.

- NJ 124 at Alexander Avenue (Ma-11)
  - Install bike lanes on NJ 124 to increase safety for bicyclists.
  - Install pedestrian countdown signals and ramps on all approaches.

- Central Avenue at Brittin Street (Ma-12)
  - Install a north crosswalk and an advanced school crosswalk sign.
  - Install a "State Law: Stop for Pedestrians in Crosswalk" sign on the southbound approach to potentially increase pedestrian safety.
  - Install "Share the Road" bicycle signs and in-road painted sharrows on all approaches.

- Greenwood Avenue at Brittin Street (Ma-13)
  - Install a north crosswalk.
  - Remove bike lane markings and install "Share the Road" signs and sharrows, or prohibit on-street parking since the existing bike lanes are less than the standard five feet.

- Greenwood Avenue at Brittin Street (Ma-14)
  - Install ADA compliant pedestrian ramps on the north side.

- Greenwood Avenue north of NJ 124 (Ma-15)
  - Relocate the "Share the Road" sign on Greenwood Avenue to improve its visibility since it is currently obscured behind a utility pole.

- Danforth Road and NJ 124 (Ma-16)
  - Install an actuated bicycle signal at this location since Danforth Road is the eastern-most access point to the Traction Line Recreation trail and bicyclists report the signal is difficult to trigger when only a bicyclist is present at the traffic light.

- Kings Road and Waverly Place (Ma-17)
  - Remove the "State Law: Stop for Pedestrians in Crosswalk" sign (which is intended for unsignalized intersections) and replace it with a "Turning Vehicles Yield to Pedestrians" sign.
  - Implement "No Turn on Red" restrictions to the northbound, southbound, and westbound approaches.
  - Install advanced pedestrian or school crosswalk signage on all approaches.
  - Install "Share the Road" bicycle signs on all approaches.

- Kings Road and Waverly Place (Ma-18)
  - Install streetlights adjacent to the north, east, and west crosswalks.
  - Install a west ADA compliant pedestrian ramp.

- Kings Road at Maple Avenue (Ma-19)
  - Install a west crosswalk.
  - Install a "State Law: Stop for Pedestrians in Crosswalk" sign on the west leg, and advanced pedestrian or school crosswalk signs on all approaches.
  - Move the mid-block pedestrian crossing across Kings Road close to Maple Avenue. Currently, the crosswalk is located away from the corner, and connects to the station parking lot at a parked car, rather than a pedestrian pathway to the station. Moving the crosswalk to the corner will connect more directly to a striped pathway that connects to the station.

- Park Avenue at Ridgedale Avenue (Ma-20)
  - Remove the outdated "Yield to Pedestrians in Crosswalk" sign.
  - Install a west crosswalk.
  - Install "Turning Vehicles Yield to Pedestrians" sign.
  - Install advanced pedestrian or school crosswalk signage on all approaches.
  - Implement "No Turn on Red" restrictions on all approaches.
  - Install "Share the Road" bicycle signs on all approaches.

- Park Avenue at Ridgedale Avenue (Ma-21)
  - Install west ADA compliant pedestrian ramps and pedestrian countdown signals.

- Park Avenue at Kinney Street (Ma-22)
  - Install crosswalks and advanced pedestrian signage on all approaches.

- Park Avenue at Kinney Street (Ma-23)
  - Install ADA compliant pedestrian ramps on all approaches.

- Central Avenue at Elmer Street/ Cook Avenue (Ma-28)
  - To increase safety for pedestrians, it is recommended to reduce the speed limit to 25 miles per hour on Central Avenue, install advanced pedestrian or school crosswalk signage on all approaches, and place "State Law: Stop for Pedestrians in Crosswalk" signs on the centerline of Central Avenue in both directions. To address a bicycle crash that occurred at this location, it is recommended to install "Share the Road" bicycle signs with in-road painted sharrows on all approaches to potentially increase safety for bicyclists.

5.5.2.1 Bicycle Recommendations

The condition of bicycle facilities and implementation vary on streets within Madison Borough. Signage and bicycle stencil markings are generally infrequent and the quality of markings varies significantly. Additionally. signage is inconsistent, varying from a standard bicycle route sign to "Share the Road" signage. Recommendations for potential bicycle network improvements are as follows, and are illustrated on Figure 5-2.

- New Bicycle Markings and Signage (Ma-24)
  - Extend existing bicycle routes to the NJ TRANSIT station. These routes are located on Kings Road, Green Village Road, Green Avenue, Prospect Street, Central Avenue, and Greenwood Avenue, and currently stop short of the station. Bicycle lane markings would be ideal; however signage, rather than markings, could also be used, as shown in Figure 5-17.
  - Along NJ 124 east of downtown, the roadway appears to have been resurfaced. Bicycle markings, if previously present, have not been replaced. These markings, along with signage, should be installed along the shoulders of NJ 124 (Ma-25).

- Restriping and Signage of Existing Bicycle Routes
  - According to the MUTCD, bicycle stencils (see Figure 5-18) should be placed after each intersection or signalized driveway. Additional bike lane markings may also be placed in visible locations on the intersection approach.

- Along NJ 124 where markings are currently present (west of downtown), restripe all bicycle stencils and install Share the Road signage (Ma-25).
- Along all other bicycle routes in Madison, restripe bicycle stencils as many are faded and barely visible (Ma-25).

Figure 5-17: Example of Share the Road and Bicycle Route Signs in Bethlehem, NY

Figure 5-18: Shoulder Bicycle Lane on Westbound Woodland Road at Green Avenue in Madison, NJ

Additional bicycle recommendations are as follows.

- Extend the Traction Line Recreation trail to Madison. The extension of this trail by 0.61 miles along the railroad tracks from Danforth Road to Elm Street would allow residents of neighborhoods west of the Madison Station to access the downtown via an off-road trail. This extension has been proposed by the Morris County Park Commission, but is not supported by the Borough of Madison. It is unclear if the project is viable at this time, but, nevertheless, extension of this trail would provide a useful link in the area's bicycle and pedestrian network and improved access to the station area (Ma-26).
- Community stakeholders requested improved access between Drew University and the Madison station. There currently are complete sidewalk connections from Drew's east gate to the station, and striped bicycle shoulders along NJ 124. However, improved pedestrian lighting along NJ 124 would likely improve the experience for those walking and bicycling (Ma-27).
- Relocate the station bicycle lockers from the remote Kings Lane parking lot to a location more proximate to the station and add additional lockers for future demand. These lockers could be located in the station underpass where there may be available space (Ma-29).

5.5.2.2 Pedestrian Recommendations

The main pedestrian recommendation is to improve the pedestrian experience along Kings Road from/ to the Kings Road commuter parking lot through wider sidewalks and additional pedestrian lighting (Ma-30).

5.5.2.3 Parking Improvements

Madison has a combination of permit and daily commuter parking at its lots in the vicinity of the rail station. Lot #1, NJ TRANSIT's crescent-shaped area on the south side of the station, is used by commuters who pay on a daily basis. Municipal Lot #2, across King Road, is restricted to resident permit holders. Municipal Lot #3, a block east on King Road, is the largest of the three lots and is available for both daily parkers and permit holders. During the public outreach effort for this study, a number of commuters parking at the daily spots at this station complained about the cash slot box at Lot #3. It is not a convenient system for users who do not have exact change, and some commuters have indicated that the slot box is cumbersome to use. It is recommended that the parking fee equipment be upgraded to electronic

parking equipment that can handle credit card transactions in addition to cash payments.

At the Madison Station, parking is currently fully utilized and demand is expected to exceed the capacity of the existing lots in the future. Proposed parking improvements at Madison Station are as follows:

- Install 3-4 electronic parking pay stations at Lot #3 (Ma-30).
- Construct a multi-level parking facility on the site of existing Lot #3, yielding approximately 300 additional spaces in a 506-car parking structure. This project would be consistent with the previous proposal that was documented in the *Morris Area GREEN Transit Initiative* report that was prepared by the Borough of Madison for its TIGER grant application in 2009. A detailed analysis of traffic circulation along Kings Road would be required for this proposed improvement, particularly at adjacent intersections along Kings Road to the east and west at Cross Street and Prospect Street, respectively. Right-in/ right-out only access may be needed on Kings Road at the proposed parking structure to eliminate conflicts and congestion with left-turning vehicles.

The 300 net additional spaces accommodated in the proposed parking structure would represent 60 percent of the high end range of the projected corridor-wide parking shortfall of 500 spaces. If it is necessary to address this entire shortfall at Madison Station, the remaining 200 spaces could be accommodated as part of a proposed redevelopment plan for the north side of the NJ TRANSIT alignment, which is documented in Section IV of this report. If a redevelopment plan for that area does not unfold as described, and all commuter parking must be accommodated elsewhere, the most feasible option for providing 200 additional spaces would be to construct a second parking structure on Kings Road directly across the street from the train station at the site of the existing municipal employee lot.

5.5.2.4 Potential Kiss and Ride

Commuter "kiss and ride" (a.k.a. drop-offs) offer the potential to provide access to Madison Station without requiring additional parking. Currently, there is not a formal "kiss and ride" area at Madison Station on the eastbound side. It is proposed that Lot #1 be reconfigured to create a formal kiss and ride to bring visibility to and encourage this access option amongst commuters. Figure 5-19 depicts this recommendation, which maintains the current parking space count in the lot but reallocates the existing green areas adjacent to the parking lot (Ma-31).

5.5.2.5 Transit Improvements (Ma-32)

In order to diminish parking demand at Madison Station and provide accessibility to the station from points outside the immediate vicinity of the station, four potential shuttle bus routes were conceptually developed to serve population areas around Madison Station, as depicted on Figure 5-11. Two short-distance routes could serve the adjacent neighborhoods and two long distance routes could serve Chatham Township, Harding Township, and Florham Park (the origins of three communities identified as primary users of parking at this station).

Florham Park Route: This route would operate on the following path:

- Start at Madison Station
- Make a left on Greenwood Avenue
- Continue on Ridgedale Avenue
- Turn around at NJ 10 and Ridgedale Avenue

0 25 50 Feet

Morris County NJ 124
Transit Access Study

Madison Station Parking Concept

FIGURE **5-19**

Since this route is designed to serve Florham Park, it should not make stops between Madison Station and NJ 24. Beyond NJ 124, stops for this route could be located once every half mile (a quarter to half mile distance is the typical spacing between bus shuttle stops), and should be based on visits to sites and input from the local community. Customers destined for locations between the station and NJ 124 could use the Madison North route.

