



North Maple Avenue (CR 607) Road Safety Audit

Evesham Township, NJ

March, 2015





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Audit TeamA-1

Executive Summary

Despite the broad decline in crashes and fatalities across the region and the country, localized crash problems persist. The DVRPC's safety program is designed to assist state and local partners address crash trends in various ways, including at the corridor and intersection levels. The Road Safety Audit (RSA) program provides local roadway owners the opportunity to examine a corridor segment through a compressed, collaborative process that combines crash data analysis and field work by a multidisciplinary team. This report is the final document of an RSA conducted in Evesham Township, Burlington County, New Jersey in the summer of 2013, and it serves as the first step toward implementation of safety improvements using funding from the Federal Highway Administration's Highway Safety Improvement Program (HSIP).

Using Plan4Safety—the New Jersey Department of Transportation (NJDOT) database analysis and mapping tool—a network screening of county-route corridors exhibiting crash trends was produced. A short list of priority corridors was shared with county partners as possible RSA locations, and North Maple Avenue (CR 607) was chosen by the Burlington County Engineers Office for an audit.

The study corridor section of North Maple Avenue is just less than one mile in length and connects NJ 70 at the southern end with North Locust Avenue on the northern end. During the 2009–2011 study period, this corridor was the site of 64 crashes. North Maple Avenue carries about 17,000 vehicles per day.

The preaudit and postaudit meetings were held at the Evesham Township Municipal Building on Tuckerton Road in Marlton, New Jersey. The audit team of 10 participants represented the following agencies: Burlington County, New Jersey Department of Transportation, New Jersey Transit, FHWA-NJ, New Jersey Division of Highway Traffic Safety, and Cross County Connection Transportation Management Association. DVRPC served as facilitator. See Appendix A for the list of audit team members.

Site-specific issues, organized by subarea or cluster, are discussed in Chapter Four, Findings and Recommendations. Crash-related problems and recommended improvements are presented issue by issue for each of the three cluster locations analyzed during the audit event. Also included in the section is text related to likely crash exposure, severity implications, a low-high-medium rating for difficulty to implement, and the primary agency responsible for taking action at that location. The chapter also includes a short list of priority issues that the roadway owner—Burlington County—discussed in their response to the audit findings, including their planned course of action likely timeline.

Introduction

As the final report for the North Maple Avenue RSA, this document represents a step toward implementation of DVRPC's *Transportation Safety Action Plan* (DVRPC #12030, 2012). The RSA process identifies safety issues through an intensive and collaborative forum and uses brainstorming and local knowledge to enhance analysis findings in developing a range of improvement ideas. The combination of an RSA having been conducted and because the RSA corridor was identified through a data-driven process makes the identified improvements eligible for funding through the federal Highway Safety Improvement Program (HSIP). This work was also coordinated with the NJDOT Bureau of Transportation Data and Safety, which assisted by providing crash rate information and staff support at the audit event. DVRPC conducted additional analysis using GIS and Plan4Safety.

Corridor Selection

Using Plan4Safety, DVRPC completed a network screening of crash concentrations with severity rankings on county routes using data for the years 2009–2011. The resulting road segments were presented to each county in a web-map. This was the starting point for identifying candidate locations in each county for the RSA program. The following criteria were used:

- 3-mile segments where 150 or more total crashes were recorded;
- 2-mile segments where 100 or more total crashes were recorded;
- 2-mile segments where 12 or more hit-fixed-object (HFO) crashes were recorded;
- 2/10th-mile segments where 7 or more left-turn and/or U-turn crashes were recorded.

After discussions with each county partner, North Maple Avenue in Evesham Township, Burlington County was selected. The county had already been contemplating a road diet for this section of North Maple Avenue to address various safety and mobility issues, and the audit provided the opportunity to examine the corridor in detail. The resulting RSA was conducted on a 0.9-mile section of North Maple Avenue.

What Is a Road Safety Audit?

An RSA is a formal safety performance examination of an existing or future road or intersection by a multidisciplinary audit team. Road safety audits can be used on any size project, from minor maintenance to megaprojects, and can be conducted on facilities with a history of crashes or during the design phase of a new roadway or planned upgrade. Typically, DVRPC conducts RSAs on roadways of five miles or less, where there is a demonstrated history of crashes. An RSA represents a first step toward funding safety improvements via the HSIP.

For each RSA, emphasis is placed on identifying low-cost, quick-turnaround safety improvements, though not excluding strategies that are more complex. Because the RSA process is adaptable to local needs and conditions, recommendations can be implemented as time and resources permit.

The audit event has three basic components:

- ▶ Preaudit – the audit team reviews location characteristics and crash analysis;
- ▶ Field visit – the audit team walks the corridor to examine conditions along the corridor; and
- ▶ Postaudit – the audit team shares findings and develops a list of problems and potential strategies.

Prior to the audit, DVRPC collects and analyzes relevant data, including crash concentrations and pedestrian crash locations, corridor-wide crash summaries, daytime and nighttime roadway video, traffic volume data, and aerial photographs. DVRPC staff also conducts a preaudit field visit to examine existing conditions. The identified crash concentrations served as the focus areas during the audit of the North Maple Avenue study area.

Following the event, DVRPC staff compiled the identified problems and potential strategies into a matrix. This document was shared with the audit team for verification. Upon approval from the team, the matrix was incorporated into the final report.

The North Maple Avenue RSA Event

The one-day road safety audit was conducted on Friday, July 19, 2013. The preaudit and postaudit meetings were held at the Township of Evesham Municipal Building, 984 Tuckerton Road, Marlton, NJ 08053. The audit team of 10 participants represented the following agencies: Burlington County, NJDOT, New Jersey Transit, FHWA-NJ, New Jersey Division of Highway Traffic Safety, and Cross County Connection Transportation Management Association; DVRPC served as facilitator. See Appendix A for the list of audit team members.

The preaudit meeting—an overview of the study area and an examination of crash history—began at 8:30 AM. Next was the field visit, where the audit team walked the three identified crash cluster locations and drove the entire corridor to examine conditions, consult the crash data, and begin to identify safety issues. After lunch, the team returned to the meeting room for the postaudit session, in which problems were defined and countermeasures discussed.

Corridor Description and Analysis

Study Location

North Maple Avenue (County Road 607) serves a predominantly suburban, residential location and is an important connector to NJ 70 within Evesham Township. The study corridor section of North Maple Avenue connects NJ 70 at the southern end with North Locust Avenue on the north end for a length of 0.9 miles. A few commercial developments located along the corridor and shopping areas along nearby Greentree Road make this corridor a useful connector and thus results in consistent traffic along the study section.

Roadway Characteristics

North Maple Avenue, classified as an urban minor arterial with a posted speed limit of 45 mph, is a two-way street with a north/south orientation. The roadway has a four-lane cross-section with no median and no shoulders. Sidewalks are present on both sides from NJ 70 to Westminster Avenue, but they are intermittent after that and only on the northbound side where available, and the street does not have bicycle lanes. The study corridor has a total of 34 access points consisting mostly of driveways, plus 11 stop-controlled side street intersections and two signaled intersections.

