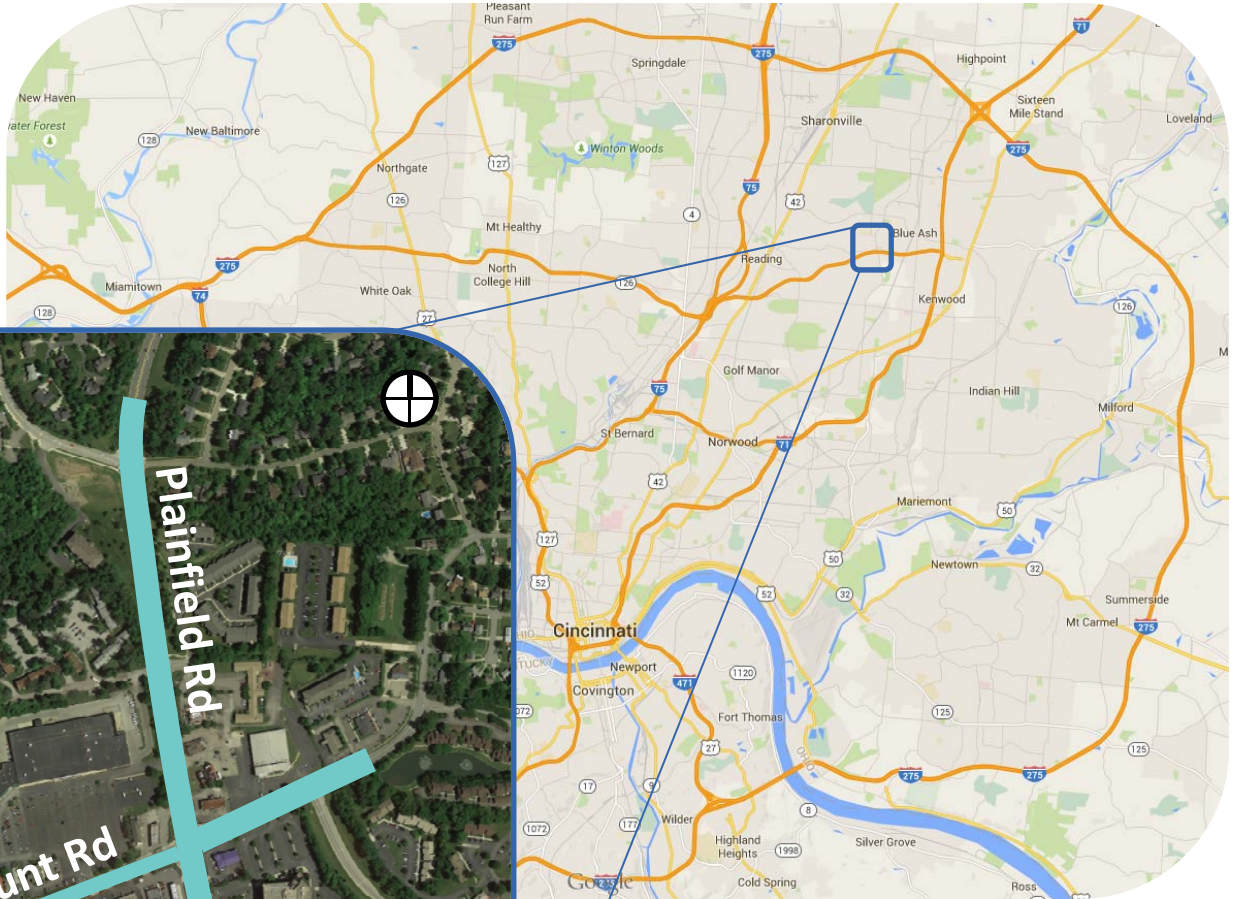




Plainfield Road & Hunt Road Safety Study Blue Ash, Ohio



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Safety Application Summary

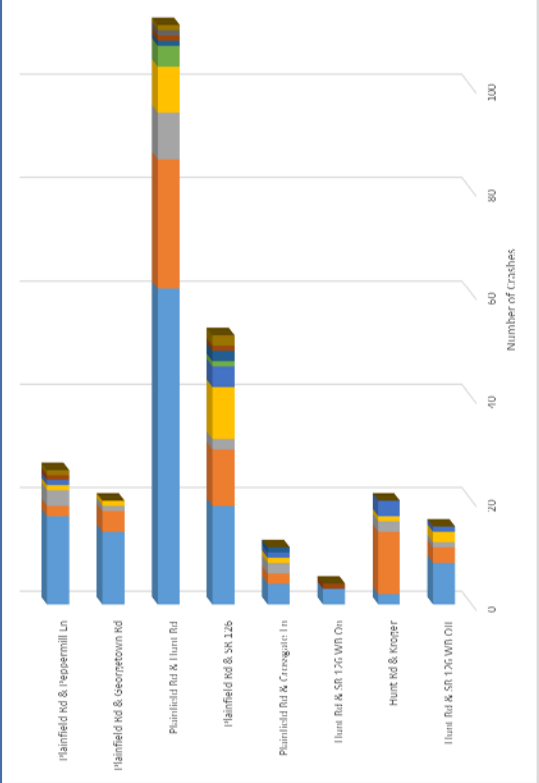
Plainfield Road & Hunt Road
 City of Blue Ash, Hamilton County OH
 April 2016