Harding Township Route: This route would operate on the following path:

- Start at Madison Station
- Make a left onto Green Avenue
- Make a right onto Wilmer Street
- Make a left on Green Village Road
- Make a right on Woodland Road
- Make a left on Loantaka Way
- Make a left on Blue Mill Road
- Turn around at Glen Alpine Road

Since this route is designed to serve Harding, it should not stop between Madison Station and Woodland Road. Stops for this route could be located once every half mile, and should be based on visits to sites and input from the local community.

Madison North Route: The northern local route would operate on the following path:

- Start at Madison Station
- Left on Greenwood Avenue
- Right on Hamilton Street
- Left on Rosedale Avenue
- Continue on Fairview Avenue
- Left on Ridgedale Avenue
- Right on Myrtle Avenue
- Right on North Street
- Right on Burnett Road to return

Stops for this route could be located once every half mile, and should be based on visits to sites and input from the local community.

Madison South Route: The southern local route would operate on the following path:

- Start at Madison Station

- Right on Prospect Street
- Left on Pomeroy Road
- Right on Samson Avenue
- Left on Woodland Road
- Right on Noe Avenue to turn around at Southern Boulevard

5.5.2.6 Running Times and Speeds

Using assumed speeds (18 MPH), one way running times for each route were developed. These are shown in Table 5-4 below.

Table 5-4: Proposed Routes with Mileage and Running Time

Station	Route Number	Mileage (One Way)	Running Time (Minutes)
Madison Station	Florham Park Route	4.53	15 minutes
	Harding Township Route	4.74	15.5 minutes
	Madison North Route	3.06	10 minutes
	Madison South Route	2.41	8 minutes

New vehicles, drivers, and a maintenance staff would be required to operate this service. A fare could be charged to offset operating costs. In order to minimize the number of vehicles required, these routes could be initially operated on a half hour headway, using six vehicles. These headways would not result in each route meeting each train, but the service could be designed so that one bus an hour meets a Hoboken train and one bus an hour meets a New York City train. After an evaluation, those routes which are successful and attract a significant amount of ridership could be continued, with less popular routes being eliminated, allowing for an increase in the frequency in service to 15 minutes, which would meet every train.

5.5.3 Convent Train Station

Convent Station is the only one of the three rail stations in the study corridor that is not located in an existing village center. As such, the access issues and constraints for this station are typical of a suburban rail station where auto-based trips are the predominant form of access for rail passengers. The 2010 Exxon Site Report included recommendations for improvements at a number of intersections along the segment of NJ 124 in Morris Township between Madison and I-287. The recommendations that directly relate to station access at Convent Station are those on NJ 124 at Convent Road and at Punch Bowl Road. Convent Road is the main access to Convent Station from NJ 124, and it also serves as a primary access point for the College of St. Elizabeth. Punch Bowl Road serves as a "back door" to and from the station parking areas via Old Turnpike Road, and carries substantial volumes of vehicular traffic during peak periods because it is one of the few connector roads between NJ 124 and Park Avenue (CR 623) in this area. The two NJ 124 intersections are included in the 2010 Exxon Site Report for a corridor-wide signal system upgrade. As mentioned previously, this improvement would include the upgrade of all signals and add video detection capability, pedestrian signals with countdown timers, and signal coordination between adjacent intersections.

The half mile area around Convent Station is an environment that is generally not hospitable to pedestrians and bicyclists. One major multi-use facility, the Traction Line Recreation Trail, connects directly to the Convent Station however; the connections from the trail to neighborhoods within walking and bicycling distance of the station are quite limited. The study area around the Convent Station differs significantly from Madison and Chatham because the station is not located in a town center: however, there are opportunities for increasing pedestrian and bicycling access to the station.

Roadway improvements were identified at several intersections, and road safety analysis improvements were identified at two intersections, along with limited additional pedestrian improvements. These recommendations are integrated in the list below. General bicycle recommendations follow the list of intersections, followed by parking and shuttle route recommendations.

- NJ 124 (Madison Avenue) & Convent Road (Co-1)
  - Modify signal timing to decrease overall intersection delay.
  - Correct and clarify the mismatched sidewalks and crosswalks at the intersection. Currently, the crosswalk across NJ 124 is on the opposite side of the intersection from the sidewalks that lead into the neighborhood to the south and toward the Convent Station to the north, as shown in Figure 5-20.

Figure 5-20: Mismatched Crosswalk and Sidewalk at Intersection of NJ 124 and Convent Road

- NJ 124 (Madison Avenue) & Convent Road (Co-2)
  - Install new pedestrian signals with countdown timers.

- Punch Bowl Road & Old Turnpike Road (Co-3)
  - To improve safety for pedestrians, relocate the existing south crosswalk to be at the intersection (instead of offset approximately 100 feet south).
  - It is recommended that a signal warrant study and safety assessment be performed to identify potential measures to improve sight distance underneath NJ TRANSIT rail bridge.
  - Potentially restrict left-turns from westbound Old Turnpike Road to southbound Punch Bowl Road due to limited sight distance to the north (this would result in higher traffic volumes exiting to NJ 124 via Convent Road, as indicated above).
  - Install bike lanes on Old Turnpike Road and Punchbowl Road if there is adequate width; otherwise, "Share the Road" bicycle signs on all approaches are recommended to potentially increase safety for bicyclists.

- NJ 124 (Madison Avenue) & Punch Bowl Road (Co-4)

- Short-term intersection improvements are underway, including a new eastbound left turn lane on NJ 124 (as this recommendation is underway it is not included in the map or table at the end of the document).
- New traffic signal, minor realignment of northbound approach, and reconstruction of bus turnouts.

- Punch Bowl Road & Old Turnpike Road (Co-5)
  - Install an ADA compliant pedestrian ramp on the south leg of the southwest corner.
  - Install a sidewalk on the south side of the west leg.

- Old Turnpike Road at Convent Road (Co-6)
  - To potentially improve safety for pedestrians, install sidewalks on the east side of the south and north legs, a sidewalk on the west side of the north leg, sidewalks on the north and south sides of the west leg, and ADA compliant pedestrian ramps on all approaches.
  - Old Turnpike Road west of Convent Road functions essentially as a parking lot. There are no sidewalks or travel lane striping, and walking through this road/ lot feels unorganized and unsafe. Old Turnpike Road should be reconfigured to include sidewalk connections from the parking stalls to the station and to sidewalks along Convent Road. This would create a safe space for pedestrians that would not require walking behind parked cars in the middle of the street. Bicyclists should also be accommodated.

- Old Turnpike Road at Convent Road (Co-7)
  - Install crosswalks and advanced pedestrian signs on all approaches.
  - To improve safety for vehicles, place the eastbound approach under stop control, which involves the installation of a stop sign and stop bar.
  - It is recommended to install “Share the Road” bicycle signs with in-road sharrows on all approaches to potentially increase safety for bicyclists.

5.5.3.1 Bicycle Recommendations

Aside from the Traction Line Recreation Trail, there are no bicycle routes near Convent Station, although one sign can be found on Convent Road between the Traction Line Trail and NJ 124. Each of the individual recommendations,

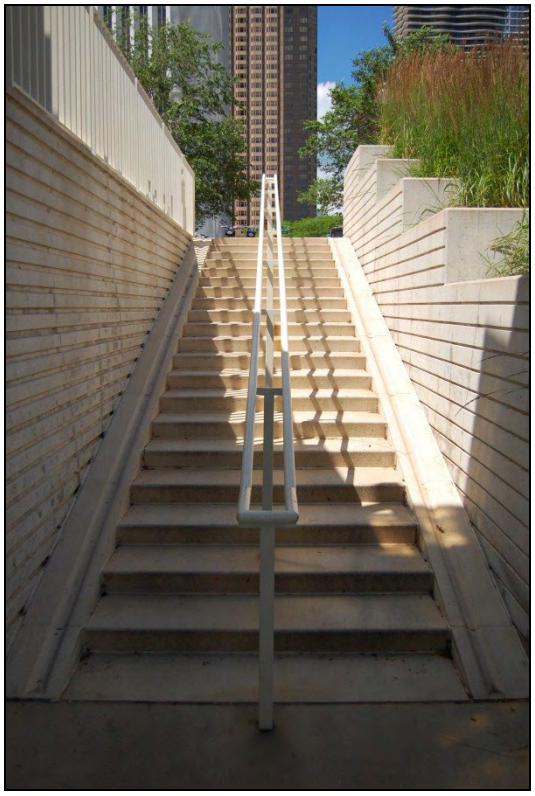
below, should be implemented as part of a complete network of bicycle facilities.

- New Bicycle Markings and Signage
  - The bicycle lane along NJ 124 ends abruptly at the border between Madison Borough and Morris Township. This bicycle facility should be continued along NJ 124, with bicycle markings and adding signage along the paved shoulder (Co-8).
  - Create a bicycle route along Convent Road between the Traction Line Recreation Trail and NJ 124. The route should be, preferably, a striped bicycle lane (Co-9).
  - Implement a bicycle connection from NJ 124 to Woodlawn Avenue and the Loantaka Reservation. The Morris County Bicycle and Pedestrian User Guide map indicates a connection along Fox Hollow Road, however, this roadway would need improvements to be appropriate for a bicycle connection (it is exceptionally steep and narrow without shoulders). Nevertheless, it is the most direct connection from the Loantaka Reservation to Convent Station and the Traction Line Recreation Trail (Co-10).
  - As part of intersection improvements at Old Turnpike Road and Convent Road, recommended above, install bicycle markings and signage, including wayfinding signs to the station (Co-11).
  - Punchbowl Road is an important roadway link within this study area. Currently, the roadway has no sidewalks and is narrow with limited shoulders in some areas. Reconstruction of this roadway to accommodate a bicycle route and sidewalks would provide a significant link in the bicycle network (Co-12).
  - There is no direct connection from Convent Station to Park Avenue. Access to the station could be improved with the addition of a bicycle and pedestrian connection through the College of St. Elizabeth (Co-13).

- Improvements to Existing Bicycle Routes
  - The bicycle route along Woodlawn Avenue, south of Convent Station, is the longest continuous bicycle route in the three-station study area. Within Morris Township, the bicycle stencils should be restriped. According to the MUTCD, bicycle stencils should be placed after each intersection or signalized driveway. Additional bike lane markings may also be placed in visible locations on the intersection approach. (Co - 14)

- Use of the Traction Line Recreation Trail could be improved through elimination of the staircase at Normandy Parkway. Alternatively, a wheel channel (Figure 5-21) should be added along the stairway to allow bicyclists to push, rather than carry, their bicycles (Co-15).
- Additional bicycle lockers should be installed at Convent Station to eliminate the current waiting list and in anticipation of future demand (Co-16).