Figure 1: Regional Setting

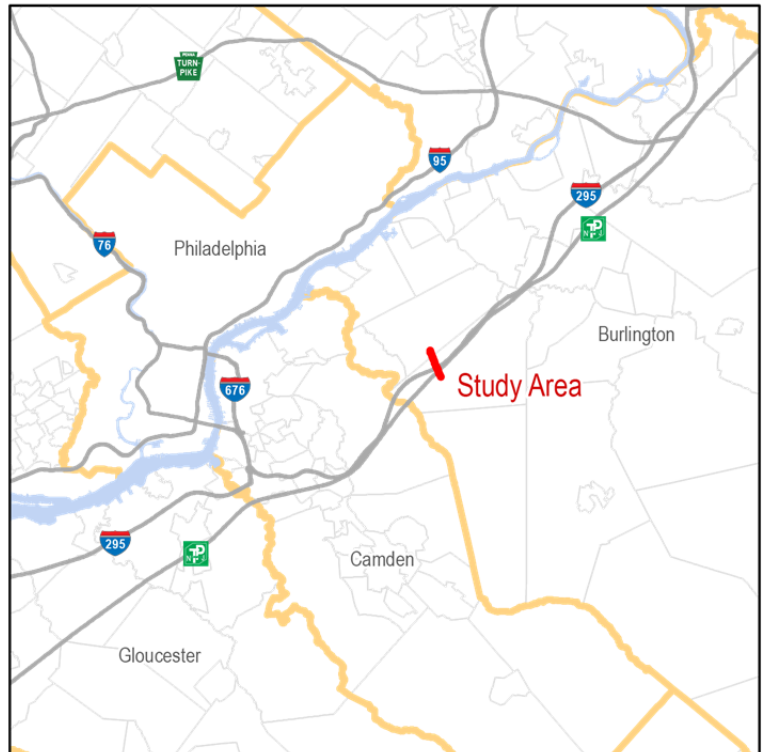


Figure 2: Study Area



Traffic Volumes

Existing Annual Average Daily Traffic (AADT) volumes were used for total vehicle movements (gathered from DVRPC and NJDOT). Traffic volume for the north end of the study area is approximately 8,500 vehicles per day (VPD), per direction. Traffic north of the study area is approximately 11,500 NB and approximately 9,000 SB on average per day (see Figure 3).

Peak hour turning movement volumes were calculated for the intersection of King Avenue and North Maple Avenue, where the highest number of crashes occurred within the study period. The identified peak volume hours were 7:00–9:00 AM and 4:00–6:00 PM for the intersection. The combined period volumes along North Maple Avenue totaled 2,686 traveling through the intersection southbound and 3,030 traveling northbound. King Avenue saw 349 traveling eastbound and 224 traveling westbound. Combining AM and PM volumes, there were a total of 226 right turns from King Avenue onto North Maple Avenue southbound and 128 right turns from the adjacent Apartment Avenue. Combined, right turns onto North Maple Avenue were the most common movement. Turns onto King Avenue from both directions of North Maple Avenue totaled 119 vehicles.

Transit Service

Figure 4 depicts bus transit service and stop locations. The study corridor is served by the NJ Transit 406 Bus, which predominantly follows NJ 70 and runs between Berlin Township and Philadelphia, Pennsylvania. It has eight stops along the study corridor, of which six are spaced evenly along the lower section of the road, and two are placed where North Maple Avenue intersects Locust Avenue. This is the only bus route that runs along the study corridor. On weekdays, headways are every 10 minutes during AM hours and every 30 minutes during PM hours. On weekends, headways are less frequent with buses passing every hour. The bus operates between the hours of 4:30 AM to 12:30 AM. Ridership averages 1,923 passengers on weekdays, 1,021 on Saturdays, and 682 on Sundays.