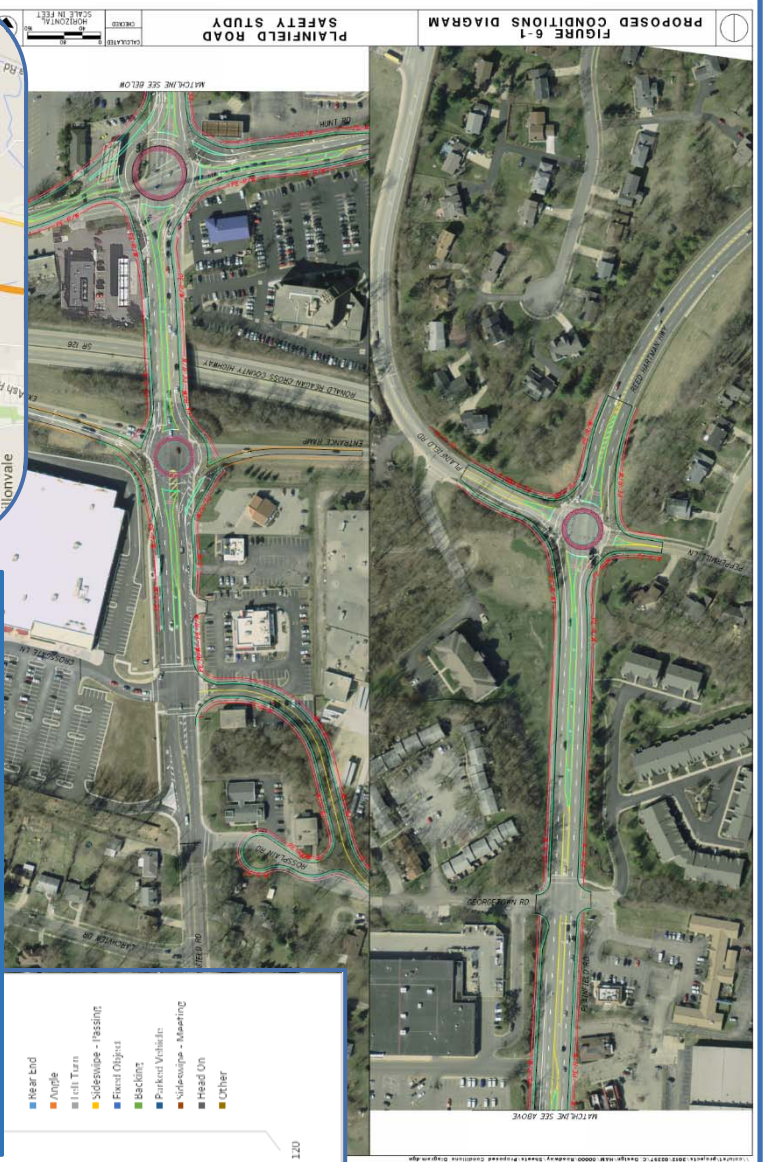
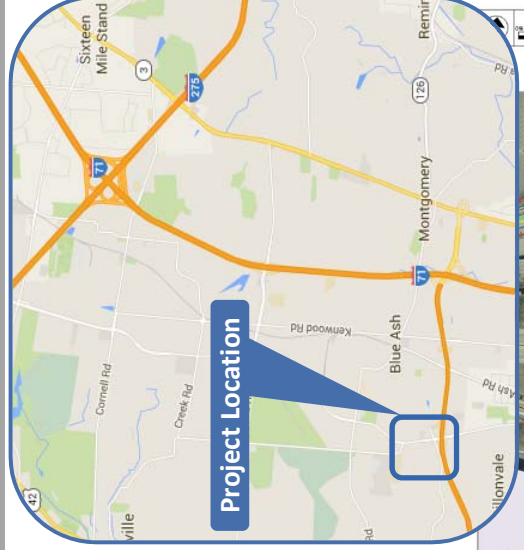
Location	Existing Conditions			Proposed Conditions Predicted Average Crash Rate
	Predicted Average Crash Frequency	Expected Average Crash Frequency	Potential for Safety Improvement	
Plainfield Rd & Peppermill Ln	10.3	10.8	0.6	6.3
Plainfield Rd & Hunt Rd	11.7	22.6	10.9	7.1
Plainfield Rd & SR 126	6.7	8.8	1.3	4.2
Plainfield Rd & Crossgate Ln	5.4	4.7	-0.7	3.3
Hunt Rd & SR 126 WB Off	3.7	3.7	0.0	2.3
Hunt Rd & SR 126 WB On	0.4	0.4	0.0	0.2

Description
 Construct multi-lane roundabouts at the following intersections to address safety and congestion issues:

- Plainfield Road & SR 126
- Plainfield Road & Hunt Road
- Plainfield Road & Peppermill Lane



Project Phase	FY	HSIP Funds	Total
PE	2017	\$ -	\$ 130,000
DD	2018	\$ -	\$ 1,531,600
RW	2019	\$ 536,900	\$ 1,877,600
Construction	2021	\$ 5,369,900	\$ 10,119,900
Totals		\$ 5,906,800	\$ 13,659,100



Executive Summary

Study Purpose

The purpose of this study is to analyze the crash trends of the Plainfield Road and Hunt Road corridors in Blue Ash, Ohio and to identify potential countermeasures to improve the safety of these corridors. The study limits include a 0.48 mile segment of Plainfield Road from Crossgate Lane to Peppermill Drive and a 0.38 mile segment of Hunt Road from SR 126 WB Entrance Ramp to SR 126 WB Exit Ramp.

The intersection of Plainfield Road & Hunt Road is a priority location for the City of Blue Ash as a significant portion of traffic entering and exiting the city passes through the intersection. The intersection experienced the most crashes of any intersection in the City of Blue Ash during the 2009-2011 analysis period. While the official ranking for the most recent analysis period has not yet been determined, the crash rates of the Plainfield Road & Hunt Road intersection clearly remain among the highest of all intersections within the City of Blue Ash during the 2012-2014 analysis period evaluated in this study. This signalized intersection is heavily congested in the peak hours, which results in queues that extend through adjacent intersections including the ramp terminals of the SR 126 interchange and contributes to the crash history.

Background Information

Plainfield Road is a four-lane north-south roadway classified as a Minor Arterial that carries an estimated Average Daily Traffic (ADT) of 20,800 vehicles per day (vpd) south of Hunt Road and 28,600 vpd north of Hunt Road. Hunt Road is classified as a Local roadway and provides three-lanes west of Plainfield Road and two lanes plus auxiliary lanes east of Plainfield Road. ADT volumes for Hunt Road are estimated at 15,750 vpd west of Plainfield Road and 9,000 vpd east of Plainfield Road. Both Plainfield Road and Hunt Road have a posted speed limit of 25 mph within the study area, which contains seven signalized intersections.

In the 2012-2014 analysis period, 263 crashes occurred within the study limits with the crash types being predominantly rear-end type crashes. The existing conditions were evaluated using the ECAT tool to determine the potential safety benefit that exists at each location. The results indicate the following intersections have potential for safety benefit:

- Plainfield Road & Hunt Road
- Plainfield Road & SR 126
- Plainfield Road & Peppermill Road

Overview of Safety Issues and Possible Causes

Crash data was evaluated and collision diagrams were prepared in efforts to identify safety issues possible causes. These efforts identified that 44% of crashes within the study area occurred at the intersection of Plainfield Road & Hunt Road, as depicted in **Figure ES-1**. The amount of angle crashes occurring at this intersection and within the segment of Hunt Road west of Plainfield Road also raised concern.