Figure 5-21: Stairway with Bicycle Wheel Channel in Chicago, IL

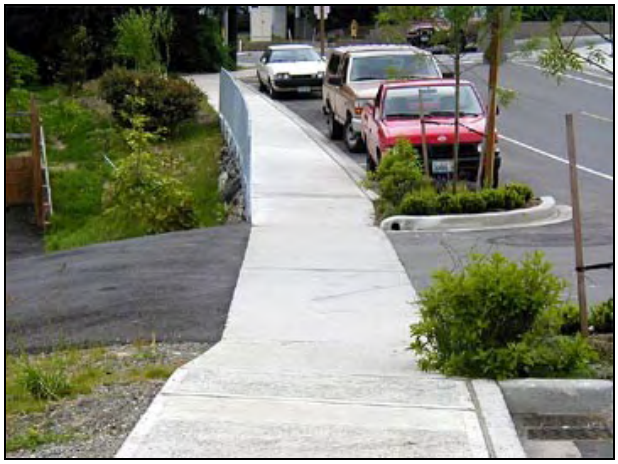


5.5.3.2 Pedestrian Recommendations

Around Convent Station, there are currently few pedestrian facilities. Because of the suburban nature of nearby neighborhoods where traffic volumes are low and speeds are slow, there is no need to install sidewalks. However, along the main roadways that connect to the station, pedestrian facilities are recommended. Pedestrian recommendations outside the immediate station area are as follows:

- Create an additional pedestrian (and bicycle) connection between the Traction Line Recreation Trail and Pilgrim Court and Constitution Way, the multifamily housing development to the north of the trail (Co-17).
- Improve lighting between the station and the Fairleigh Dickinson campus (Co–18).
- Connect the two segments of sidewalk at the west end of the station parking lot, as shown in Figure 5-22. The gap is a driveway to a gravel area which can be paved to complete the connection (Co-19).

Figure 5-22:
Top: Existing Condition at Convent Station
Middle: Example of a Contiguous Sidewalk Crossing at a Driveway (credit: Dan Burden)
Bottom: Location of Proposed New Sidewalk at West End of Convent Station Parking Lot



5.5.3.3 Parking Improvements

Convent Station has the most complex parking restrictions in the study corridor, and a number of complaints about the confusing parking regulations were received during field work and study outreach. The parking lots are owned by Morris Township, and the municipal regulations include four different types of parking: (1) resident permit holders (annual), (2) non-resident permit holders (annual), (3) daily metered parking (open to the public), and (4) daily metered parking for resident permit holders (for those residents who do not use the train station frequently enough to need an annual permit). Adding to this complexity is that there is no specially designated area for the non-residents described in Item (3); rather, the spaces available for these commuters are also available for resident permit holders. The combination of cash and electronic payment systems at the same location can be somewhat confusing.

The parking utilization study conducted for this project indicated that Convent Station has some excess capacity during a typical weekday. Municipal officials who oversee the parking permit system in Morris Township indicated that this might be a temporary situation related to turnover in the parking permits; the municipality was preparing to update its waiting list and release some additional parking permits as this study was being conducted. In addition, Convent Station is a less desirable location for non-resident commuters to park simply because it is the westernmost station of the three in the study corridor and is not as convenient for many commuters who drive to this corridor from Harding and Florham Park.

Proposed parking improvements at Convent Station are as follows:

- *Short-Term*: Review and simplify parking regulations, including the possible elimination of daily/ permit metered parking for residents (minimal cost to remove meters, if necessary). Install two additional electronic parking pay stations. Modify payment system to consolidate all payments (cash and electronic) into one type of machine (Co–19).

- *Intermediate-Term*: Conduct an ongoing review of resident and non-resident waiting lists to possibly re-allocate spaces among the different permit types, depending on demand (Co–20).

- *Long-Term*: Construct a multi-level parking structure on the site of Lot 1. This would involve the displacement of a maximum of 250 spaces, depending on the size and shape of the parking structure and the surface spaces that might remain along Old Turnpike Road due to inefficiencies in the irregularly-shaped land parcel where Lot 1 is

located. The TOD redevelopment analysis documented in the following section includes nearly four acres of land at this location, without that proposed redeveloped it is assumed that a parking structure would cover 2.5 acres in a configuration that provides the most efficient "footprint" for the parking facility. Based on the average ratio of 400 square feet per space in structured parking, a 2.5-acre area would provide 532 spaces in a two-level facility and nearly 800 spaces in a three-level structure. Since as many as 250 existing surface spaces would be displaced by this structure, the three-level structure would be needed to replace the 250 spaces and accommodate the high end (500-space) of the projected long-term shortfall for the three stations in the NJ 124 corridor. Additional traffic analyses would be required to assess the capacity of adjacent roadways to accommodate this proposed structure (Co–21).

5.5.3.4 Transit Improvements (Co-22)

In order to diminish parking demand at Convent Station and provide accessibility to the station from points outside of the immediate vicinity of the station, two shuttle bus routes were developed as depicted in Figure 5-12.

The north route at Convent Station would supplement the existing shuttle service (NJ TRANSIT routes 878 and 879) but would operate via Normandy Parkway, a more residential street in order to attract commuter rail riders who might park at Convent Station. NJ TRANSIT's routes are primarily distributors of rail passengers from Convent Station. This proposed shuttle route would serve as a feeder; transporting patrons to the station in the morning and returning them home in the evening.

The proposed routing follows:

- Start at Convent Station along Old Turnpike Road
- Turn left on Langdon Lane
- Turn right on Madison Avenue
- Turn right on Normandy Parkway and merge into Normandy Heights Road
- Turn left on Woodruff Road
- Turn right on Whippany Road
- Turn right Woodcrest Drive
- Turn-around via Boxwood Drive

The south route would cover the residential neighborhoods adjacent to the station and would operate on the following route:

- Start at Convent Station along Old Turnpike Road

- Turn left on Punch Bowl Rd straight into Canfield Road
- Turn right on Easley Terrace
- Turn left on Bradwahl Drive
- Turn right on Yorke Road
- Turn right on Bennington Road
- Turn right on Woodland Avenue
- Turn left on Dwyer Lane
- Turn left on South Street
- Turn left on Spring Valley Road
- Turn left on Kitchell Road
- Turn left on Woodland Avenue
- Turn right on Steeple Chase Way
- Turn right on Pippins Way
- Turn right on Canfield Road
- Turn left Old Turnpike Road to turn-around

Using assumed speeds of 18 MPH, one way running times for each route were developed. These are shown in Table 5-5 below.

Table 5-5: Proposed Routes with Mileage and Running Time

Station	Route	Mileage (One Way)	Running Time (Minutes)
Convent Station	Convent North Route	2.66	8 minutes
	Convent South Route	4.38	15 minutes

New vehicles, drivers, and a maintenance staff would be required to operate this service. A fare could be charged to offset operating costs. In order to minimize the number of vehicles required this service could be initially operated on half hour headways using four vehicles. These headways could be designed so that one bus an hour meets a Hoboken train and one bus an hour meets a New York City train. After an evaluation, those routes which are successful and attract a significant amount of ridership could be continued, with less popular routes being eliminated allowing for an increase in the frequency in service to 15 minutes, which would meet every train.

5.6 Implementation and Order of Magnitude Costs for Proposed Improvements

A short-term, medium-term, or long-term implementation time frame has been assigned to each improvement. Each of these categories generally corresponds with an order of magnitude cost estimate with some exceptions as noted below.

Short-term recommendations include striping or restriping of crosswalks, bicycle stencils, and stop bars, as well as signage installation, traffic signal re-timings, and signal warrant studies. The cost of these projects varies by location, but typically these are low cost improvements that would not cost over $25,000 per intersection, with individual sign and striping projects costing a fraction of this amount. Example costs in this category include electronic parking stations ($10,000 to $20,000 each). These projects could be performed under existing operating and maintenance funding. Of the approximately 150 improvements shown on Table 5-2, about two-thirds of the recommendations are short-term, low-cost improvements.

Medium-term recommendations include the addition of shuttle bus routes; changes to signals such as adding actuated signals or additional phases for pedestrians or left turns; installation of new ADA compliant pedestrian ramps and sidewalks, streetscaping or street lighting; completing a bicycle master plan; the addition of bicycle stencils and lanes; creation of a corridor-wide bicycle map; and installation of parking pay stations. It should be noted that bicycle markings are designated as medium-term because they must be studied before implementation. As for cost estimates, the cost of these projects would range from approximately $25,000 to $100,000, except for the shuttle bus routes, which are a high-cost item of over $100,000. Additional information about costs can be found in the following sources:

- According to the Federal Highway Administration Pedestrian Safety Guide (2008) and Countermeasure Selection System website, a pedestrian ramp or curb ramp costs approximately $800 to $1,500 per ramp, sidewalks cost approximately $11 per square foot, and curbs cost approximately $15 per linear foot. According to the same site, streetlight installation varies depending on the fixture type and service agreement with the local utility. About 30 percent of recommendations fall into this category.
- The operating cost of the proposed shuttle routes would depend on a final routing, the number of stops, and the fares collected. Generally, the operating cost could be anywhere from $100,000 to $250,000 per route per year, and funding may be available from several sources, as

discussed in the next section.[23] There would be economies of scale in setting up multiple routes in the same geographic area since a single contractor would be more likely be interested and provide a competitive bid for multiple routes due to common costs like maintenance facilities that would be shared amongst the routes. Costs for the routes could range from $600,000 to $800,000 per year. The cost to purchase vehicles can be anywhere from $80,000 to $100,000 each; typically municipalities do not own the vehicles, they contract the service out to someone who owns them.