Figure 3: Traffic Volumes

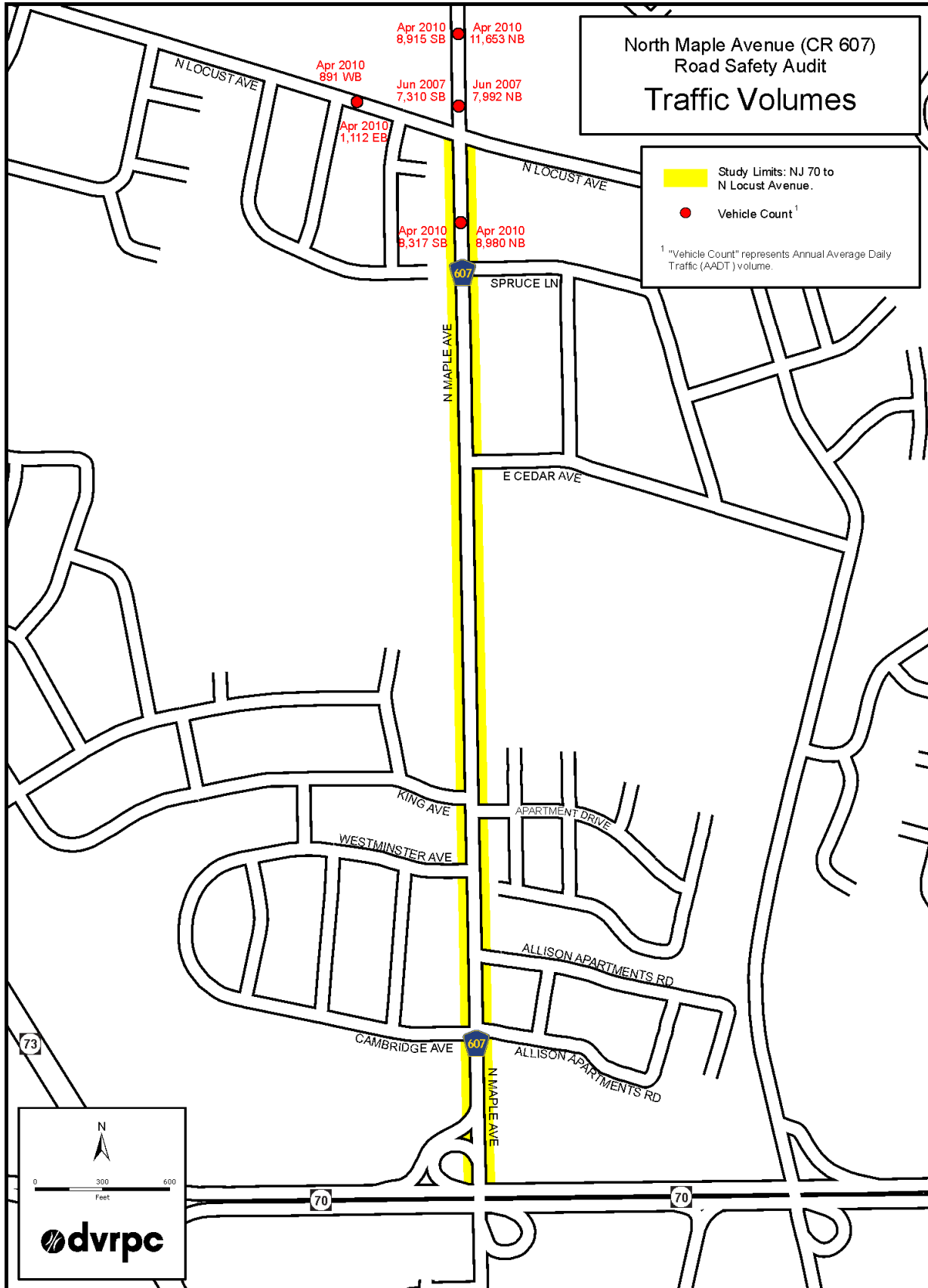
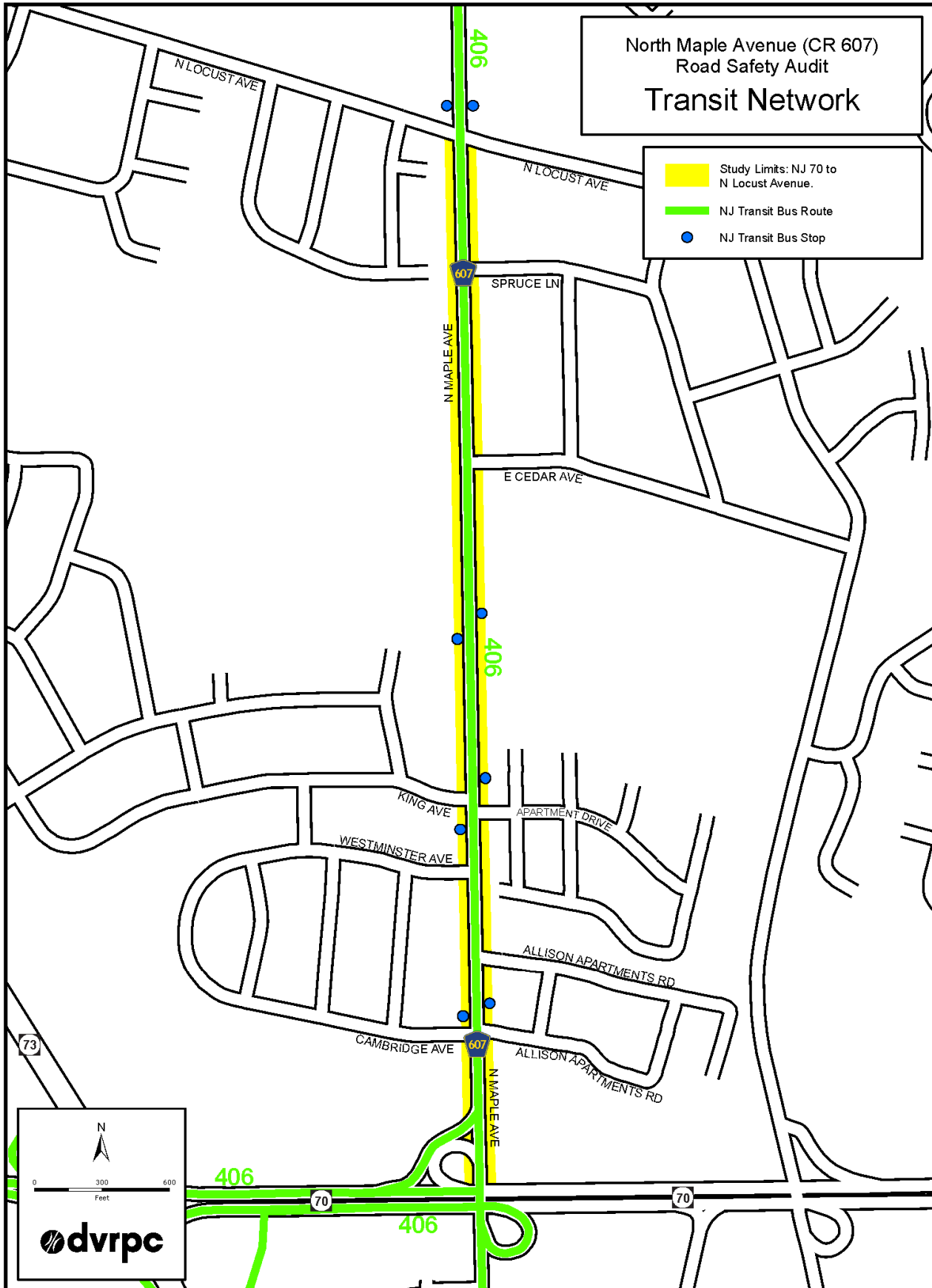


Figure 4: Transit Network



Crash Findings

Corridor-wide Crash Findings

The analysis used for the North Maple Avenue RSA was based on reportable crashes and excludes those classified as non-reportable. Reportable crashes result in personal injury or property damage of \$500 or more, determined by the reporting officer. Corridor-wide crash characteristics and trends for the three-year period are discussed in the appropriate subcategories below.

Chronology

According to the NJDOT crash database, there were a total of 64 reportable crashes during the three-year analysis period of 2009–2011. Table 1 demonstrates that while crashes stayed the same between 2009 and 2010, the number of crashes was reduced by over half in 2011.