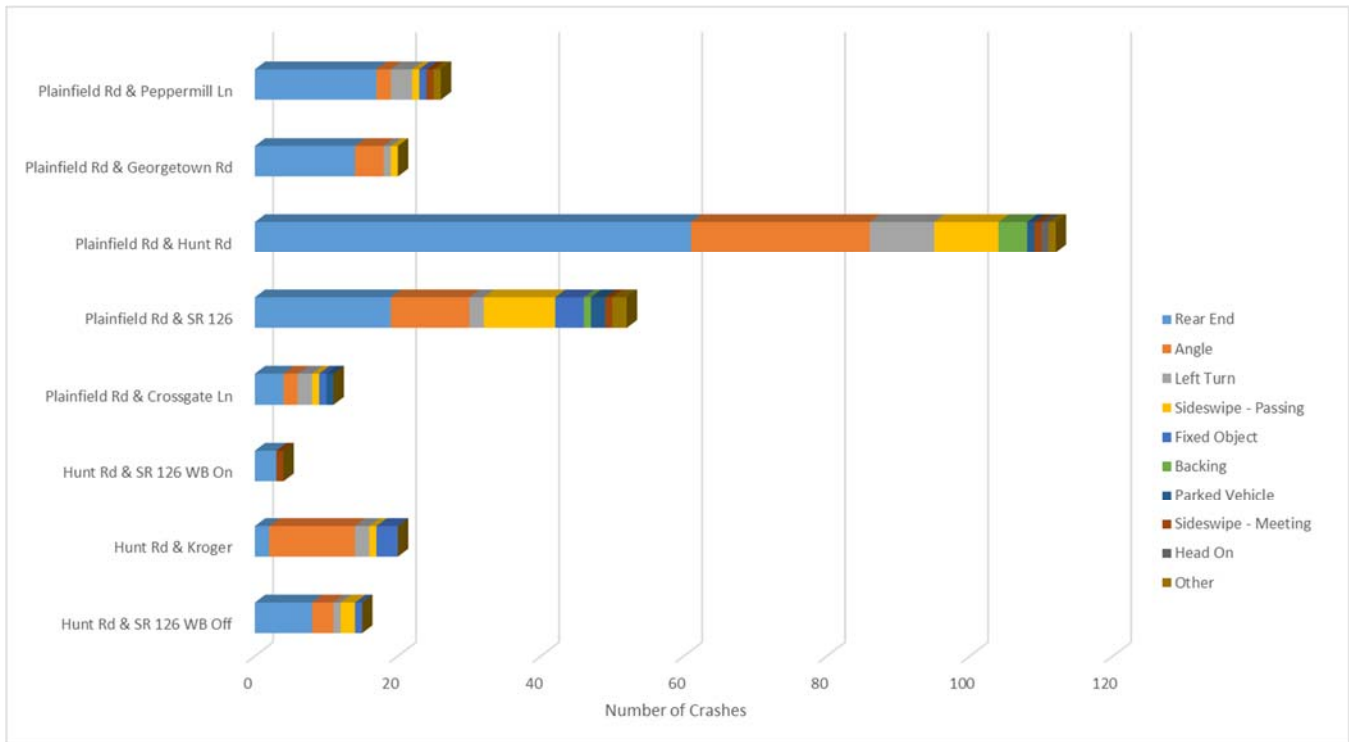


Figure ES-1 Crash Frequency by Location

Based on a thorough evaluation of the crash data, the major factors contributing to the crashes are a lack of access management, and congestion which leads to aggressive driving and last minute lane changes.

Recommended Countermeasures

Several potential countermeasures have been evaluated in this study. Of these countermeasures, only those listed in **Table ES-1** have potential for improving safety within the study area and are therefore recommended for implementation.

Table ES-1 Recommended Countermeasures

Location	Recommended Countermeasure
Plainfield Rd & Peppermill Ln	Reconfigure intersection as a roundabout
Plainfield Rd & Hunt Rd	Reconfigure intersection as a roundabout
Plainfield Rd & SR 126	Reconfigure intersection as a roundabout
Hunt Road at Kroger's main driveway	Prohibit left turns exiting Kroger

The proposed roundabouts not only provide a substantial safety benefit, but also provide a substantial amount of congestion relief to the Plainfield Road corridor, which is severely congested in the peak hours. This congestion results in queues that extend north from the Plainfield Road & Hunt Road intersection and frequently exceed one-half mile in length in the PM peak hour. This congestion also interferes with

operations of the SR 126 eastbound exit ramp, which frequently causes the ramp to queue onto the mainline lanes of SR 126. A traffic analysis of the Plainfield Road corridor was completed in 2014 to evaluate alternatives for relieving congestion. The study identified roundabouts at the intersections of SR 126, Hunt Road and Plainfield Road as providing the most congestion relief of all alternatives evaluated in the study. These roundabouts are expected to reduce queuing to acceptable levels and improve travel times through the corridor by 43% in the PM peak hour, which is when congestion levels are currently the most severe.

Requested HSIP Funding

The totals of the safety benefit associated with each roundabout is the HSIP funding amount requested for this project. This amount is provided in **Table ES-2**. No funding is requested for the improvements to Kroger’s driveway as this improvement will be solely funded by the City.

Table ES-2 Recommended Countermeasures

Location	Requested HSIP Funding
Plainfield Rd & Peppermill Ln	\$2,180,000
Plainfield Rd & Hunt Rd	\$2,471,600
Plainfield Rd & SR 126	\$1,255,200
Hunt Road at Kroger's main driveway	\$0
Total	\$5,906,800

Funding

The roundabouts of the Plainfield Road, Hunt Road and SR 126 intersections will be funded through several sources. The City was awarded \$3.8M in CMAQ funding for construction of these three roundabouts. These funds will be available in Fiscal Year 2021 and will be applied to the construction phase of this project. The requested \$5.9M in HSIP funds coupled with the CMAQ funds will result in a shortfall of approximately \$3.9M, which the City intends to provide through a combination of the City’s general fund and a Tax Increment Financing (TIF) district that encompasses the improvements.

Table 0.1 Requested HSIP Funding

	Plainfield Rd & Peppermill Ln	Plainfield Rd & Hunt Rd	Plainfield Rd & SR 126	Totals
Project Cost	\$3,639,400	\$6,899,700	\$3,120,000	\$13,659,100
CMAQ Funds (Awarded)*	\$1,266,667	\$1,266,667	\$1,266,667	\$3,800,000
STP Funds (Requested)	\$0	\$0	\$0	\$0
HSIP Funds (Requested)	\$2,180,000	\$2,471,600	\$1,255,200	\$5,906,800
Blue Ash Contribution	\$192,733	\$3,161,433	\$598,133	\$3,952,300

1.0 Purpose and Need

The purpose of this study is to analyze the crash trends of the Plainfield Road and Hunt Road corridors in Blue Ash, Ohio and to identify potential countermeasures to improve the safety of these corridors. The intersection of Plainfield Road & Hunt Road is a priority location for the City of Blue Ash as a significant portion of traffic entering and exiting the city passes through the intersection. The intersection experienced the most crashes of any intersection in the City of Blue Ash during the 2009-2011 analysis period. While the official ranking for the most recent analysis period has not yet been determined, the crash rates of the Plainfield Road & Hunt Road intersection clearly remain among the highest of all intersections within the City of Blue Ash during the 2012-2014 analysis period evaluated in this study. This signalized intersection is heavily congested in the peak hours, which results in queues that extend through adjacent intersections including the ramp terminals of the SR 126 interchange and contributes to the crash history.