Long-term projects represent less than 10 percent of recommendations and are all high-cost improvements of over $100,000. These consist of recommendations requiring significant lead time, design, and construction. Projects in this category would include construction of parking facilities; new or reconstructed roadways or trails to create additional pedestrian and bicycle connections; creation of the new kiss-and-ride at Madison Station; and physical intersection improvements. Specific costs for these long-term, high-cost elements are listed below:

- Create a new parking lot adjacent to Lot 1 on site of athletic field at Chatham Station (Ch–23). The estimated construction cost is about $507,500 (145 spaces x estimated $3,500 per space).[24]
- Construct a three-level parking structure on the site of the existing Lot 1 at Chatham Station (Ch–24). The cost of the new parking structure is estimated at $13.1 million (assuming average cost of $20,000 per space).
- Construct a multi-level parking facility on the site of existing Lot #3 at Madison Station, yielding approximately 300 additional spaces in a 506-car parking structure. The cost of this measure would be about $10.1 million, assuming an average cost of $20,000 per space (Ma–31). If it is assumed that an additional 300-car parking facility would be needed to accommodate both additional commuters, to meet the high end of the projected parking deficit, and the municipal employees. The cost of this measure would be about $6 million (300 spaces x $20,000 per space). The cost of this additional garage constructed on the municipal lot across from the train station, would be about $6 million (300 spaces x $20,000 per space).
- Reconfiguration of the "kiss-and-ride" at Madison Station. The estimated cost for the reconfiguration is $600,000 (Ma–31).

[23] http://www.ezride.org/2-1-2-Whattheycost.asp

[24] Assumes no land acquisition cost, and does not include cost of replacing athletic fields elsewhere in Chatham Borough. There is minimal open space available in the Borough, but one possibility would be to improve/expand the existing athletic fields located east of Parrott Mill Road and adjacent to the utility right-of-way along the Passaic River.

- Construct a multi-level parking structure on the site of Lot 1 at Convent Station. The estimated cost of this parking structure would be about $16 million (800 spaces x $20,000 per space). Additional traffic analyses would be required to assess the capacity of adjacent roadways to accommodate this proposed structure (Co–21).

5.7 Potential Funding

Funding for the proposed roadway improvements would likely come from multiple traditional resources. For minimal cost improvements, the cost of the physical improvements should be weighed against the potential cost of providing data, reports, other information in applications for grant funding, since grant funding is intended for capital projects with moderate to high costs. Furthermore, applying for grants increases the implementation time for improvements. For the physical safety improvements recommended in this project, local maintenance funds are recommended for implementation.

Potential funding sources for the proposed traffic, safety, and bicycle and pedestrian improvements would include traditional NJDOT funding, including County, Municipal, and Local Aid funding, and the recently adopted NJDOT Safe Streets to Transit (SSTT) Program. Under the provisions of MAP-21, the Federal transportation law adopted in 2012, some projects may be eligible for Surface Transportation Program (STP) funding. The corridor-length signal system improvements may be a good candidate for STP funding if it can be packaged as part of a multi-modal corridor improvement program that includes mobility, safety, pedestrian and bicycle accessibility, and transit improvements. Depending on the environmental benefits of this proposed improvement, it may also be eligible for Federal funding under the Congestion Mitigation and Air Quality Improvement (CMAQ) program.

Other potential funding sources could include:

- Federal Safe Routes to School funding can be used for pedestrian and bicycle infrastructure improvements within two miles of schools.
- Safe Streets to Transit grants are available through NJDOT.
- The NJDOT Highway Safety Improvement Program has funding for high crash locations.
- The NJDOT Division of Highway Traffic Safety has grants for law enforcement personnel to perform safety enforcement patrols.
- TransOptions has funding for safety education projects.

The Federal Government provides funding for shuttle services through its Congestion Mitigation and Air Quality program. Funds are distributed to the

states based on formulas that take into account population and the attainment status of the region for National Ambient Air Quality Standards. CMAQ funding is available to fund the operation and capital cost of a shuttle (with a local match of 20 percent) for the first two years. After the second year, funds need to be identified to pay for the full operation of the service. If fares are charged for the shuttle service they can offset the operating and maintenance cost but they will not be sufficient to cover the cost. The need to fully fund shuttle services beyond the second year often results in the discontinuation of service. If shuttles are intended to be implemented in this corridor, a stable and continuing local funding source should be established prior to application for CMAQ funding.

In New Jersey, CMAQ funds for shuttle service are distributed through NJ TRANSIT via the Community Shuttle Program. This competitive program evaluates proposed shuttles through New Jersey and provides vehicles and funds a portion of the operating costs. There are multiple municipalities throughout the state that participate in this. The MAD Shuttle is funded through this program and managed by TransOptions.

5.8 Transit–Oriented Development (TOD) Analysis

As described in Chapter 3, there are opportunities in Chatham Borough, Madison Borough, and Morris Township to envision and support implementation of denser development (infill and potentially more substantial development) surrounding the three study area commuter rail stations. Demographic analyses and trends indicate a need to serve a young professional as well as an older adult population in these communities that are increasingly interested in living in walkable and transit-oriented downtowns. Both Chatham and Madison boroughs are substantially transit-oriented environments, though they are still significantly auto-dependent with large parking areas throughout their downtowns and a lack of affordable downtown housing choices. The Convent Station area is the most auto-oriented of the three station areas, lacking a mixed-use and centralized land use composition, and having large parcels of land in use primarily for parking.

In order for any of these station areas to redevelop in a denser, mixed-use, and transit-oriented manner the following general conditions would be required:

- The municipalities would need to embrace a departure from the "status quo" in land use planning and zoning. Revisions to the zoning code in each municipality would be required to support redevelopment.

- Parcels of land for development/ redevelopment would need to be identified.
- The parcels would need to be of sufficient size and layout so that a developer would find them feasible for redevelopment, and that the zoning code would enable sufficiently dense development to support an acceptable return on investment.
- Real estate market conditions in the three municipalities would need to remain favorable.
- The redevelopment would need to secure environmental permits and the surrounding infrastructure would need to be assessed for its ability to support the development.

Also, as mentioned in Chapter 2, a commuter parking space deficit of 121 spaces exists and is forecasted to increase across the corridor stations ranging from 250 to 500 additional spaces. The high end of this forecasted demand cannot be accommodated in existing commuter surface lots. Development of structured parking is extremely expensive ($20,000 per space), consumes valuable land within walking distance of the station, and is not easily or typically funded by other than local or private sources. While the recommendations and strategies to encourage station access by modes that do not require parking will result in some diminishment of parking demand, it is likely that additional commuter parking will be needed in this corridor in the future.

Given this data, the following alternative land use scenarios have been developed to give a general concept what type of development could be encouraged and supported at each station area. Each scenario was envisioned to occur in such a manner that the developer could also support the construction of structured parking to meet the high end of the forecasted commuter parking deficit. It is important to note that these alternative land use scenarios are highly conceptual and should only be viewed as the earliest step in visioning what the station areas could support. Significantly more detailed analyses would be required to advance any of these concepts. In addition, each of these concepts assumes that the development would need to absorb and support the development-related parking demand, the existing individual station parking demand that would be displaced by the development plus the high end of the forecasted commuter parking deficit. Additional analyses and discussion would be required to assess the actual parking need taking into account revised assumptions for bicycle, pedestrian, carpool, transit, and other access modes (assuming this project's recommendations are implemented), as well as an assessment of whether the entire deficit should be addressed at one station location or distributed among the three stations. The costs of accommodating the demand at three commuter parking structures would be greater than if it was all accommodated at a single, albeit higher, structure.

5.8.1 Background

An in-depth build-out and financial feasibility analysis of hypothetical TOD scenarios around each of the three stations was performed. The principle objectives for performing the build-out and financial feasibility analysis were:

- Objective 1: To determine the minimum dwelling unit density and land-use mix scale (e.g., residential, retail and/ or office) which could be financially viable – that is, a mixed-use development project which would permit a sufficient market rate of return, given associated risks for undertaking a TOD project at each station site.
- Objective 2: To determine a minimum dwelling unit density and land-use mix sufficient to provide a market rate of return to a private developer, given the associated risk inherent with the subject project, while allowing the TOD project to underwrite some portion of rail station infrastructure improvements – the most important of which being on-site structured parking.

It should be understood that objective 1 is independent of objective 2 (e.g., objective 1 is not dependent upon the viability of objective 2) while objective 2 is, necessarily, dependent upon the viability of objective 1, given that a private developer will not consider subsidizing public infrastructure if the underlying private investment returns are inadequate, given project risk. Consequently, this analysis takes into consideration and reports out on the viability of both objectives for all of the hypothetical scenarios examined.

5.8.2 Methodology

The TOD analysis was approached in the same way that a typical developer would approach it. Land parcels close to each of the three rail stations – within a 1,500 foot radius – were identified and examined for their redevelopment potential. This initial assessment: a) was based on the principle that TOD development typically occurs within a quarter mile of a rail station, b) considered each parcel's current land use, and c) considered the effective utilization of the parcel (see Figures 5-23 through 5-25 for the land parcels identified). Undeveloped parcels dedicated to parking were considered as a priority.

For these parcels, TOD supportive assumptions regarding permitted land-use zoning within the identified land areas, with respect to building heights (e.g., commercial buildings of not more than five stories (mid-rise), multi-family structures of up to five stories (low- to mid-rise), parking requirements of 1.25 per residential dwelling unit, 3.0 parking spaces per 1,000 square feet (s.f.) of

retail and 3.0 per 1,000 s.f. of office space) were made. These TOD supportive assumptions would require changes in the municipal code as identified in the Analysis of TOD Scenarios with Commuter Parking and Required Zoning Changes section, below. Conventional and locally germane metrics were used for site work and construction costs. Further, assumed pre-development costs were identified and modeled within the financial development pro forma (e.g., estimated property acquisition, demolition, and general site improvements).

Table 5-6 identifies a wide range of land acquisition costs across the three station areas. This range in costs was estimated based on the number and scale of structures needing to be acquired (with commercial buildings and lot areas representing higher values than non-commercial property and/ or unimproved non-commercial land). Further, the share of public land (greatest by far in Convent Station at 76 percent) within a prospective TOD project area also influenced overall acquisition cost, under the assumption that publicly controlled land would be contributed to a TOD project as part of a public/ private partnership. It should be noted that acquisition costs were based on a cursory analysis of existing building types and uses and, therefore, should not be relied upon as a substitute for conducting a professional appraisal for these properties. Therefore, the estimated acquisition costs will need to be refined as specific development proposals are advanced for consideration.