Table 1: Crashes by Year

Year	Crashes	Percent of Total
2009	26	41%
2010	26	41%
2011	12	19%
Total	64	

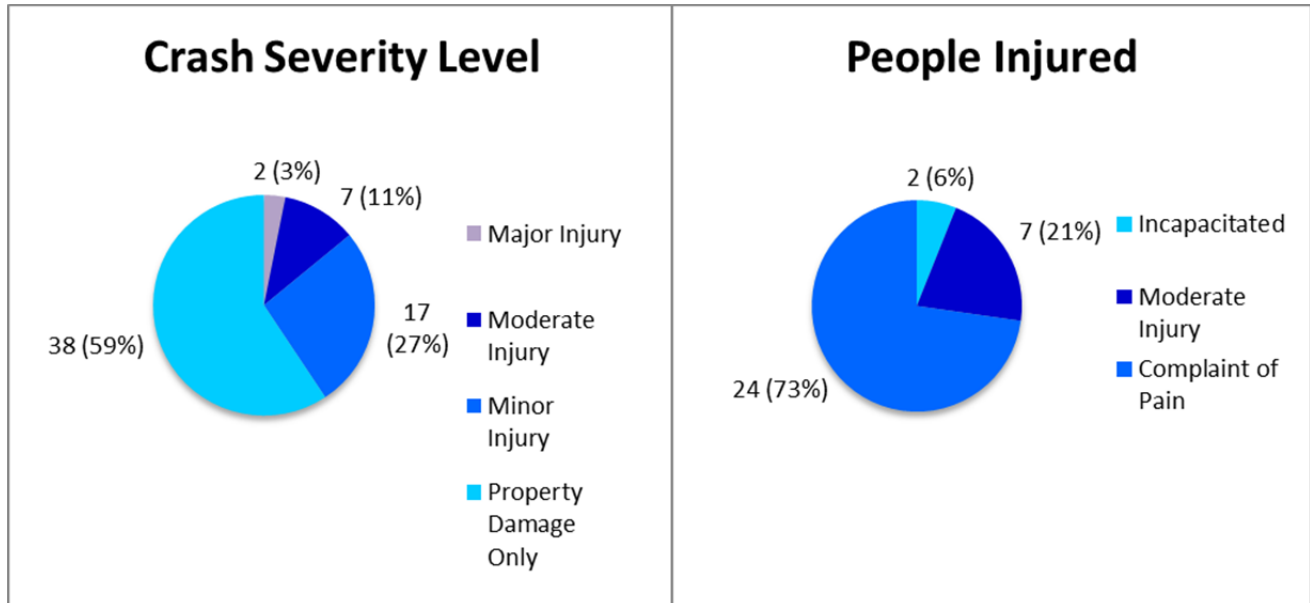
Source: DVRPC, 2014

Viewing the concentration of crashes by month over the three-year period, the total ranges predominantly between four and six crashes for most months. April and December had the highest number of total crashes with 10 and nine, respectively, and July had the lowest with one recorded crash. Examining crashes by day of week, totals were somewhat inconsistent with 14 crashes on Fridays (the highest) and only three on Sundays (the lowest). Saturday and weekdays varied between six and 12 crashes per day, thus no real trend emerged. The highest crash totals by hour of day occurred between 3 PM and 6 PM during the afternoon commute, when 30 crashes occurred, representing 46 percent of the total. During the 7 AM to 9 AM morning commute, nine crashes occurred, marking the only other notable concentration by time period. The lowest total was recorded between 11 PM and 6 AM, when three crashes occurred.

Severity

Injury severity was relatively low along the corridor during the study period. There were no fatal crashes reported during the study period. Only three percent of reported crashes involved major injury, and a quarter involved minor injuries. The majority (over half) were property damage only (see Figure 5 below).

Figure 5: Crash Severity



Source: DVRPC, 2014

Of those crashes that resulted in injury, two (6 percent) resulted in incapacitating injuries, 21 percent were moderate injuries, and almost three quarters were recorded as "complaint of pain."

Collision Type

Of the seven recorded collision types among the 64 crashes, the three highest concentrations consisted of rear-end (38 percent), right angle (27 percent), and left turn/U-turn crashes (11 percent). Rear-end collisions recorded in the corridor were 5.9 percent higher than the state average, and right-angle collisions were 9.2 percent higher than the state average. Although left turn/U-turn collisions represented only 11 percent of the crash total, they were more than double the state average of 4.5 percent. These concentrations can be commonplace on corridors with a high density of access points. Also at 11 percent of the corridor total, same direction sideswipe collisions were just under the statewide average of 11.7 percent. No pedestrian crashes occurred during the study period; one bicyclist crash was recorded. Pedestrian and bicyclist activity was noticeably low during the audit event. See Table 2 for more details.

Table 2: Collision Type

Collision Type	Total Crashes	Percentage	State Average for County Routes—2011
Rear-End	24	38%	32.1%
Right Angle	18	27%	18.8%
Left Turn/U-Turn	7	11%	4.5%
Same Direction (Sideswipe)	7	11%	11.7%
Fixed Object	6	9%	11.6%
Bicyclist	1	2%	0.9%
Non-fixed Object	1	2%	0.5%

Source: DVRPC, 2014

Roadway Surface and Lighting Conditions

Table 3 below provides road surface and illumination conditions during the study period. Three quarters of the crashes occurred on dry road surface conditions, 22 percent occurred on wet road surface conditions, and only two percent occurred on snowy road conditions. This suggests that road surface conditions were not likely a factor in these crashes. When considering light conditions, almost a third of the crashes occurred at night, and three percent occurred at dusk. Typically, most crashes occur on dry roads during the daytime, which reflects when most people chose to travel. Although 67 percent of the crashes occurred during daylight conditions, that majority is less than typical, suggesting further investigation into nighttime crashes may be warranted.

Table 3: Road Surface and Illumination

Category	Condition	Crashes	Percentage
Road Surface	Dry	49	76%
	Wet	14	22%
	Snowy	1	2%
Illumination	Daylight	43	67%
	Dusk	2	3%
	Night	19	30%

Source: DVRPC, 2014

Corridor-wide Summary

Table 4 below summarizes the data indicators considered in the corridor-wide analysis.

Table 4: Corridor-wide Statistics Summary

Issue	North Maple Avenue
Three-year trend (2009–2011)	Decreasing
Highest crash months	April, December
Highest crash days	Friday
Daily trends	Early PM rush hour
Collision type overrepresentations	Rear-end, Right angle, Left turn/U-turn
Injury crashes	Low severity
Surface condition and illumination	Dry/30% Nighttime
Pre-crash action trends	“Stopped in traffic” and “Making a left turn”