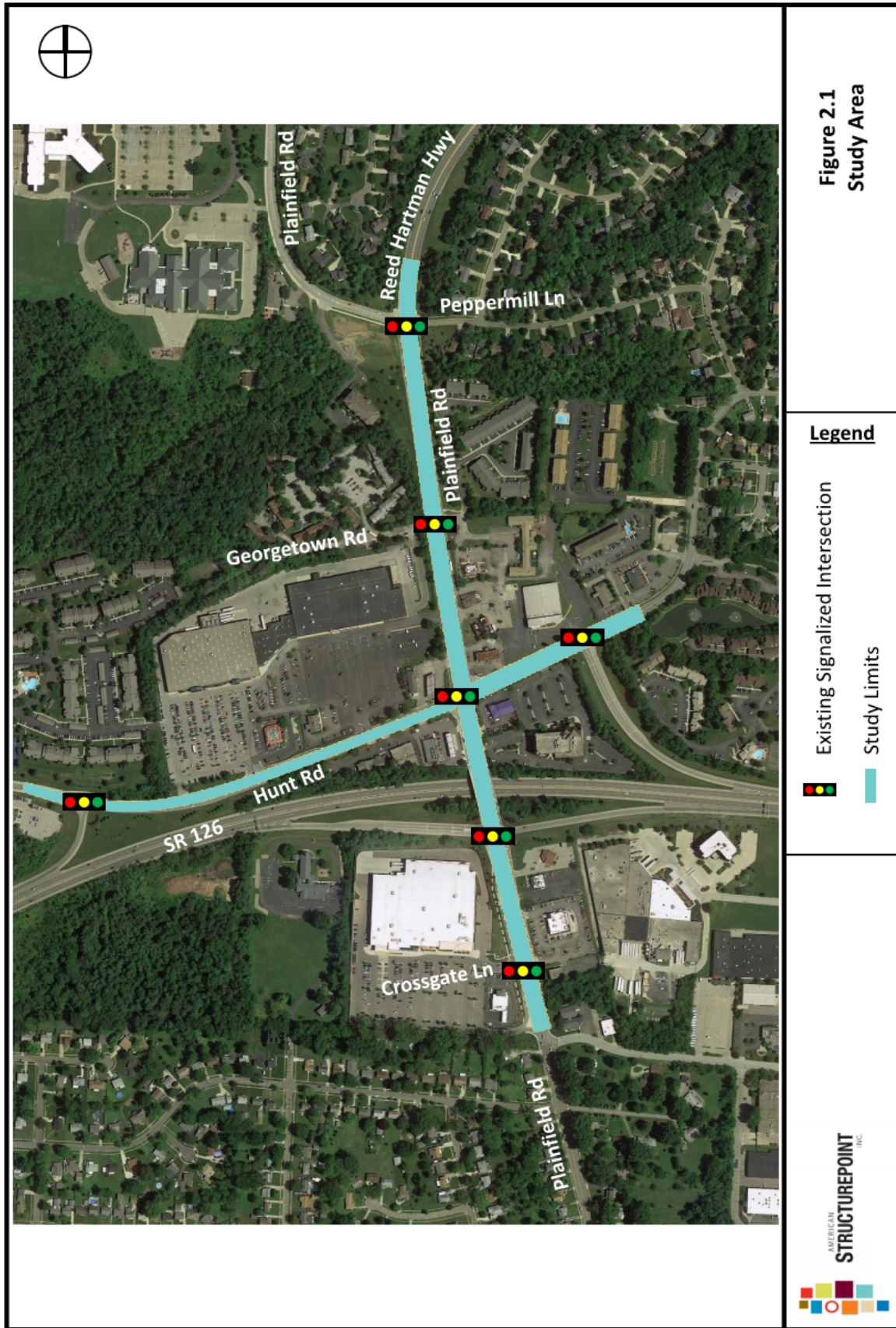
2.0 Existing Conditions

2.1 Background Information

The Plainfield Road and Hunt Road corridors are located in Blue Ash, Ohio. The study segments include a 0.48 mile segment of Plainfield Road (CHAMCR00273) from Crossgate Lane to Peppermill Drive and a 0.38 mile segment of Hunt Road (CHAMCR07001) from SR 126 WB Entrance Ramp to SR 126 WB Exit Ramp. The study corridor consists of seven signalized intersections and several access driveway locations between intersections. The study area is depicted in **Figure 2-1**.

Plainfield Road (CR 273) is a four-lane north-south roadway classified as a Minor Arterial with a posted speed limit of 25 miles per hour within the study limits. Based on peak hour counts collected in 2014, the Average Daily Traffic (ADT) volumes for Plainfield Road are approximately 20,800 south of Hunt Road and 28,600 north of Hunt Road. Plainfield Road is a curb and gutter facility with sidewalks provided along the west side of Plainfield Road. Roadway lighting is present throughout the study area.

Hunt Road (CR 7001) is a three-lane roadway between the westbound Entrance Ramp to SR 126 and Plainfield Road. Hunt Road is a two-lane roadway east of Plainfield Road with turn lanes spanning this entire segment. The posted speed limit is 25 mph along all segments of Hunt Road. Hunt Road is classified as a Local roadway. Based on turning movement counts collected in 2014, the ADT volumes of Hunt Road are estimated at 15,750 west of Plainfield Road and 9,000 east of Plainfield Road. Hunt Road is a curb and gutter facility with sidewalks provided along the north side of Hunt Road. Roadway lighting is present throughout the study area.



2.2 Conditions Diagram

Condition diagrams for Plainfield Road and Hunt Road are provided in

These diagrams depict the existing lane configurations of each roadway, lane widths, existing signing and pavement markings, adjacent land uses and other key features of each roadway.

2.3 Physical Conditions

Pavement & Markings

Asphalt pavement is utilized within the study limits. All pavement appears to be in good condition with no rutting or severe cracking observed. Pavement markings also appear to be in good condition.

Structures

Bridge No. 3105083 carries Plainfield Road over SR 126. This bridge appears to be in good condition.

Horizontal & Vertical Alignments

Plainfield Road follows a relatively straight horizontal alignment within the study area. The profile of Plainfield Road follows the rolling terrain of the area with a crest vertical curve centered about the SR 126 interchange and a vertical sag curve located between Georgetown Road and Peppermill Lane.

From the intersection of Hunt Road & SR 126 WB Entrance Ramp, the horizontal alignment of Hunt Road curves to the northeast and then follows a tangent alignment from approximately 1,000 feet west of Plainfield Road to east of the SR 126 WB Exit Ramp. The crest of a vertical crest curve lies approximately 400 feet west of Plainfield Road.

Intersections

Seven signalized intersections are located within the study limits. Strain pole/span wire supports are the predominate type of signal support used within the study area, with mast arms utilized at the Plainfield Road & Crossgate Lane intersection. Each intersection utilizes protected/permitted left turn signal phasing with 5-section signal heads for all left turn lanes along Plainfield Road and for the westbound left turn lane of the Hunt Road & SR 126 WB Entrance Ramp intersection. The Plainfield Road signalized intersections all operate within a single closed loop system, while the Hunt Road signalized intersections operate independently. This information is summarized in the **Table 2.1**.