0 150 300 Feet

Zoning

B-2
Business District

X.XX Parcel Area (Acres)

Morris County NJ 124
Transit Access Study

Chatham Station Area Parcel Ownership

FIGURE 5-23

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0 250 500 Feet

Zoning

- CC (Community Commercial)
- CBD1 (Central Business District)
- X.XX Parcel Area (Acres)

VHB

Morris County NJ 124
Transit Access Study

Convent Station Area
Parcel Ownership

FIGURE **5-24**

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0 300 600 Feet

OL-5 (Office and Research Lab)

OSGU (Open Space Government Use)

x.xx Parcel Area (Acres)

Morris County NJ 124
Transit Access Study

Madison Station Area Parcel Ownership

FIGURE **5-25**

Table 5-6: Key Land Metrics Associated with Prospective TOD Station Sites

	Parcels	Total Acreage	Estimated Acquisition Cost	Public Land Acres	Share of Public Land
Chatham	5	2.76	$6,000,000	1.21	43.8%
Convent Station[1]	6	6.45	$3,000,000	4.9	76.0%
Madison	15	5.81	$9,000,000	0.0	0.0%

[1]Does not include the MetLife Insurance/Cushman Wakefield and Madison Hotel-Timbers properties (these excluded properties represent 13.32 acres)

5.8.3 TOD Scenarios Modeled and Key Assumptions

Development costs associated with development-related parking were broken out into surface and structured parking, with the scale of development determining the mix of each type of parking (e.g., a low-density, relatively small dwelling unit project would not require structured parking, while a high-density, large scale mixed-use project would likely require structured parking).

The pro forma development models (located at the end of this analysis) assumes no more than 50 surface parking spaces would be located within the near-term TOD target land area parcels, and all other zoning required parking as structured parking. No commuter parking spaces (surface or structured) were included as part of this initial development analysis; however, it is assumed that some portion of a mixed-use development's parking spaces (surface and/ or structured) could be shared with a public transit use. Analyzing the dynamics of shared parking falls outside of the scope of this assignment and is, therefore, not addressed here. However, it should be explored as a potentially viable strategy.

The financial analysis performed (e.g., development and operating pro forma for each of the TOD scenarios examined) were performed on an unleveraged basis – that is, each development scenario was modeled without the assistance of debt, which is customary when performing a financial feasibility analysis for real estate development. Market area financial benchmarks such as the cash-on-cash rate of return (ROE) or return on equity and the internal rate of return (IRR) were incorporated into the operating pro forma to allow analysis of financial viability (identified financial benchmarks based on experience with similar scale and types of development were used). An assumption was made that a project sale (the entire mixed-use project) would occur in year 15, which is a reasonable hold period for a project of this size.

The financial return rate metrics showed that a seven percent internal rate of return and an eight percent annual average cash-on-cash rate of return over 15 years is needed to satisfy a developer's interest in building investment. Experienced professionals have found that these financial return metrics are reasonable in today's market climate, based on projects which are, principally, multi-family rental led. However, it is recognized that the above financial return rate metrics will vary according to a developer's tolerance for risk, personal interests in the development project, and changing market conditions.

Prior to performing financial modeling, it was necessary to understand the general parameters that should be used for conducting the analysis – that is, what should be the minimum and maximum dwelling unit densities per acre that would be assumed. In order to establish these parameters, a cursory review of TOD zoning regulations found on-line and within various TOD case study analyses, also found on-line, were examined. This examination showed that dwelling unit densities (required or otherwise) within many established or zoned TOD areas, nationally, range from as low as six to as high as 100 units per acre.

Unsurprisingly, the more urban locations featured the higher densities. However, many national studies and zoning regulations reviewed showed 30 units as a typical minimum dwelling unit density for TOD areas. No maximum dwelling unit density standard was identified. Though, based on the development character of each TOD community examined, generally, it is believed that a maximum dwelling unit density of 50 units per acre is at the upper end of what should be permitted.

The Task 4 analysis of zoning regulations in the municipalities surrounding the station areas also informed our dwelling unit density assumptions. For instance, in Madison, the Green Village Road Special Use District allows up to 28 dwelling units per acre with bonuses. By comparison, in the Township of Morris, the RH-20 mixed housing zone allows up to 20 dwelling units per acre. However, empirically, higher dwelling unit densities can have a positive impact on the economic viability of a TOD project; consequently, densities up to 50 dwelling units per acre were included in the model.

Accordingly, an Excel based financial model was developed which allowed for creation of development and operating pro forma associated with two TOD project scenarios modeled for each of the three station areas – a 30 dwelling unit per acre scenario (lower end threshold) and a 50 dwelling unit per acre scenario (upper end threshold).

At each station, each of the two TOD scenarios also included approximately 10,000 s.f. of low-rise professional office building space and approximately

15,000 s.f. of first floor convenience retail and restaurant space. The relatively small amount of office space included in these models reflects current area weakness in the office market (the Morris County office market features an overall vacancy rate of more than 22 percent – among the highest office vacancy rates in New Jersey). However, given the strong presence of large corporate facilities near Convent Station, as well as the relatively large and unimproved land area around Convent Station, it would not be unreasonable to foresee as much as 200,000 square feet of new office built in this corridor in the next ten years, assuming a stronger regional office market.

Much detail was built into the development and operating pro forma, including estimated annual inflation rates, estimated construction and lease costs per square foot, surface and structured parking costs per square foot, estimated acquisition costs, and estimated demolition costs (see Appendix C: Pro Forma Analysis).

The pro forma variables having the most influence on the prospective financial return rates (e.g., cash-on-cash and internal rate of return) are as follows:

- Residential construction costs per square foot
- Number of structured parking spaces
- Property acquisition costs
- Market residential rental rates
- Office and retail lease rates

While adjustments to any of the above variables had a noticeable impact on return rates within the cash-flow model, it should be understood that all of these variables, with little exception, are subject to market forces (and, in the case of parking, prudent zoning requirements) and, therefore, cannot be arbitrarily adjusted for the purpose of achieving the desired financial result. While a limited amount of sensitivity testing was performed by slightly adjusting the values of the above variables, no marked change in return rate was observed.

It was also important to make sure that the input variables were considered as market supportable, based on a prospective TOD project. For example, the average per square foot residential rental rate used in the analysis is $2.00.[25] The estimated per square foot construction cost used in the analysis for the

[25] Based on an online review of current market rental rates for new apartment units near to shopping and transit amenities.

residential units is $185 per square foot, which is inclusive of all hard and soft costs, and includes finishes and fixtures.[26]

The cost estimates used for structured and surface parking per space are $20,000 and $3,500, respectively, based on inquiries with a national parking consulting firm with deep experience in the tri-state region.

Table 5-7 summarizes the expected investment return rates identified for each development scenario using the pro forma model:

Table 5-7: Financial Performance Metrics

Chatham Station	ROE	IRR
30 DU Scenario	6.3%	5.9%
50 DU Scenario	6.6%	6.4%
Madison Station	**ROE**	**IRR**
30 DU Scenario	6.4%	5.9%
50 DU Scenario	6.7%	6.5%
Convent Station	**ROE**	**IRR**
30 DU Scenario	7.1%	7.2%
50 DU Scenario	7.2%	7.3%

While no scenario achieves both the target eight percent or higher ROE (cash-on-cash rate) and a seven percent internal rate or return rate (IRR) or higher, the Convent Station scenarios come closest – achieving IRRs of 7.2 and 7.3 for the 30 and 50 dwelling unit scenarios, respectively.

Principal cost factors which depress the financial performance for both Chatham and Madison include:

- High estimated upfront acquisition costs since both of these locations feature a number of improved properties in good condition (primarily commercial); and
- Associated demolition costs.

It should be noted, however, that the above financial return findings should not be taken to mean that a TOD would be unsuccessful or impossible to

[26] This figure, which was validated by RS Means regional construction data, a number of architects and developers consulted through outreach on previous TOD projects. Based on this information and professional experience, the value is considered a proven number.

implement in Chatham or Madison. To the contrary, there will be a few developers who, notwithstanding the identified low return rates, will still be interested in pursuing TOD at these locations, if in fact alternative development opportunities in the region are not significantly more attractive, financially.

Still, other development interests will seek to close the financial gap (e.g., the difference between the above identified financial return metrics and the return metrics they desire, given project risk) by requesting public financial assistance in the form of real property tax relief or direct financial contribution towards property acquisition and/ or infrastructure improvements (e.g., structured parking). It should be understood that the public sector, while supportive of TOD and amenable to entertaining changes to certain zoning ordinances which would offer the equivalent of financial relief to a prospective TOD project (e.g., reduction in the parking ratios required, increases in dwelling unit density, increases in lot area coverage, etc.), can only influence the financial viability of a TOD by only so much – and the variables used within financial modeling performed for this analysis push the upper limits of that influence.

It is important to note that, while TOD activity is certainly viable (given the above caveats and qualifications), a TOD of any scale or dwelling unit density would be challenged, at best, to contribute any financial assistance towards public infrastructure improvements, such as a new parking structure benefitting commuters (see implications of structured commuter parking below). As stated above, the greater likelihood is that a TOD project that goes forward within any of the municipalities in the study area may require financial assistance from the public sector. Table 5-8 provides a summary of the analysis of each location and scenario.

Table 5-8: Summary of Development Metrics

Station Area	Dwelling Units per Acre	Total Dwelling Units	Office S.F.	Retail S.F.	Structured Parking	Total Project Cost ($M)	Return Rates	
							IRR	ROE
Chatham								
	30	83	9,618	24,045	204	$40,268	5.9%	6.3%
	50	138	9,618	24,045	273	$57,148	6.4%	6.6%
Convent								
	30	194	11,238	25,287	351	$71,421	7.2%	7.1%
	50	323	11,238	25,287	513	$110,869	7.3%	7.2%
Madison								
	30	174	10,123	25,308	324	$72,770	5.9%	6.3%
	50	291	10,123	25,308	469	$108,304	6.5%	6.6%

Source: 4ward Planning LLC, 2013

5.8.4 Financial Analysis of TOD Scenarios

An order of magnitude analysis of the impacts of the new hypothetical development on the municipal taxable values of the proposed properties to be developed was performed. One of the potential economic benefits of TOD is the generation of additional tax ratables for local municipalities. Table 5-9 indicates the existing property values in each of the three study areas and the estimated increases in values that could be anticipated from redevelopment at 30 and 50 dwelling units per acre. As shown, TOD developments could increase taxable property values in the Convent area by approximately $29 to $61 million, in Madison by $38 to $68 million, and in Chatham by $21 to $40 million, depending upon the number of dwelling units constructed per acre. Therefore, each location could potentially experience a significant increase in property tax collections due to the new, higher density TOD. Taxable values should not be confused with tax revenue.