Source: DVRPC, 2014

Cluster Analysis

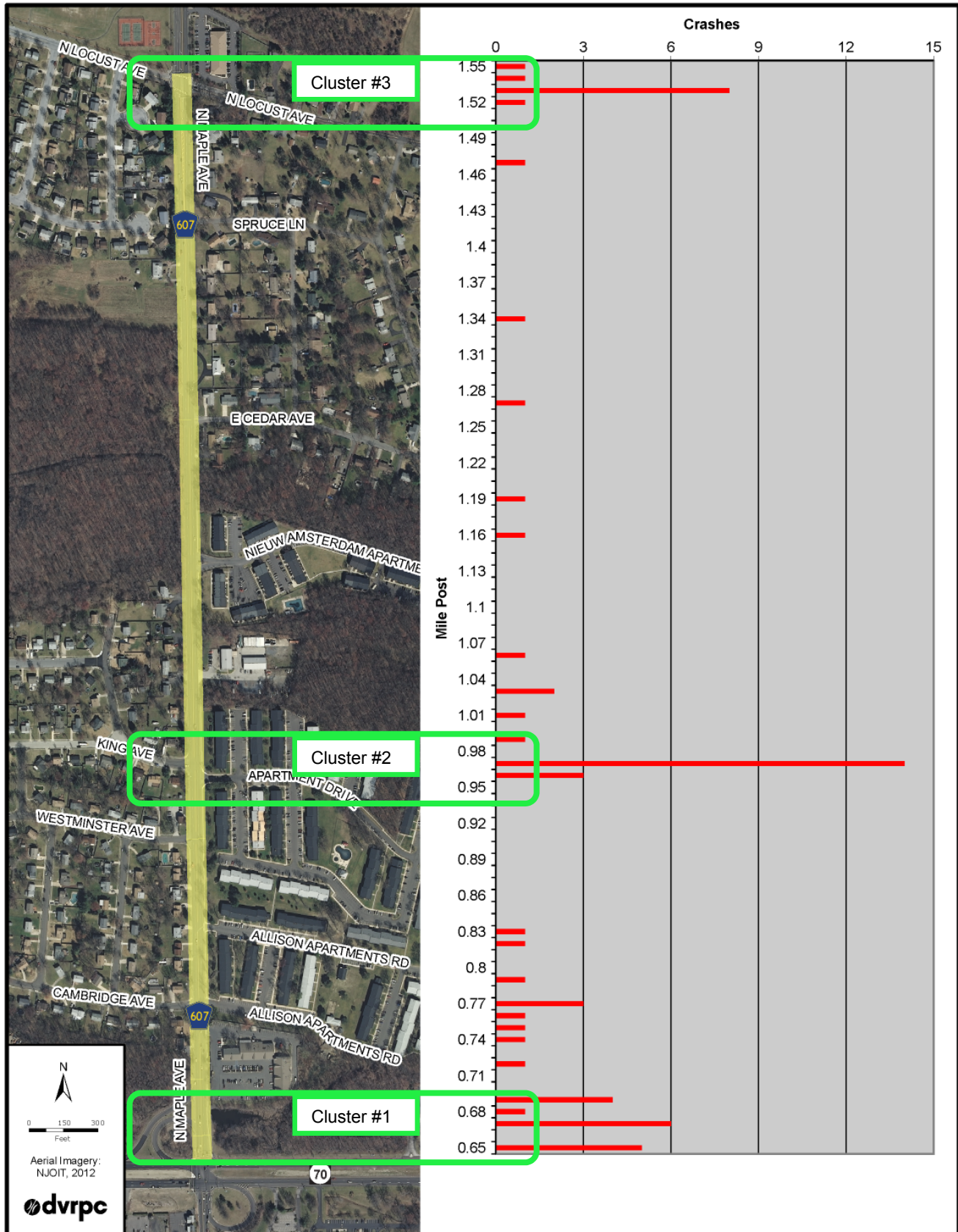
Crash Frequency by Milepost

The crash frequency by milepost map (Figure 6) depicts a bar graph representing crash concentrations by mile post aligned with an aerial view map of the corridor. Crashes are coded to a two-decimal place tolerance, which allows for locating crashes within approximately 50 feet of one another. The map revealed three crash cluster locations which became the focus of the audit analysis and field visit. Although the catchment area for each of these clusters differs, they are relatively similar in size, and each centers on an important intersection along the study corridor. The map in Figure 6 was used during the audit to demonstrate to the RSA team where there were crash trends.

Corridor-wide, crashes occurred in a total of 27 unique locations, of which 19 locations had only one crash during the study period. The highest single concentration of crashes—14 crashes—occurred at milepost 0.97 where North Maple Avenue intersects with King Avenue and Apartment Drive; the focus of a cluster location. Another cluster was identified where North Maple Avenue intersects NJ 70, and a third at the intersection of North Locust Avenue. These three cluster locations were the focus of further analyses and were examined closely during the field visit (see Figure 6 for the geographic limits of each cluster). The areas between these three locations had comparatively fewer crashes.

The following section summarizes crash findings and presents a collision diagram for each of the three clusters.

Figure 6: Crash Frequency by Milepost



Source: DVRPC, 2014

Cluster #1: North Maple Avenue at NJ 70

Located at the southern terminus of the study area, Cluster #1 includes the section of North Maple Avenue where it intersects NJ 70. The three-year crash summary revealed the following:

- ▶ There were 16 total crashes, 25 percent of the corridor total
- ▶ Predominant collision types: rear-end (69%), same-direction sideswipe, and right angle (13% each)
- ▶ Predominant pre-crash actions were “stopped in traffic” and “going straight ahead”
- ▶ 12 crashes involved drivers traveling southbound
- ▶ No fatalities, five minor injury crashes, nine property damage only crashes

Figure 7: Cluster #1 Crash Diagram

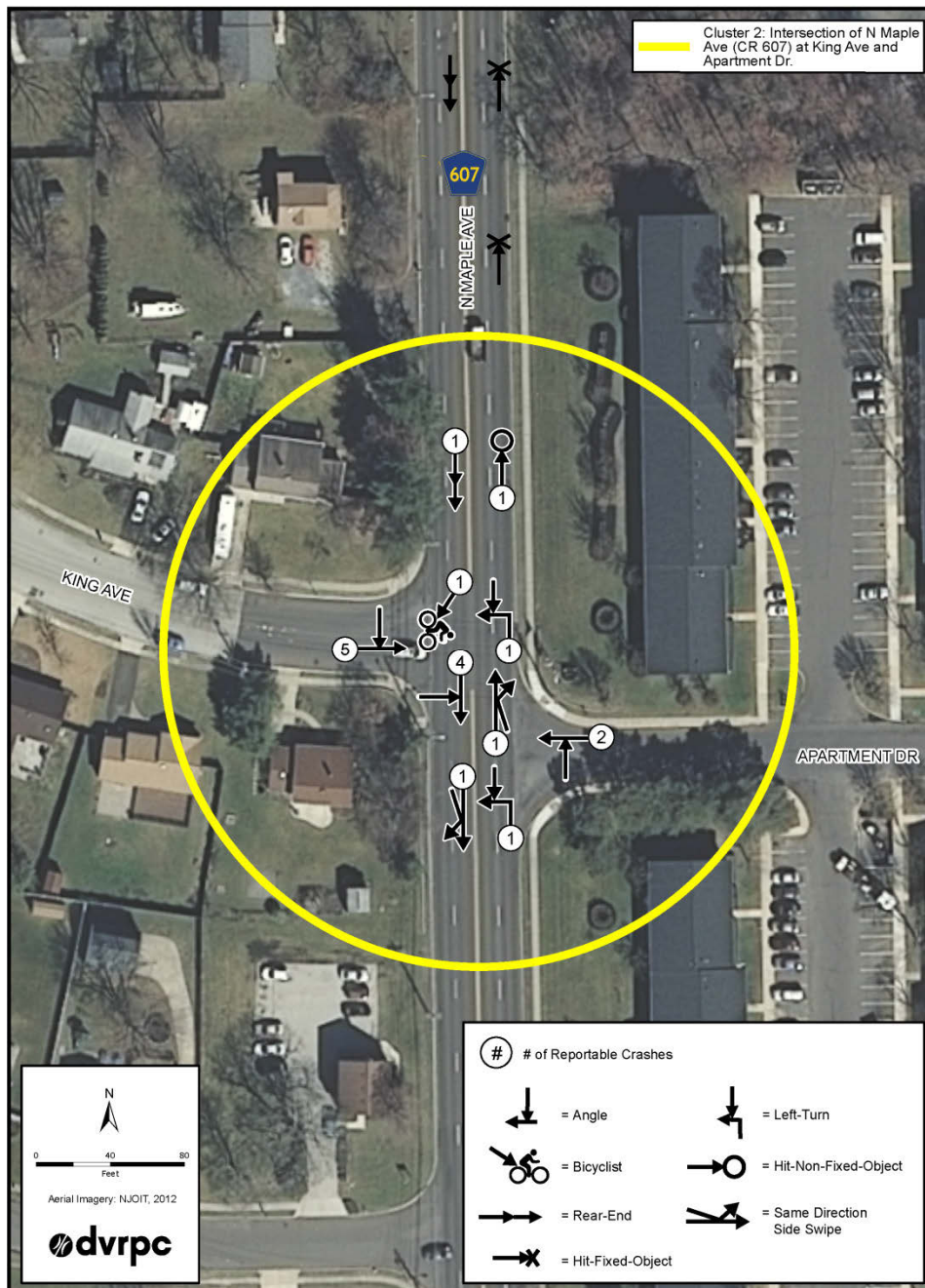


Cluster #2: North Maple Avenue at King Avenue/Apartment Drive

Located one third of a mile north of the NJ 70 intersection, Cluster #2 is at the King Avenue and Apartment Drive offset intersection with N. Maple Avenue. The three-year crash summary revealed the following:

- ▶ There were 18 total crashes, 28 percent of the corridor total
- ▶ Predominant collision type: right angle (61%), same-direction sideswipe, and left/U-turn (11% each)
- ▶ Predominant pre-crash action was “going straight ahead”
- ▶ Nine crashes (50%) involved drivers entering N. Maple Avenue from King Avenue eastbound
- ▶ No fatalities, one major, one moderate, and seven minor injury crashes; nine property damage only

Figure 8: Cluster #2 Crash Diagram



Cluster #3: North Maple Avenue at North Locust Avenue

Located at the northern terminus of the study area, Cluster #3 is centered on the intersection of North Locust Avenue and N. Maple Avenue. The three-year crash summary revealed the following:

- ▶ There were 11 crashes, 17 percent of the corridor total
- ▶ Predominant collision types: left turn/U-turn (45%), right angle (27%)
- ▶ Predominant pre-crash actions were “going straight ahead” and “making a left turn”
- ▶ Six of the 11 crashes involved southbound vehicles
- ▶ No fatalities, one major, five moderate, and one minor injury crash; four property-damage-only crashes

Figure 9: Cluster #3 Crash Diagram



Findings and Recommendations

The following section summarizes the findings, recommended strategies, and priorities of the North Maple Avenue RSA in Evesham Township, New Jersey. The analysis is organized by cluster location and includes identified issues and improvement recommendations, along with photos.

Crash-related problems and recommended improvements are presented issue by issue for each of the three cluster locations analyzed during the audit event. Also included is an indication of likely crash exposure and severity implications based on crash history and location details, as well as the primary agency responsible for taking action. Because Burlington County is the roadway owner, they are identified as the responsible agency in most of the recommendations, although some recommendations identify other agencies with whom the county should coordinate.

To provide some context regarding the level of commitment required to implement recommendations, this section includes a category called “Difficulty to Implement,” which uses the following general descriptions to characterize each of the three ratings:

- Low—can be accomplished through maintenance;
- Medium—requires use of existing or new contract and some engineering, and funding may be readily available; and
- High—longer-term project, may need full engineering, may require right-of-way acquisition and new funding.

Note that potential strategies that call for further study do have a safety benefit because they are the next step toward a more detailed and appropriate safety improvement. Given fiscal constraints, recommendations may be considered one at a time or in small groups.

Being the roadway owner, Burlington County should use the findings of the RSA as a guide for designing improvements to address these issues. Whereas the RSA findings are numerous, Burlington County should use its experience in safety engineering to determine which issues from the table will yield the highest safety benefit given limited funds.

In the following pages, all issues identified during the audit are discussed in detail according to cluster. Recommendations that have been vetted by the Audit Team are presented for each location.

Cluster # 1: North Maple Avenue at NJ 70

Issue #1: Problematic weave between left-turn lane and through lane approaching the NJ 70 intersection on North Maple Avenue southbound



Vehicles queuing in the southbound through lanes



Southbound where the left lane becomes the left-turn-only lane and NJ 70 westbound off-ramp traffic enters North Maple Avenue southbound

Issue:

There is a problematic weave movement for North Maple Avenue southbound traffic from the left-turn lane to the through lane approaching NJ 70. In advance of this location the corridor is two through lanes, and at the junction with the NJ 70 westbound off-ramp the left lane becomes a left-turn-only lane, but with little advance warning (see lower photo). This situation is further complicated by vehicles entering the southbound North Maple Avenue traffic flow from the NJ 70 westbound off-ramp. The RSA team identified a lack of adequate signage and lane markings to alert motorists of the change in lane designation.

Exposure:

With 12 southbound crashes (75% cluster total), 11 of which are rear-end collisions, this issue has a notable number of associated crashes making the exposure relatively high.

Severity:

The severity trend is relatively low at this cluster (eight PDO, four minor injury crashes), possibly related to drivers slowing as they approach the intersection. Also, congestion in the southbound through lane was noted during the audit.

Recommendation:

Additional signage and addition of fog-line striping and lane markings on North Maple Avenue southbound to address weave problem between the left-turn and through lanes, and improved signage and better sign placement in advance of the NJ 70 off-ramp to alert motorists of entering traffic.

Difficulty to Implement:

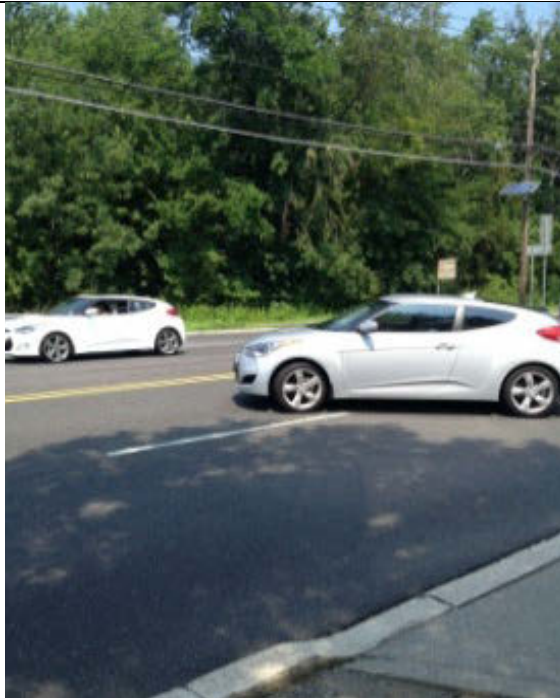
Low

Responsible Agencies:

NJDOT, Burlington County

(Cluster # 1: North Maple Avenue at NJ 70, continued)

Issue# 2: Left-turns crossing multiple live traffic lanes into and out of the Wawa parking lot



Drivers exiting the southern driveway of the Wawa convenience store

Issue:

There is a Wawa convenience store situated along northbound side of North Maple Avenue that has two full-access driveways onto the corridor. The southernmost driveway is approximately 275 feet north of the NJ 70 intersection, and the second is about 285 feet further north of the first. The southern access is partially aligned with the NJ 70 westbound on-ramp. Left turns to and from Wawa can be especially problematic due to the four-lane cross-section of the corridor, which presents many conflict points for turning traffic, particularly for motorists turning left out of Wawa. Also, drivers were observed cutting across North Maple Avenue from Wawa's southern driveway directly to the NJ 70 westbound on-ramp, crossing all four lanes of through traffic. This is an inherently unsafe practice, though not an illegal movement.

Exposure:

The crash analysis revealed four crashes in the vicinity of the driveways; three were right-angle crashes involving drivers exiting the store parking lot. Although crash frequency is not very significant, the convenience store is a significant trip generator, which greatly increases crash exposure.

Severity:

This location reflects the overall low severity of the cluster.

Recommendations:

Short term - Explore access management changes for Wawa's southern driveway: consider change from full access to right-in right-out or ingress only, and consider creation of a joint driveway for the northern Wawa access and the adjacent apartment complex access. **Long term** – Incorporate access management changes into a corridor-wide road diet.