Table 2.1 Signalized Intersection Details

Intersection	Signal Support Type	Left Turn Phasing
Plainfield Rd & Peppermill Ln	Box Span	Protected/Permitted
Plainfield Rd & Georgetown Rd	Box Span	Protected/Permitted
Plainfield Rd & Hunt Rd	Box Span	Protected/Permitted
Plainfield Rd & SR 126	Box Span	Protected/Permitted
Plainfield Rd & Crossgate Ln	Mast Arm	Protected/Permitted
Hunt Rd & SR 126 WB Entrance Ramp	Diagonal Span	Protected/Permitted
Hunt Rd & SR 126 WB Exit Ramp	Box Span	N-S Split Phased

Signage

Regulatory and warning signs within the study limits appear to be adequate and in good condition. Overhead guide signing for the SR 126 interchange is in poor condition, retro reflectivity levels believed to be inadequate and damage visible to several sign panels. Ground mounted guide signs are provided at the intersections to indicate street names, block numbers and guidance for motorists to UC Blue Ash and to Reed Hartman Highway. The ground mounted guide signs are inadequately sized and frequently placed in obscure locations.

Access Management

A raised median separates the north-south lanes of Plainfield Road between Crossgate Lane and the SR 126 EB ramps; however, the raised median ends 50 feet south of the SR 126 eastbound ramps intersection. A painted median is used in this 50 foot segment of Plainfield Road.

A raised curb median is utilized to separate north-south traffic along a 920 foot portion of Plainfield Road that extends from north of the bridge over SR 126 to the Georgetown Road intersection. This median restricts all adjacent driveways to right-in/right-out operations.

Table 2.2 Existing Driveways

Plainfield Road		Hunt Road	
Driveway	Type	Driveway	Type
Taco Bell/ Offices/ Townhouses	Signalized	Kroger	Full
Skyline Chili	Right-In/Right-Out	Kroger	Full
Former K-Mart	Right-In/Right-Out	Former K-Mart	Full
Vacant	Right-In/Right-Out	Speedway	Full
Marathon	Right-In/Right-Out	Speedway	Full
Speedway	Right-In/Right-Out	Marathon	Full
Marathon	Right-In/Right-Out	Evans Auto Care	Full
Evans Auto Care	Right-In/Right-Out	Marathon	Full
Office Bldg	Right-In/Right-Out	Office Bldg	Full
Shell	Right-In/Right-Out	Crossgate Lanes	Full
Gold Star Chili	Right-In/Right-Out		
Long John Silver's	Right-In/Right-Out		
Frisch's	Right-In/Right-Out		
Target/ Frisch's	Signalized		

3.0 Crash Data

3.1 Crash Data, Graphs & Tables

A total of 263 crashes occurred within the study area from January 1, 2012 through December 31, 2014. Only one of these crashes resulted in a fatality, while 46 of the crashes (17.5%) resulted in injuries. The type of crashes occurring in each year was reasonably consistent, with an increase of 25% to property damage crashes occurring in 2014 as depicted in **Figure 3-1**.

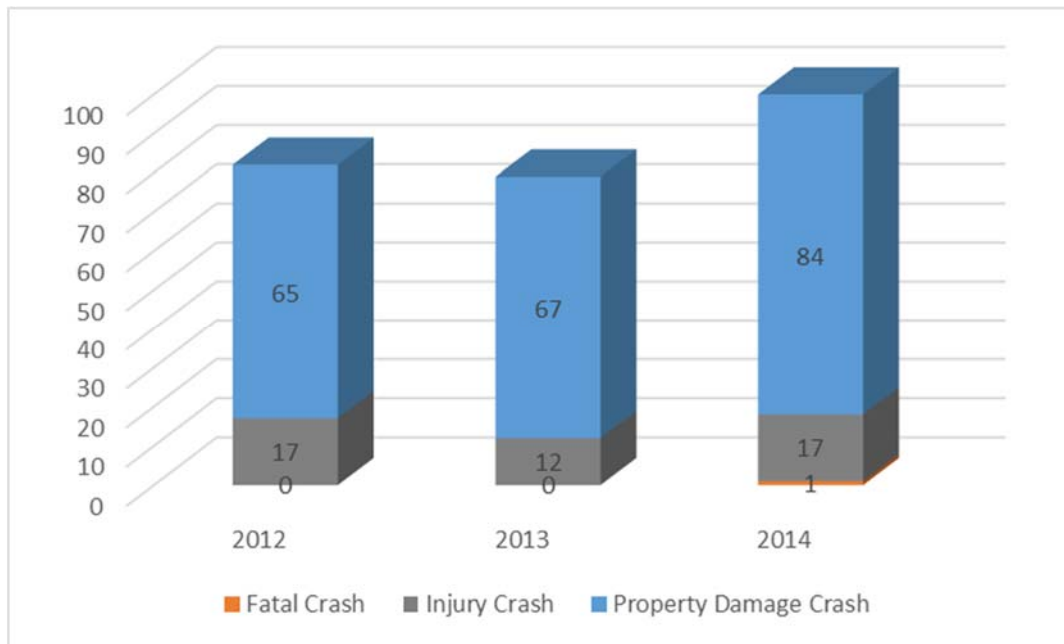


Figure 3-1 Number of Crashes per Year

Crash Causes

Rear-end crashes are the prominent crash type within the study limits. This suggests that congestion is a major contributing factor. Weather was not identified as a significant contributing factor to the crashes as only 29% of crashes occurred when the roadways were either wet or snow covered and only 17% of all crashes occurred during rain or snow events. Roadway lighting is not believed to be a significant crash contributor as 83% of crashes occurred in daylight and 90% of all crashes occurred between the hours of 7am and 6pm, which are typically considered to be daytime hours. Drugs and alcohol contributed to less than 3% of all crashes in the study area and are also not considered to be a significant contributor to the crashes of this study area.

Crash Frequency

Crash types within the study area are predominantly rear-end type crashes. The large percentage of rear-end type crashes suggests that congestion is a contributing factor. The number of driveways and lack of access management is also believed to be a major contributor to crash types, as nearly one quarter of all crashes are angle type crashes. Nearly 10% of all crashes are sideswipe crashes that occurred as one motorist changed lanes and collided with a second motorist traveling in the same direction. This suggests that lane changes frequently occur within the corridor. Percentages for all crash types are provided in **Table 3.1**.

Table 3.1 Crash Types

Crash Type	# of Crashes	%
Rear End	128	48.7%
Angle	61	23.2%
Sideswipe - Passing	25	9.5%
Left Turn	20	7.6%
Fixed Object	10	3.8%
Backing	5	1.9%
Sideswipe - Meeting	4	1.5%
Parked Vehicle	4	1.5%
Other Non-Collision	2	0.8%
Head On	1	0.4%
Pedestrian	1	0.4%
Pedal cycles	1	0.4%
Other Object	1	0.4%
Grand Total	263	100.0%

The intersection of Plainfield Road & Hunt Road experienced the most crashes, with 115 (44%) of the 263 total crashes occurring at this intersection. The intersection of Plainfield Road & SR 126 experienced the second most crashes in this time period, with 17% of the study area crashes occurring at this intersection. The intersection of Plainfield Road & Peppermill Lane experienced 10% of the total crashes. All other intersections accounted for less than 10% of the total crashes, as depicted in **Figure 3-2**.