It is important to recognize that the TOD analysis for Convent Station excluded two of the largest privately held land parcels within the 1,500 foot study area – the MetLife/ Cushman Wakefield low-rise office building and adjacent surface parking lot, and the Madison-Timbers Hotel Conference Center and adjacent surface parking lot. These two properties, combined, represent slightly more than 13 acres (more than two times the acreage included in the Convent Station analysis). While it should be assumed that the inclusion of the aforementioned properties within a Convent Station TOD would require in-depth negotiations with the current property owners and, likely, a public/ private partnership involving ground leases on existing surface parking areas, in order to permit mixed-use development and structured parking, the financial and real property tax implications of such an expanded project would be significantly greater than that of the analyzed scenarios (estimated to be more than two times greater than the analyzed 50 dwelling-unit Convent Station Scenario). For example, assuming a total of 16 buildable acres (as opposed to 6.45 buildable acres under current development scenario), the total number of dwelling units under a 50 unit per acre scenario would increase from 323 to 800 units. Retail square footage would likely expand from approximately 25,000 s.f. to just over 67,000 s.f. Office square footage would remain relatively constant, given current and near-term office market weakness metrics. Total development costs associated with the increased residential and retail square footages would rise from $111 million to $270 million (a 143 percent increase).

Table 5-9: Taxable Value Analysis

CONVENT TOD STUDY AREA			
Land Use	**Existing Taxable Value[1]**	**30 Dwelling Units/Acre Projected Taxable Value**	**50 Dwelling Units/Acre Projected Taxable Value**
Residential	$0	$48,955,500	$81,592,500
Commercial	$25,713,000	$5,408,519	$5,408,519
Total	$25,713,000	$54,364,019	$87,001,019
	Difference from Existing Value:	$28,651,019	$61,288,019
MADISON TOD STUDY AREA			
Land Use	**Existing Taxable Value[1]**	**30 Dwelling Units/Acre Projected Taxable Value**	**50 Dwelling Units/Acre Projected Taxable Value**
Residential	$147,600	$44,097,900	$73,496,500
Commercial	$10,710,400	$5,188,214	$5,188,214
Total	$10,858,000	$49,286,114	$78,684,714
	Difference from Existing Value:	$38,428,114	$67,826,714
CHATHAM TOD STUDY AREA			
Land Use	**Existing Taxable Value[1]**	**30 Dwelling Units/Acre Projected Taxable Value**	**50 Dwelling Units/Acre Projected Taxable Value**
Residential	$0	$20,948,400	$39,914,000
Commercial	$5,294,600	$4,929,250	$4,929,250
Total	$5,294,600	$25,877,650	$44,843,250
	Difference from Existing Value:	$20,583,050	$39,548,650

[1] Existing taxable values are sourced from Morris County tax assessor data records.

However, the inclusion of the additional properties under the Convent Station scenario would only slightly raise the key return rates examined (IRR and ROE) for a development sponsor. This does not take into consideration the cost associated with the development of additional commuter rail parking or

another scenario which would include only the parking portions of the MetLife/ Cushman Wakefield and Madison-Timbers Hotel sites.

5.8.5 Implications of Structured Commuter Parking on TOD Financial Return Rates

The financial performance of the modeled TOD projects was reassessed with the assumption that commuter parking was included as part of the developer's investment. Specifically, the two key return rates examined (IRR and ROE) were reexamined to determine how they would respond if the additional project cost of structured commuter rail parking were to be included in the development and operating pro forma of the scenarios modeled.

This issue was analyzed by increasing the cost of structured parking associated with project development (residential, retail, and office) in $1,000,000 increments. It was further assumed that the commuter parking fees charged would be no more than an equal offset to annual maintenance costs for the structured parking (under the assumption that structured parking yields little profit).

The findings suggest that for each $1 million increase in the cost of structured parking, financial return rate performance decreases by approximately a tenth of a percentage point. Consequently, a $10 million dollar structured parking garage would likely lower both key return rates by a full percentage point – making it less likely that private investment would underwrite the cost of the commuter structured parking, without substantial financial assistance. A $1 million structure would yield only 50 parking spaces; a $10 million structure would yield 500 spaces. At Chatham and Convent stations, the proposed TOD would displace existing commuter parking which would need to be re-captured in the TOD-supported parking structure. At all three stations, the financial performance assessment was performed assuming that the entire high end of the forecasted parking deficit range (500 spaces) was incorporated into the TOD structure at each station. This is the worst case scenario and was used to show the maximum impact per site. More realistically, the access improvements recommended earlier in this chapter would reduce the high end deficit and some of the needed parking at each station location. Table 5-10 summarizes the impact of adding the commuter parking to each TOD. The change in financial return is the smallest at Madison Station due to the fact that existing commuter parking was not displaced by the potential TOD.

Table 5-10: Financial Performance Metrics with Commuter Parking (displaced spaces plus 500 additional spaces)

	ROE without Commuter Parking	IRR without Commuter Parking	Commuter Parking Needed*	Cost of Parking Structure	ROE with Commuter Parking	IRR with Commuter Parking
Chatham Station						
30 DU Scenario	6.3%	5.9%	613	$12.5M	5.1%	4.7%
50 DU Scenario	6.6%	6.4%	613	$12.5M	5.4%	5.2%
Madison Station						
30 DU Scenario	6.4%	5.9%	500	$10.0M	5.4%	4.9%
50 DU Scenario	6.7%	6.5%	500	$10.0M	5.7%	5.5%
Convent Station						
30 DU Scenario	7.1%	7.2%	1,089	$22.0M	4.9%	5.0%
50 DU Scenario	7.2%	7.3%	1,089	$22.0M	5.0%	5.1%

*Does not include development parking needs; development parking needs already captured in ROE and IRR without parking rates

5.8.6 Analysis of TOD Scenarios with Commuter Parking and Required Zoning Changes

The analyses of potential transit oriented developments at or near the three stations indicate that all would require some adjustments to the current zoning in order to be achievable. Most importantly, densities and heights above what is permitted by the existing zoning in each of the locations, which cover three separate municipalities, would need to be increased in order to permit the amount of development needed to make each scenario financially feasible. In addition, depending on how parking is to be provided on a particular property, permitted uses might need to be specified in a way such that public parking is allowed as an accessory or free-standing use.

The zoning revisions that would be required, and the general outline of what development they might result in, are discussed below. The scenarios were selected to be representative of possible developments for analysis purposes, but are not intended to be proposals for development. Other configurations could, for example, utilize larger building footprints, resulting in additional first floor commercial space and allowing the residential units to be accommodated within a shorter building. Any selection of an alternative to pursue would require consideration of a range of factors including financial, market, design, and public policy considerations.

5.8.6.1 Chatham Borough TOD

The area identified in Chatham as a possible TOD site is zoned B-2 Regional Business District. Permitted uses include offices, services, retail, and restaurants, among others. Apartments are a conditional use as is commercial recreation. The potential uses likely to be included in a mixed use TOD are, therefore, already permitted in the zone.

In keeping with Chatham's planning policies, the scale of permitted development in the B-2 is relatively low with a maximum height of two stories or 35 feet and a Floor Area Ratio (FAR) of 30 percent. Thus, on the 2.76 acres identified for possible development, only 36,000 square feet of floor area could be developed with the existing code, or, approximately 36 apartments, which is significantly less than what would be needed for economic viability.

Chatham's B-4 Community Business District permits more dense developments: three stories, 90 percent lot coverage, and no FAR. Residential units are permitted as conditional uses. As in the B-2, the Financial Feasibility analysis indicates that it would not be possible to achieve the density required to make a TOD feasible on the subject properties.

Since Chatham does not have a zone that would permit the necessary density in to achieve viability, the zoning of the properties would need to be adjusted, either by revisions to the B-2 code or through creation of a new TOD zone.

The requirements of new zoning could, for example, include the following:

- Height of five to nine stories
- FAR value of 0.9 for the mixed use building plus additional for any above-ground parking structure as per Chatham's Code
- 1.25 parking spaces per residential unit; three spaces per 1,000 square feet of commercial space (lower numbers to reflect adjacency to the railroad and downtown)

With these basic controls, the 2.76 acre lot could accommodate a range of building layouts and sizes. For example, the lot could accommodate a five-story building containing approximately 21,500 square feet of first floor commercial space and four stories of residential space above, containing a total of 86 units. This is comparable to the 30 unit per acre scenario in the TOD Financial Analysis. With the indicated controls, the development alone would need to provide 172 parking spaces. It is assumed that the building would be constructed in the portion of the site closer to NJ 124, providing good street frontage for the first floor commercial uses.

If the plan were to develop at 50 units per acre, the higher range in the Financial Analysis, the building would have 138 units and would need to have at least six floors of apartments above the first floor commercial space, resulting in a seven-story building. Parking for the mixed use building would need to total 237 spaces.

The proposed development would displace approximately 113 public parking spaces. Added to the spaces needed for the new development, this would give a total of 285 for the 30 unit/ acre scenario, and 350 for the 50 units/ acre scenario. In addition, the objective is to also provide commuter spaces on the site. If that number is 500 (the high end of the forecasted parking deficit), it would bring the required total spaces to 775 and 850 for the two scenarios (a $15.5 million and a $17 million structure respectively). A free-standing parking structure with a 40,000 s.f. footprint can typically accommodate approximately 100 cars per floor, depending on its dimensions and design. Then, an estimated eight or nine floors of parking would be needed. Depending on soil conditions and other engineering considerations, it is possible that one or more levels might be provided below grade, but at greater expense. The structured parking might be fit on the site in various ways, such as one long structure parallel to the tracks or two separate structures to serve: (1) the development; and (2) commuters/ shoppers. Overall, this development scenario would result in approximately one acre of building, one acre of parking and ¾ acre for circulation, open space, pedestrian areas, etc., recognizing that there are multiple ways in which the various elements could be arranged on the site. As an alternative, some or all of the parking could be located within the mixed use building, which would leave more open space while requiring a substantially taller structure. However, it would not be necessary to accommodate all 850 parking spaces in the shared parking structure if additional commuter parking was constructed on the south side of Chatham Station adjacent to the existing Lot #1, as described previously.

Table 5-11 summarizes the potential building heights for the proposed TOD at Chatham Station. A more detailed analysis of building layout and available lot percentage (100 percent was assumed) would be needed to formalize the potential building heights since multiple arrangements are possible.