Difficulty to Implement:

Medium/High

Responsible Agencies:

Burlington County, Property Owners

(Cluster # 1: North Maple Avenue at NJ 70, continued)

Issue #3: General maintenance



Debris from ponding along the curb in the northbound lane



Roadway signs lack retro-reflectivity



Roadway pavement cracking in several locations

Issues:

- Evidence of ponding on North Maple Avenue northbound and southbound between NJ 70 and the westbound NJ 70 on-ramp along curb line. During rain events, ponding can create a potentially hazardous situation as drivers may be forced to swerve out of their lane to avoid the water;
- Most signs lack retro-reflectivity;
- Deteriorating pavement condition and faded striping was noted at select locations within this cluster.

Exposure:

Since no crashes were directly correlated with any of the noted deficiencies, exposure is considered low. However, left unaddressed, problems may arise in the future.

Severity:

This location reflects the overall low severity of the cluster.

Recommendation:

Investigate drainage system regarding ponding issue; if not correctable, then further investigate during scheduled corridor repaving. Upgrade roadway signs to retro-reflective.

Difficulty to Implement:

Medium

Responsible Agencies:

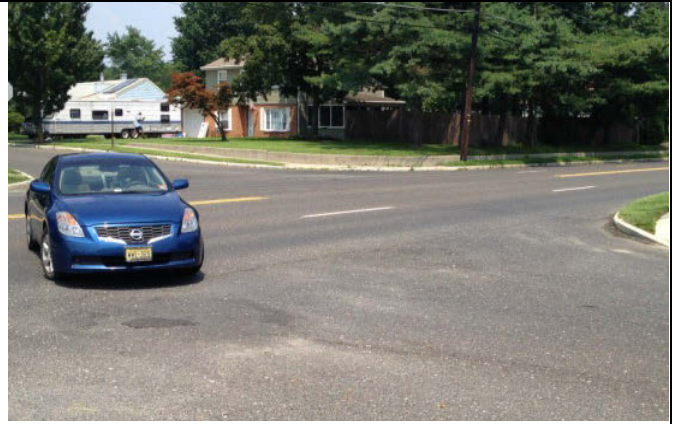
Burlington County, NJDOT (responsible for striping and sign maintenance relative to the traffic signal at NJ 70).

Cluster # 2: North Maple Avenue at King Avenue/Apartment Drive

Issue #1: Offset intersection alignment, tight turning radii, missing pedestrian crossings, right-turn crash trend



Confluence of through traffic and traffic entering the corridor



Driver passing between offset side street legs

Issues:

- The crash analysis shows a right-turn crash trend: 50 percent of the cluster total involves eastbound King Avenue traffic colliding with southbound North Maple Avenue traffic;
- The right-turn turning radius from both King Avenue and Apartment Drive is tight and sometimes leads to drivers crossing into the inner/passing traffic lane when entering North Maple Avenue;
- Offset alignment of King Avenue and Apartment Drive creates a potentially dangerous move for drivers crossing North Maple Avenue between the two side streets;
- The confluence of motorists leaving the opposing side street intersection legs at the same time as drivers turning from North Maple Avenue onto these side streets creates a confusing situation, increasing the likelihood of a crash. The situation is further complicated when drivers queue side-by-side waiting to exit the side streets onto North Maple Avenue;
- This location has no crosswalks, and no accommodations exist for transit riders seeking to cross North Maple Avenue to access bus stops.

Exposure:

According to the turning movement traffic count data, right turns onto North Maple Avenue were the most common turning movement. More turns at this location increases the exposure to crashes. Although no pedestrian crashes were recorded, the proximity of bus stops to the intersection combined with the adjacent apartment complex makes it a likely locale for pedestrian activity.


Severity:

This location reflects the low overall severity of the cluster.



Missing pedestrian accommodations at/to bus stop along corridor northbound

<p>Recommendation:</p> <p>Short Term – Approaches to North Maple Avenue need proper lane markings and signs, including stop bars, lane designation, crosswalk striping, and replacement of the Apartment Drive stop sign with a code-compliant sign. Agreement is needed among the property owner, Evesham Township, and Burlington County to share installation and maintenance responsibilities for the Apartment Drive improvements. A mid-block crosswalk over North Maple Avenue to accommodate pedestrians walking to bus stops should be considered (NJ Transit must be a partner on this item). Long term – Incorporate access management changes as part of a corridor-wide road diet. This would separate turning traffic from through traffic, calm traffic through the intersection, and improve general pedestrian access as well as access to the transit stops.</p> <p>Note: The apartment complex is responsible for maintaining the traffic controls for their access. Burlington County does not have the authority to require them to maintain it.</p>	
<p>Difficulty to Implement: High</p>	<p>Responsible Agencies: Burlington County, Evesham Township, Property Owners, NJ Transit</p>

<p>(Cluster # 2: North Maple Avenue at King Avenue/Apartment Drive, continued)</p> <p>Issue #2: Sight distance obstructions</p>	
 <p>Utility poles obscure view of oncoming traffic for drivers exiting King Avenue onto North Maple Avenue</p>	<p>Issue: Telephone poles obstruct view from King Avenue eastbound, specifically blocking the view of traffic approaching the intersection from North Maple Avenue southbound. Left turns are particularly problematic due to the crossing of multiple live traffic lanes, combined with sight distance obstructions.</p> <p>Exposure: As mentioned in Issue #1, traffic count data shows frequent right turns onto North Maple Avenue, increasing the chance of right angle crashes, making the exposure relatively high.</p> <p>Severity: This location reflects the overall severity of the cluster.</p>
<p>Recommendation:</p> <p>Conduct further study into mitigation of visual obstructions.</p> <p>Short Term - Burlington County will collect traffic count data to determine if two travel lanes are warranted in each direction on North Maple Avenue (road diet feasibility analysis). A cross-section of three lanes and shoulders (i.e., road diet) will address the drainage along the gutter line and improve the visibility from the driveways and side streets. Long Term - Relocation of the utility poles would be a costly, long-term project and would require the county to purchase right of way from each parcel before the utility companies would agree to relocate. No action regarding this option was planned at the time of publication.</p>	
<p>Difficulty to Implement: Medium</p>	<p>Responsible Agency: Burlington County</p>

Cluster # 3: North Maple Avenue at North Locust Avenue

Issue #1: Left-turn crash trend, signal head misalignment



Aerial view of intersection illustrating skewed alignment



Looking southbound on North Maple Avenue from north side of the intersection; signal head not centered over left-turn lane

Issues:

- Left turns at this intersection are accommodated by an exclusive left-turn lane and protected/permitted signal phasing. Eight of the 11 crashes involved a turning movement, and left-turn crashes were specifically overrepresented at 45 percent of the cluster total. The predominant pre-crash movement was drivers turning from North Maple Avenue onto North Locust Avenue east- or westbound (six cases). This may be related to the skewed intersection geometry;
- The left-turn arrow signal head is misaligned with the left-turn lanes in both directions on North Maple Avenue. This compromises drivers' view of the signal;

Exposure:

In the context of this crash cluster, turning movement-related crashes represent the largest majority of crashes (eight of 11). Balanced with the relatively low crash total, the exposure would be low to moderate.