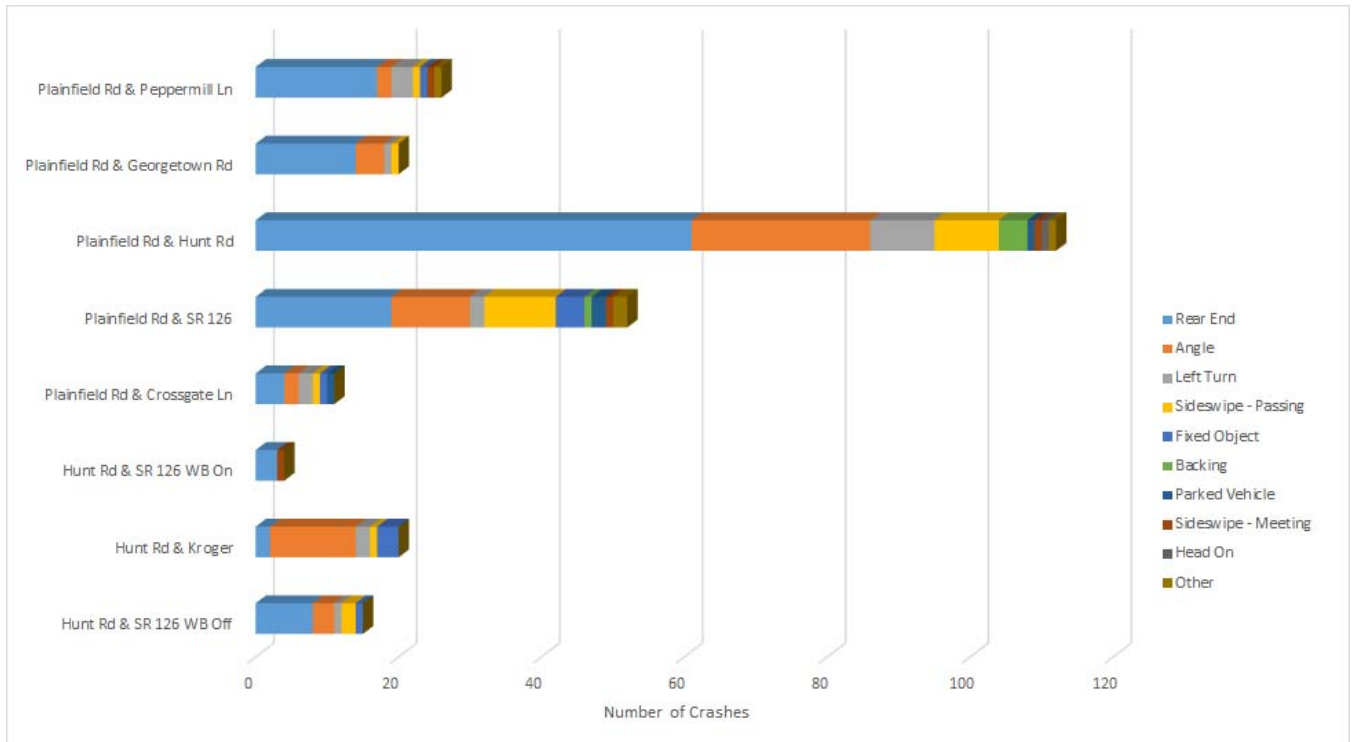


Figure 3-2 Crash Frequency by Location

3.2 Collision Diagrams

Collision diagrams of the study area were prepared from the crash data using the ODOT Crash Analysis Module (CAM) Tool. The collision diagrams are provided in **Appendix B**. The following trends were identified from the collision diagrams:

Plainfield Road & Crossgate Lane Intersection

Three rear-end collisions occurred north of the intersection in the northbound lanes, indicating these vehicles were in the northbound queue of the Plainfield Road & SR 126 intersection.

Plainfield Road & SR 126 EB Ramps Intersection

A majority of the rear-end crashes occurred on the SR 126 EB Exit Ramp. These are likely due to congestion that occurs in the peak hours.

Plainfield Road & Hunt Road Intersection

- A large majority of the rear-end crashes occurred on the northbound and southbound approaches to the intersection. These crashes are largely due to congestion that occurs along Plainfield Road in the peak hours. Wet weather may have contributed to 60% of the southbound rear-end collisions.
- A majority of the sideswipe – passing type crashes occurred on the southbound approach to the intersection. Based on field observations, frequent lane changes occur on the southbound approach as motorists seek the southbound right-turn lane. Congestion leads to a low number of gaps for these lane changes to occur and likely contributes to these crashes.

- Eight of the 14 rear-end crashes that occurred on the westbound approach occurred in the PM peak hours. The westbound approach volumes are lower in the PM peak hour than in the AM peak hour, which suggests that north south volumes of the Plainfield Road & Hunt Road intersection are utilizing most of the green time and causing queues to form on the westbound approach.

Plainfield Road & Georgetown Road

- Eleven of the 21 crashes occurred in the northbound direction, and all but one was a rear-end type crash. Of the southbound rear-end crashes, 60% of them occurred when the pavement was wet.

Plainfield Road & Peppermill Lane

- 80% of the southbound crashes occurred in the AM hours. Southbound congestion levels are low and southbound speeds are at or above the posted speed limit in the AM peak hours. These factors are believed to have contributed to these crashes.

Hunt Road at Easternmost Kroger Driveway

A majority of crashes are angle type crashes involving vehicles traveling west on Hunt Road. Sight distance and vehicle speeds may be contributing factors here based on field observations.

3.3 Crash Analyses

A crash analysis was performed using the July 2015 release of ODOT’s Economic Crash Analysis Tool (ECAT). This analysis identified the potential for site safety improvements and potential countermeasures.

The Predictive Method for Urban & Suburban Arterial Intersections was analyzed to determine the expected safety performance of the study intersections compared to similar urban and suburban arterial intersections (*Highway Safety Manual 2010*). The expected average crash frequency at the study intersections is based on the site conditions and site crash history. A positive difference between the predicted and expected crash totals of a given location represents the potential for safety improvement, assuming the fundamental conditions of the intersection do not change (e.g. signalized intersections remain signalized). Based on this methodology, a potential for site safety improvements exists at several locations within the study limits as indicated in **Table 3.2**. The ECAT reports are provided in **Appendix C**.

Table 3.2 Site Potential for Safety Improvements

Location	Existing Conditions Potential for Safety Improvement
Plainfield Rd & Peppermill Ln	0.6
Plainfield Rd & Georgetown Rd	-0.8
Plainfield Rd & Hunt Rd	10.9
Plainfield Rd & SR 126	1.3
Plainfield Rd & Crossgate Ln	-0.7
Hunt Rd & SR 126 WB Entrance Ramp	0
Hunt Rd & SR 126 WB Exit Ramp	0

3.4 Design Evaluation

The existing bridge over SR 126 is six-lanes wide and provides sidewalks on both sides. A prior study of the Plainfield Road corridor indicated widening of the bridge would be necessary to alleviate the congestion issues of this corridor. The City of Blue Ash is opposed to widening this bridge. Due to the costs associated with said widening and the City's stance, solutions to the safety and congestion issues of the Plainfield Road corridor that do not involve bridge widening are being sought.