Table 5-11: Chatham TOD Potential Building Heights

TOD Scenario	TOD Structure	Parking Structure*
30 Units per Acre	5 stories	8 stories
50 Units per Acre	7 stories	9 stories

*Includes development and commuter parking

Figures 5-26 and 5-27 depict an alternate to the building arrangement described above. The alternative layout depicts two five-story residential

buildings, one additional five-story building with two floors of residences atop one floor of office, and two floors of retail. In these depictions, a five-story parking garage would accommodate the development parking requirement as well as the displaced commuter parking, but it does not depict the additional 500 spaces to meet the corridor's forecasted parking deficit. These figures visualize the potential massing of TOD at each of the station areas and represent the current commuter parking demand as well as the parking needed for the new development. It is assumed that the future demand would be distributed amongst the municipalities and any future parking allocation would be in addition to what is depicted here.

5.8.6.2 Madison Borough TOD

The properties identified for TOD in Madison are located in two zoning districts: CBD-1 and CC Community Commercial. Though neither would permit the typical density required for a viable TOD, the Town's Green Village Road Special Use District (GVRSU) does provide some elements that are potentially more supportive of the development scenarios being considered. Most importantly, with bonuses the residential density in the GVRSU, which was designed to encourage TOD on a specific site, can go as dense as 28 units/ acre with heights limited by application of a sky exposure plane but potentially permitting five stories with a mix of uses. In order to realize the TOD potential around Madison Station at 30 or 50 units per acre, creation of a new zone permitting higher densities and a mix of uses would be needed.

The Madison properties, a total of 5.81 acres, are divided by Prospect Street. The properties to the west total 2.46 acres; and 3.35 acres to the east. No commuter parking would be displaced in developing those properties, so parking would only be needed to serve the development plus additional commuter parking that is needed to meet the projected study area demand.

A variety of building arrangements and heights could accommodate the requirements of the TOD. For instance, on the 2.46 acre west site, zoning at 30 units to the acre would result in 74 units. This would be slightly higher than the 28 units/ acre allowed in the GVRSU with bonuses. The units could be placed within a five-story building – four stories of apartments over a first floor of commercial. The building footprint would be approximately 18,500 s.f. and the total floor area would be 92,500 s.f. Thus, a FAR of 0.9 would be necessary to accommodate this structure; additional FAR would be needed to accommodate any structured parking in accordance with the definition in Madison's code. At 50 units per acre, 123 units would be produced; a six-story building with a footprint of 24,600 s.f. could accommodate first floor commercial plus five stories of apartments.

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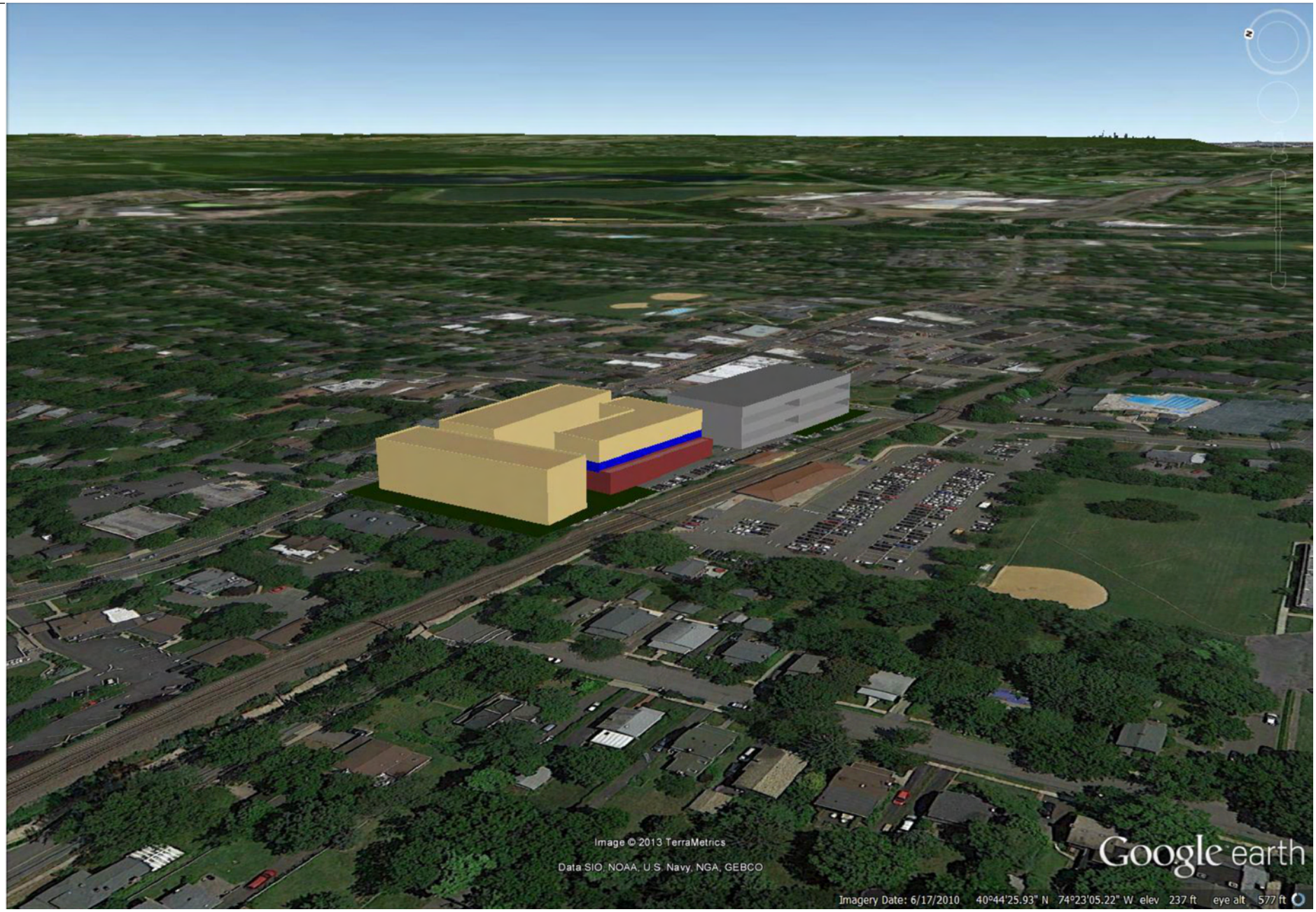

Morris County NJ 124
Transit Access Study

Massing Analysis, Chatham Station
Isometric View - Looking East

FIGURE **5-26**

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Morris County NJ 124
Transit Access Study

Massing Analysis, Chatham Station
Street View

FIGURE **5-27**

Required parking for the 30 and 50 units per acre scenarios would be 148 and 228, respectively. The high end of the projected commuter parking deficit range is an additional 500 spaces. Assuming 200 spaces are provided on the smaller west site, this would require approximately 348 spaces or 448 spaces in the two development scenarios (a $7 million and $9 million parking structure, respectively). With a 40,000 s.f. level of parking providing approximately 100 spaces, these space totals would translate into three or four stories of structured parking (Garage 1). There is sufficient acreage on this site to accommodate a free-standing structure (approximately one acre for the parking, a half acre for the building, one acre for driveways, open space). Alternatively, the parking could be provided beneath the building (and perhaps partially below grade), which would leave more open space but result in a taller building.

On the east side of Prospect Street, the identified parcels total 3.35 acres. Taking an approach similar to the analysis done for the west side, a development at 30 units per acre would yield about 100 units. In a five-story building, with 25 units per floor, the building footprint would provide for approximately 25,000 s.f. of commercial space and require 200 parking spaces. In the 50 units per acre scenario, a similar five-story building would hold 167 units and 42,000 s.f. of first floor commercial space. The parking requirement would be 335 spaces. Adding in the 300 remaining commuter spaces projected high-end deficit (in addition to the 200 proposed for the west side of Prospect Street) would create a need for 500 and 635 spaces ($10 million and $13 million parking structure respectively) for the two scenarios respectively. Assuming one acre for the building, 0.5 acre for open space and circulation would leave approximately 1.85 acres for a parking structure. At approximately 185 spaces per level, a three- or four- story garage would be needed (Garage 2). This parking could possibly be split into two smaller structures or sections to separate the development parking from that provided for commuters, although this could increase construction costs. Splitting the parking in this fashion and into separate structures on either side of Prospect Street might enable an acceptable rate of return on the development plus partial commuter parking scenario for a developer, thereby having at least some of the parking deficit met by private developer investment.

Table 5-12 summarizes the potential building heights for the proposed TOD at Madison Station. A more detailed analysis of building layout and available lot percentage (100 percent was assumed) would be needed to formalize the potential building heights since multiple arrangements are possible.

Table 5-12: Madison TOD Potential Building Heights

TOD Scenario	TOD Structure	Parking Structure*
30 Units per Acre	5 stories	Garage 1: 3 stories Garage 2: 3 stories
50 Units per Acre	6 stories	Garage 1: 4 stories Garage 2: 4 stories

*Includes development and commuter parking

Figures 5-28 and 5-29 depict an alternate to the building arrangement described above. The alternative building arrangement would include eight individual residential structures. One of the two buildings would also accommodate retail development while another would accommodate retail and office development. As depicted, one of the buildings would wrap around the six-story parking garage on two sides, concealing the garage when viewed from NJ 124. The garage as depicted would accommodate the development parking but it does not depict the additional 500 spaces needed to meet the corridor's forecasted demand. These figures visualize the potential massing of TOD at each of the station areas and represent the current commuter parking demand as well as the parking needed for the new development. It is assumed that the future demand would be distributed amongst the municipalities and any future parking allocation would be in addition to what is depicted here.

5.8.6.3 Convent Station TOD

The area proposed for possible TOD near the Convent Station totals 6.45 acres and is zoned Open Space/ Government Use by Morris Township. To the west of Convent Road there are 3.94 acres predominantly utilized for commuter parking. To the east, the 2.51 acres includes both a Township-owned commuter parking lot and a portion of the parking owned by the adjacent church, some of which is made available to commuters. As a result, development of these parcels would require replacement of approximately 589 commuter spaces in addition to the 500 additional spaces needed in the area and those required for the new development.

The highest density residential zone in the Township, RH-20, which provides for 20 units per acre, is intended to meet affordable housing obligations. Across the railroad tracks from the potential TOD parcels is a townhouse development that is zoned TH-8 with a maximum density of eight units per acre. There is no zone designed specifically for TOD. In order to realize the TOD potential

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Morris County NJ 124
Transit Access Study

Massing Analysis, Madison Station
Isometric View - Looking East

FIGURE **5-28**

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Morris County NJ 124
Transit Access Study

Massing Analysis, Madison Station Street View

FIGURE **5-29**

around Convent Station, the creation of a new zone permitting higher densities and a mix of uses would be needed.