Severity:

Five of the 11 crashes resulted in moderate injury, plus one major and one minor injury crash. Regarding overall severity and the property damage only to injury crash ratio, this location has the most severe crash experience on the corridor, despite the lowest number of total crashes.

Recommendation:

Short Term – Center signal heads over left-turn lanes. During the audit event, team members suggested that this may be accomplished by adjusting the swing mast arms; examine the signal timing in search of issues that may affect turning-movement-related crashes. **Long Term** – Consider adding post-mounted signals on North Maple Avenue to improve signal visibility.

Difficulty to Implement:

Medium to High

Responsible Agency:

Burlington County

(Cluster # 3: North Maple Avenue at North Locust Avenue, continued)

Issue #2: Pedestrian crossings and connectivity; general maintenance

Issues:

- Crosswalk striping is beginning to fade; ADA ramps are missing on southeast quadrant, and crossing time is reportedly insufficient, especially when crossing North Maple Avenue due to the skewed intersection alignment;
- Sidewalks are nonexistent along northbound and southbound North Maple Avenue on the south side of the intersection;
- Overgrown vegetation blocking pedestrian connection.



Missing pedestrian connection, overgrown goat path.



Faded crosswalk and missing curb ramp (far side)

Exposure:

No crashes were directly correlated with any of the noted deficiencies; exposure is therefore low.

Severity:

The overall severity of the cluster is likely not related to these issues.

Recommendation:

Upgrade or add needed pedestrian accommodations at each intersection approach: curb ramps, push buttons, striping, and sidewalk sections. Shorten the crossing distance by restriping crosswalks to a more perpendicular alignment. Revisit signal timing to check time for pedestrian crossing phase; upgrade to standard if needed. Trim vegetation at corners where needed to clear path for pedestrians. Add missing sidewalk along North Maple Avenue to connect to existing network.



Faded striping

Difficulty to Implement:

Medium/High

Responsible Agency:

Burlington County

Priorities and Road Owner's Response

The following is a short list of the highest priorities that should be addressed first, as discussed by the audit team and vetted by Burlington County—the lead agency. After their review of the draft issues and recommendations, county representatives from the audit team provided the following actions and timeline in priority order:

1. Implement the recommendations identified at the North Locust Avenue (page 26) intersection cluster;
 - ◆ Responsible Agency: Burlington County
2. Conduct a road diet feasibility analysis for the entire North Maple Avenue corridor examined in the RSA;
 - ◆ Responsible Agency: Burlington County
3. The biannual striping contract will address striping deficiencies identified on North Maple Ave during the RSA; this work will likely take place in 2015;
 - ◆ Responsible Agency: Burlington County
4. County maintenance crews are systematically upgrading all crosswalks in the county. School zones are priority number one, and signalized intersections are priority number two. This program will address ADA issues identified during the audit on North Maple Avenue;
 - ◆ Responsible Agency: Burlington County
5. Striping and additional signage along North Maple Avenue southbound approaching the NJ 70 westbound off-ramp;
 - ◆ Responsible Agency: NJDOT in coordination with Burlington County.

Progress to Date

Since the audit, Burlington County investigated and will be implementing the signal layout and signal timing changes needed to address issues #1 and #2 at Cluster #3 (page 26)—North Locust Avenue intersection (#1 above). This includes a revised timing directive to implement pedestrian clearance times that conform to the 3.5 feet per second Manual on Uniform Traffic Control Devices criteria. These improvements will be completed in the fall of 2014.

In addition, a work order has been submitted to the county maintenance division to rotate the 30-foot traffic signal mast arm on the southwest corner of the intersection to align the five-section signal head above the left-turn lane as per audit recommendation. The work order will also include installing five-section signal heads on the traffic signal standards to the far left of North Maple Avenue's left-turn lanes.

Although the county is concerned about safety throughout the corridor, a schedule for implementation of the remaining recommendations from this report was not available at the time of publication. However, if the road diet feasibility analysis proves favorable, and the county advances implementation, many of the recommended improvements would be implemented at the same time. Also, striping and sign improvements recommended at Cluster #1—North Maple Avenue at NJ 70—is the responsibility of NJDOT because of North Maple Avenue's intersection with a state facility. Following the audit, NJDOT reviewed these

improvement recommendations, expressed their support for them, and agreed to close collaboration with Burlington County at the appropriate time.

Conclusion

The North Maple Avenue RSA was conducted to identify issues that compromise safety for the users of the corridor: walkers, bicyclists, and drivers. The team identified a long list of issues from the field visit, as well as many practical short- and long-term improvements.

Some of the strategies identified can be implemented through routine maintenance; all will be constrained by available time and budgetary priorities. The audit process and the resulting final document highlight the safety issues posed to drivers, pedestrians, and bicyclists and present the needed improvements by location organized for systematic implementation by the roadway owner.

Burlington County officials have been interested in this corridor's suitability for a road diet to address the safety and access issues inherent in its cross-section design. The analysis demonstrated that 39 percent of the crashes involved a turning movement: 28 percent right-angle, 11 percent left turn/U-turn. The four-lane undivided cross-section can be less safe than two-lane and three-lane situations due to the opportunity for motorists to change lanes frequently while avoiding turning traffic. Entering the four-lane cross-section is also problematic as motorists must navigate two oncoming lanes of traffic.

The road diet—most commonly a conversion from four lanes to three with a center turn-lane—has many benefits for a corridor like North Maple Avenue. It works best where there is a high density of driveways and side streets, each one a conflict point. The road diet is a comparatively inexpensive way to help manage access where consolidating driveways is a less likely option. With only one lane per direction and a center turn-lane for turning vehicles to queue out of the through lane, a road diet can make turning safer, calm traffic, and maintain throughput. Road diets are also one of the FHWA's nine proven safety countermeasures and eligible for HSIP funds. With traffic volume below 20,000 AADT, combined with the more than 30 access points over 0.9 miles, North Maple Avenue is good candidate for a road diet.

When it comes to improving safety, engineering strategies work best as part of a coordinated effort. A targeted enforcement campaign is an effective approach for addressing the driver behaviors that lead to crashes. In addition, policy actions can provide the legal weight needed to motivate people to be safer and more conscientious drivers, as well as pedestrians and bicyclists. Employing a multipronged approach that includes engaging the appropriate stakeholders is an effective course of action to advance the goal of improved safety on the corridor. Those primary stakeholders are the roadway owners (Burlington County and NJDOT), the Evesham Township police department, and Evesham Township officials.



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Abstract: This report documents the process and findings of the North Maple Avenue Road Safety Audit undertaken by the Delaware Valley Regional Planning Commission (DVRPC). The report details safety issues identified by the audit team at the study location and remedial strategies to address them. The audit goal is to identify safety issues and generate improvement recommendations for the study area in an effort to reduce crashes and improve walking and biking. Emphasis is placed on identifying low-cost, quick-turnaround safety projects to address the identified issues, where possible. This project represents a step toward implementation of DVRPC's Safety Action Plan. Implementation of improvement strategies are eligible for funding through the FHWA's Highway Safety Improvement Program

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