3.5 Identification of Counter Measures

3.5.1 Road Safety Audit

A Road Safety Audit (RSA) was conducted in June 2015 to identify counter measures to reduce crash frequency and mitigate the concerns of both the owner and the public. This RSA was conducted per the current FHWA guidelines for RSAs.

Audit Team

The audit team chosen for this RSA was selected by the RSA team leader and the City of Blue Ash. The team, which is listed in **Table 3.3**, was comprised of individuals with backgrounds in road safety, traffic operations and roadway design. The audit team also included representatives from the local community.

Table 3.3 Audit Team

Name	Organization
Frank Aransky	American Structurepoint, Inc.
Ryan Huebschman	American Structurepoint, Inc.
Bryan Becker	Michelman, Inc.
Michael Miller	Sycamore Community Schools
Pete Gemmer	UC Blue Ash
Lt. Steve Schueler	Blue Ash Police Department
Fire Chief Rick Brown	Blue Ash Fire Department
Tommy Arnold	ODOT District 8

Pre-Audit Meeting

Prior to the field review, the audit team and two representatives from the City of Blue Ash Public Works Department (Gordon Perry and Zak Bradley) held an information sharing meeting. This meeting occurred on June 26, 2015 immediately before the field review was conducted. In this meeting, the City and American Structurepoint briefed the team members on multiple items including the reason for conducting the RSA, the crash histories of the intersections, the history of the corridors, and the goals of the field review.

Field Review

The RSA team conducted a field review of the Plainfield Road and Hunt Road corridors on the morning of June 26, 2015. Several observations were noted during the field review, as listed in **Table 3.4**. Documentation of the field review is provided in **Appendix D**.

Table 3.4 Field Review Observations

Plainfield Road & Hunt Road	
1	Turning radius for the northbound left turn movement is insufficient for trucks. This results in low turning speeds and reduces the capacity of the northbound left-turn movement.
2	Turning radius for the northbound right-turn movement is insufficient for trucks. Curb in the southeast quadrant has been damaged by trucks passing over it.
3	Turning radius for the southbound right-turn movement is insufficient for trucks. The curb in the northwest quadrant is covered in tire marks.
4	Southbound right turning vehicles frequently enter the southbound right-turn lane near the intersection in lieu of entering near the beginning of the turn lane.
Plainfield Road & SR 126	
5	Based on anecdotal information provided by the police department, the eastbound Exit Ramp from SR 126 frequently queues onto SR 126 mainline in the peak hours.
6	Sight distance for the eastbound right-turn movement appears to be insufficient due to various poles, foliage and the bridge barrier wall.
7	Radius of the leftmost eastbound left-turn movement is tight. Southbound vehicles stopping beyond the stop bar negatively influence the capacity of this turn lane by hindering the ability of motorists in the inside eastbound left turn lane to complete a left turn movement.
8	The northbound left-turn lane of the Plainfield Road & Hunt Road intersection frequently queues into the SR 126 intersection and limits the capacity of the leftmost eastbound left turn lane
9	The efficiency of the intersection may be improved by reconfiguring the southbound lanes as follows: LEFT TURN, LEFT TURN, THROUGH.
Hunt Road & SR 126 Westbound Entrance Ramp	
10	The need for a signalized intersection was questioned due to low volumes observed during the field review.
Hunt Road East of SR 126 Westbound Entrance Ramp	
11	The travel lanes of the Kroger parking lot don't align with the main driveway. This results in numerous conflicts between vehicles entering and exiting the parking lot.
12	Sight distance for left turning vehicles exiting from the main driveway of Kroger appears to be insufficient due to the profile of Hunt Road.
13	Sight distance for right turning vehicles exiting from the main driveway of Kroger is frequently blocked by left turning vehicles exiting Kroger.
14	The speed of westbound vehicles were sampled using a speed monitor device. Average speeds were in the 35-40 mph range.
15	The McDonald's drive thru frequently queues onto westbound Hunt Road during lunch hours.
All Signalized Intersections	
16	Add back plates to all signal heads.

3.5.2 Evaluation of Countermeasures Identified by RSA Field Review

Several countermeasures were developed from the field observations made during the RSA. These countermeasures are explained and evaluated in the following paragraphs. ECAT analysis has been performed for viable countermeasures. ECAT reports for these countermeasures are provided in **Appendix E**.

All Signalized Intersections – Add Back Plates to All Signal Heads

None of the existing signalized intersections utilize back plates to improve the target value of the signal heads. Each intersection was evaluated using the ECAT tool to determine if back plates provide potential to improve the safety of the study area. The results of this analysis indicate that back plates have potential for improving safety and reducing the expected number of annual crashes. Based on this finding, back plates should be considered as a countermeasure to be implemented at all study intersections. The ECAT results corresponding to back plates are summarized in **Table 3.5**.

Table 3.5 Benefit to Cost Ratios of Signal Head Back Plates

Location	Existing Conditions Predicted Average Crash Frequency	Existing Conditions Expected Average Crash Frequency	Existing Conditions Potential for Safety Improvement	Proposed Conditions Predicted Average Crash Rate	Expected Annual Crash Adjustment
Plainfield Rd & Peppermill Ln	10.3	10.8	0.6	9.2	-1.6
Plainfield Rd & Georgetown Rd	11.2	10.5	-0.8	8.9	-1.6
Plainfield Rd & Hunt Rd	11.7	22.6	10.9	19.2	-3.4
Plainfield Rd & SR 126	6.7	8.0	1.3	6.8	-1.2
Plainfield Rd & Crossgate Ln	5.4	4.7	-0.7	4.00	-0.7
Hunt Rd & SR 126 WB On	0.4	0.4	0.0	0.3	-0.1
Hunt Rd & SR 126 WB Off	3.7	3.7	0.0	3.1	-0.6

Plainfield Road & SR 126 – Reconfigure Southbound Lanes

During the RSA, it was noted that southbound through traffic volumes were light at the intersection of Plainfield Road & SR 126. To reduce queues associated with the southbound left-turn movement and queues of the SR 126 eastbound Exit Ramp, a suggestion was made to reconfigure the southbound lanes as follows: LEFT TURN, LEFT TURN, THROUGH. Capacity analysis was performed for this potential countermeasure to determine if the proposed lane configuration would reduce queues. If queues are reduced, a crash analysis would then be performed for the proposed condition to determine its safety benefit.

Capacity analysis of the existing and proposed conditions were performed for the AM and PM peak hours using 2014 traffic counts obtained from a corridor study of Plainfield Road. The results of this capacity analysis, which are provided in **Table 3.6**, indicate the proposed southbound lane configuration would generally improve operating conditions of the intersection. Despite this finding, queue lengths are expected to increase threefold for the southbound through movement due to the capacity reduction

associated with this movement as noted in **Table 3.7**. Southbound queues of this length would spill through the intersection of Plainfield Road & Hunt Road and would compound the current operational and safety issues of this intersection. For this reason, no crash analysis of this potential countermeasure was undertaken and the proposed lane configuration is not recommended.