A variety of building arrangements and heights could accommodate the requirements of the TOD. For analysis purposes, the two sides of Convent Road were initially considered separately. On the 3.94 acre west site, zoning at 30 units to the acre would result in 118 units. If these were placed within a five-story building – four stories of apartments over a first floor of commercial, the building footprint would be approximately 30,000 s.f. and the total floor area would be 92,500 s.f. Thus, a FAR of 0.9 would be necessary to accommodate this structure. Since the Township Code's definition of Floor Area excludes areas devoted to parking, no additional FAR would be required for a parking structure. At 50 units per acre, 197 units would be produced. A six-story building with a footprint of 39,000 s.f. could accommodate first floor commercial plus five stories of apartments.

Required parking for the 30 and 50 units per acre scenarios would be 208 and 314, respectively. In addition, assuming that 350 of the 589 displaced commuter spaces would be accommodated on this site. Moreover, an additional 500 commuter spaces would be required to meet the high end of the forecast parking deficit range. Assuming that 300 of these are provided on the west site, which is larger than the east site, the total requirement on the west site would be approximately 858 or 964 in the two scenarios ($17 million and $19 million parking structure, respectively). With a 60,000 s.f. level of parking typically able to provide approximately 150 spaces, this would translate into six or seven stories of parking (Garage 1). While 3.94 acres would theoretically be sufficient to accommodate the TOD building plus a parking structure with a 60,000 s.f. footprint and accessory open space and circulation, the configuration of the west parcel, which is triangular in shape, could substantially inhibit the possibility of achieving all of those elements in a realistic and efficient manner. Making the building taller and narrower and placing some of the parking below grade are possible design solutions that would need to be explored if such a TOD were advanced on this site.

The east parcel, though substantially smaller at 2.51 acres, has the advantage of being more regularly shaped. A five-story development at 30 units per acre would provide 75 units with a 19,000 s.f. first floor accommodating commercial space. At 50 units per acre, a six-story building would provide for 125 units and 25,000 s.f. of first floor commercial space. The parking required for these two scenarios would be 132 and 200 spaces, respectively. Combined with the remaining 239 replacement spaces and the 200 spaces needed for additional demand, the parking space totals would be 571 ($12 million structure) and 639 ($13 million structure), respectively. With a one acre footprint, this would require five to six story structured parking (Garage 2). It appears that the 2.51 acres could accommodate a development of that size.

Table 5-13 summarizes the potential building heights for the proposed TOD at Convent Station. A more detailed analysis of building layout and available lot percentage (100 percent was assumed) would be needed to formalize the potential building heights since multiple arrangements are possible.

Table 5-13: Convent TOD Potential Building Heights

TOD Scenario	TOD Structure	Parking Structure*
30 Units per Acre	5 stories	Garage 1: 6 stories Garage 2: 5 stories
50 Units per Acre	6 stories	Garage 1: 7 stories Garage 2: 6 stories

*Includes development and commuter parking

Figures 5-30 and 5-31 depict an alternate to the building arrangement described above. This alternate layout would include six individual five-story residential structures. One of the two buildings would also accommodate retail development while another would also accommodate retail and office development. As depicted, one of the buildings would wrap around the five-story parking garage on two sides, partially concealing the garage when viewed from NJ 124. The garage as depicted would accommodate the development parking as well as the displaced commuter parking. These figures visualize the potential massing of TOD at each of the station areas and represent the current commuter parking demand as well as the parking needed for the new development. It is assumed that the future demand would be distributed amongst the municipalities and any future parking allocation would be in addition to what is depicted here.

In looking at the Convent Station area, the large surface parking lots for the adjacent hotel and office building are obvious features that could, potentially, be incorporated into a TOD at this prime location. While any such development would need to be carried out in partnership with the two property owners and their tenants, the substantial acreage of their properties (13.32 acres in total), and the fact that the at-grade lots represent underutilization of a key site, suggests that further exploration of their use would be warranted. Including either one or both of these properties within the TOD planning could provide much greater flexibility in designing a realistic, achievable development that includes the desired level of parking.

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Morris County NJ 124
Transit Access Study

Massing Analysis, Convent Station
Isometric View - Looking North

FIGURE **5-30**

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Morris County NJ 124
Transit Access Study

Massing Analysis, Convent Station Street View

FIGURE **5-31**

5.8.7 Traffic Implications of the TOD

For all three stations, the TOD redevelopment scenarios that have been analyzed in this study provide an opportunity to incorporate complementary mixed uses in the immediate vicinity of the rail stations. This will allow for "shared trips" that effectively reduce the person-trips associated with the proposed land uses compared to the net person-trip generation rates that would be associated with each of the land uses if they were not located in close proximity to each other. For example, a 50-unit apartment building will generate X person-trips on a daily basis, while a coffee shop will generate Y person-trips during the course of the same day. If these two land uses are located far apart they will have their own separate trip-making characteristics. If, however, the coffee shop is located on the ground floor of the 50-unit apartment building, then many of the person-trips associated with each land use will actually involve the same person. Locating these two land uses in close proximity to a rail station such as those along the NJ 124 corridor provides an even greater opportunity for shared trips (e.g., a person who leaves his apartment in the morning and stops at the coffee shop downstairs before walking down the block to the train station is counted as three separate person-trips for the separate land uses but has little impact on the transportation network). Given that the scenarios in Chatham and Madison are already TODs, complementary trip-making with existing uses in a non-automotive fashion will also occur. In this way, each of the municipalities could increase their ratables without the typical increases in trip-making. However, each of the developments would accommodate some parking and with the added allowance for commuter parking, trip-making from these sites will increase and will have implications that would need careful consideration, as described below.

5.8.7.1 Chatham Station Area

The location of the aforementioned redevelopment option at Chatham Station will require careful consideration of traffic circulation along Railroad Plaza North. The existing Fairmount Avenue intersection may require upgrades, particularly in light of the close intersection spacing along Fairmount between the Lot #1 driveway, Railroad Plaza North, Fire House Plaza, and Main Street (NJ 124). Converting Railroad Plaza North to a one-way westbound street at this location might reduce turning conflicts at these closely-spaced intersections. Regardless of whether Railroad Plaza North functions as a one-way or two-way street, the signal warrant study recommended and described previously for the intersection of NJ 124 and Railroad Plaza North / Coleman Avenue will be critical under the proposed TOD redevelopment plan.

5.8.7.2 Madison Station Area

Traffic circulation along Prospect Street could be impacted considerably by the proposed development. To the extent possible, the main vehicular access point on the east side of Prospect Street should be fixed as a fourth leg of the existing intersection of Prospect Street and Lincoln Place. Feasible access options on the west side of Prospect Street may be constrained by existing driveway locations on both sides of Prospect Street, and some consideration should be given to restricting access to right-in/ right-out only for any new parking structures that connect to the local street network between existing intersections.

5.8.7.3 Convent Station Area

Traffic access is limited to Convent Road and Old Turnpike Road, and the intersections of these two roadways with NJ 124 and Punch Bowl Road, respectively, will likely require substantial improvements. One issue of note at this station, which has been discussed previously in this report, is that the irregular shape of these parcels may not be ideal for large parking structures. To optimize the use of land and provide as many parking spaces as possible in a reasonably-sized parking structure, it may be feasible to re-align Old Turnpike Road along its approach to Convent Road to provide a more efficient rectangular shape to the area between Old Turnpike Road and the NJ TRANSIT rail alignment. This would require the acquisition of property on the south side of Old Turnpike Road that is now occupied by the parking areas for the Madison Hotel and the adjacent office building to the west.

5.8.8 Key Findings of the TOD Analysis

The financial and other analyses of TOD scenarios was performed to assess if a combined TOD and commuter parking scenario could exist at any of the three corridor station areas, incorporating private investment to provide the needed commuter parking. Based on these analyses the following key findings result:

- Viable TOD could be implemented at each of the three stations, without the added investment of commuter parking. Even with commuter parking added, the rate of return on the investment might be attractive to a developer if provided with public assistance or if other regional investments were not more attractive.
- The analyses with commuter parking by station assumed that the high end of the corridor-wide parking deficit range would need to be accommodated at that station (500 spaces). This is the worst case scenario and it was used to show the maximum impact per site. More

realistically, the access improvements described earlier in this chapter would reduce the high end deficit and some of the needed parking would be developed at each station location. Thus the impact of commuter parking to the developer and to each site would be less than described herein and would need to be quantified should any of the TOD scenarios progress.

- Development at each of the proposed station sites would require revised and denser zoning codes and allowances. At each station area, the heights of the proposed development would exceed those in the immediate vicinity. Heights ranging from five to seven stories would be required.
- Development of the properties at each of the sites would result in improved taxable values for those properties. Additionally, the quality of the urban design and architecture, and how well parking could be concealed, would determine whether the development impact on adjacent properties would be positive. Development at each station location would result in increased trip-making which would result in impacts upon the street network. A detailed traffic analyses and investment in the roadway network would be required. Should these improvements be imposed upon the developer, their rate of return would be diminished, which could impact the attractiveness of development at any of the sites.
- Chatham Station's TOD scenario would result in a similar rate of return for a developer as the proposed TOD at Madison Station (both with and without the commuter parking), and thus similar ability to attract the investment. However, meeting the forecasted parking demand at Chatham would result in the highest parking structure of the three scenarios (eight stories). The proposed development would range from five to seven stories which would be a departure from the character of the Chatham Station area.
- The Madison Station TOD scenarios are the only scenarios that would not displace existing commuter parking, and require the lowest structured parking cost. Madison Station offers the greatest potential to attract private investment to meet the needed parking. While the developer's up-front costs for acquisition and demolition would be higher at Madison, the height of the proposed structures would be more consistent with the character of the Borough and the adjacent TOD zoning.
- Convent Station would provide for the densest and most attractive investment for a developer with the inclusion of commuter parking. Of the three sites, this location would have relatively easy land assemblage and low property acquisition costs. However, the shape of the parcels could present a challenge. Of the three considered TOD sites, development at Convent Station would displace the highest amount of existing commuter parking, which when combined with

provision of spaces needed to meet the high end of the projected commuter parking deficit range in the corridor, results in the largest parking investment. Constructing two projected structured parking garages at this location (with a combined high end cost of $32 million) diminishes the chances of the entire parking investment being funded by the private developer. However, adjacent properties were not considered in the financial analysis. Should these properties be considered, an overall profitable mixed-use public-private solution could be viable.

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