Table 3.6 Plainfield Road & SR 126 Intersection Capacity Analysis

Peak Hour	Scenario	LOS / Delay (sec/veh)				
		Overall	Eastbound	Westbound	Northbound	Southbound
AM	Existing	LOS D / 42.9	LOS D / 58.3	n/a	LOS D / 35.8	LOS D / 33.7
AM	Proposed	LOS B / 17.9	LOS C / 26.5	n/a	LOS C / 24.0	LOS A / 2.5
PM	Existing	LOS C / 21.3	LOS D / 46.6	n/a	LOS C / 23.4	LOS A / 6.5
PM	Proposed	LOS C / 20.0	LOS E / 61.6	n/a	LOS B / 11.2	LOS A / 2.9

Table 3.7 Plainfield Road & SR 126 Intersection Queue Lengths

Peak Hour	Scenario	95th Percentile Queue Lengths (ft)			
		Eastbound	Westbound	Northbound	Southbound
AM	Existing	1,095	n/a	375	195
AM	Proposed	750	n/a	360	0
PM	Existing	330	n/a	250	155
PM	Proposed	660	n/a	150	0

Plainfield Road & Hunt Road – Improve Turning Radii

The turning radii for trucks utilizing the northbound left turn, northbound right turn and southbound right turn movements were found to be deficient during the field review. The northbound right and southbound right curb lines should be moved outward while the eastbound stop bars should be moved upstream to address these deficiencies.

The collision diagram of this intersection indicates that no right turn crashes were associated with the northbound right and southbound left turn lanes. For this reason, improving the turning radii of these movements will have no associated safety benefits.

The collision diagram indicates four crashes involved northbound left turning vehicles. A review of these crash records indicates that none of these crashes involved trucks, which indicates moving the eastbound stop bar upstream will not produce a significant safety benefit. For this reason, no crash analysis was performed for these potential countermeasures. It is recommended that turning radii improvements for these movements be incorporated into any intersection improvements.

Plainfield Road & Hunt Road – Improve Intersection Capacity

High frequencies of rear-end collisions are typically associated with congestion. For this reason, the congestion of the Plainfield Road & Hunt Road intersection is believed to be the most significant factor contributing to the high frequency of rear-end crashes at this intersection. A prior study of the Plainfield Road corridor recommended adding a second northbound left-turn lane, a second westbound right-turn lane, a second southbound right-turn lane and a second westbound receiving lane to the intersection as a means of improving intersection operations. These improvements are considered to be infeasible due to the associated right-of-way costs and the need to widen the bridge over SR 126. Based on the capacity analysis results, the capacity of this intersection and the associated queue lengths cannot be significantly improved without adding lanes or without using a method of traffic control other than that of an at-grade signalized intersection. The City of Blue Ash is considering a multi-lane roundabout at this location. This roundabout is evaluated in **Section 5.3** of this document.

Hunt Road & SR 126 Westbound Entrance Ramp – Perform Signal Warrant Analysis

Traffic volumes observed during the field review of the RSA were light, which led the review team to question the need for this signalized intersection. Capacity analysis of the intersection under the existing and the proposed conditions was performed for comparison purposes. The analysis of the proposed conditions indicates the westbound left-turn movement would suffer extreme delay in the PM peak hour if stop controlled. The volume of traffic associated with the westbound left turn movement in the PM peak hour would result in insufficient gaps in traffic for the eastbound through movement and would lead to extreme delays for eastbound motorists. For these reasons, no signal warrant analysis has been performed and replacing the signalized intersection with a stop controlled intersection is not recommended.

Hunt Road from SR 126 WB Entrance Ramp to Plainfield Road – Perform Signal Warrant Analysis

The collision diagram of this intersection identifies ten angle crashes that have occurred at the main driveway to Kroger in the past three years. During the field review, the study team observed a potential sight distance issues associated with motorists departing Kroger and also found the average speed of westbound vehicles on Hunt Road.

An investigation of the intersection sight distance available at the main driveway to Kroger indicated the sight distance is adequate for the posted speed of 25mph. Since motorists were found to be traveling on average 10 mph over the posted speed limit, the sight distance associated with the prevailing speed of traffic is insufficient and has likely contributed to the angle crashes associated with this driveway.

To improve safety in the vicinity of the driveway, the following options were considered:

- Reduce the prevailing speed of traffic to the posted speed limit
- Improve sight distance by reducing the grade of Hunt Road
- Prohibit left turns out of the driveway

Reducing the prevailing speed of traffic to the posted speed limit could be achieved through enforcement or adding rumble strips to the westbound lanes of Hunt Road. Rumble strips are not recommended due to the noise generated by these devices, which would be undesirable in an urban area such as this. Enforcement could be accomplished by speed patrols or dynamic signs that display a motorist's current speed. Based on conversations with the Blue Ash Police Department (BAPD) neither method of enforcement is practical in this segment of Hunt Road. The BAPD does deploy dynamic "YOUR SPEED"

signs but has encountered mixed results as such signs encourage speeding by some motorists. Speed patrols in this segment of Hunt Road are not practical as locations for officers to park while monitoring speeds or in which to stop motorists are extremely limited.

Improving the sight distance associated with the main Kroger driveway is feasible, but cost prohibitive, as reducing the grade of Hunt Road would require substantial right-of-way acquisition. For this reason, this countermeasure is not recommended.

Prohibiting the left turn movement out of this driveway would eliminate the sight distance issue and prevent future angle crashes involving westbound vehicles on Hunt Road and southbound left-turning vehicles exiting Kroger. This restriction could be accomplished by constructing a “pork chop” island in the driveway that would prevent the left turn movement and could be supplemented with a traffic separator along Hunt Road. Prohibiting this movement would increase the volume of left turning vehicles at the second (minor) driveway to Kroger that is located to the west of the main driveway. This minor driveway currently provides sight distance that is adequate for the prevailing speed of motorists. Based on approximate implementation costs, this potential countermeasure produces a favorable benefit to cost ratio and is a recommended countermeasure.

3.5.3 Evaluation of Roundabout Countermeasures

The City of Blue Ash has developed a concept for the Plainfield Road corridor that replaces the signalized intersections at Crossgate Lane, SR 126, Hunt Road and Peppermill Lane with two-lane roundabouts. This concept also includes single lane roundabouts for the intersections of Hunt Road with SR 126. The intent of this concept is to reduce congestion and in turn reduce the number of rear-end crashes along the corridor. Conceptual plans for these roundabouts are provided in **Appendix F**.

A crash analysis has been conducted using the ECAT tool to determine the safety benefit of each proposed roundabout. This analysis indicates the roundabouts provide potential for safety improvement at intersections, with the greatest amount of potential at the Plainfield Road & Peppermill Lane and Plainfield Road & Hunt Road intersections. These safety improvement potentials are depicted in **Figure 3-3**. ECAT reports for each intersection are provided in **Appendix G**.

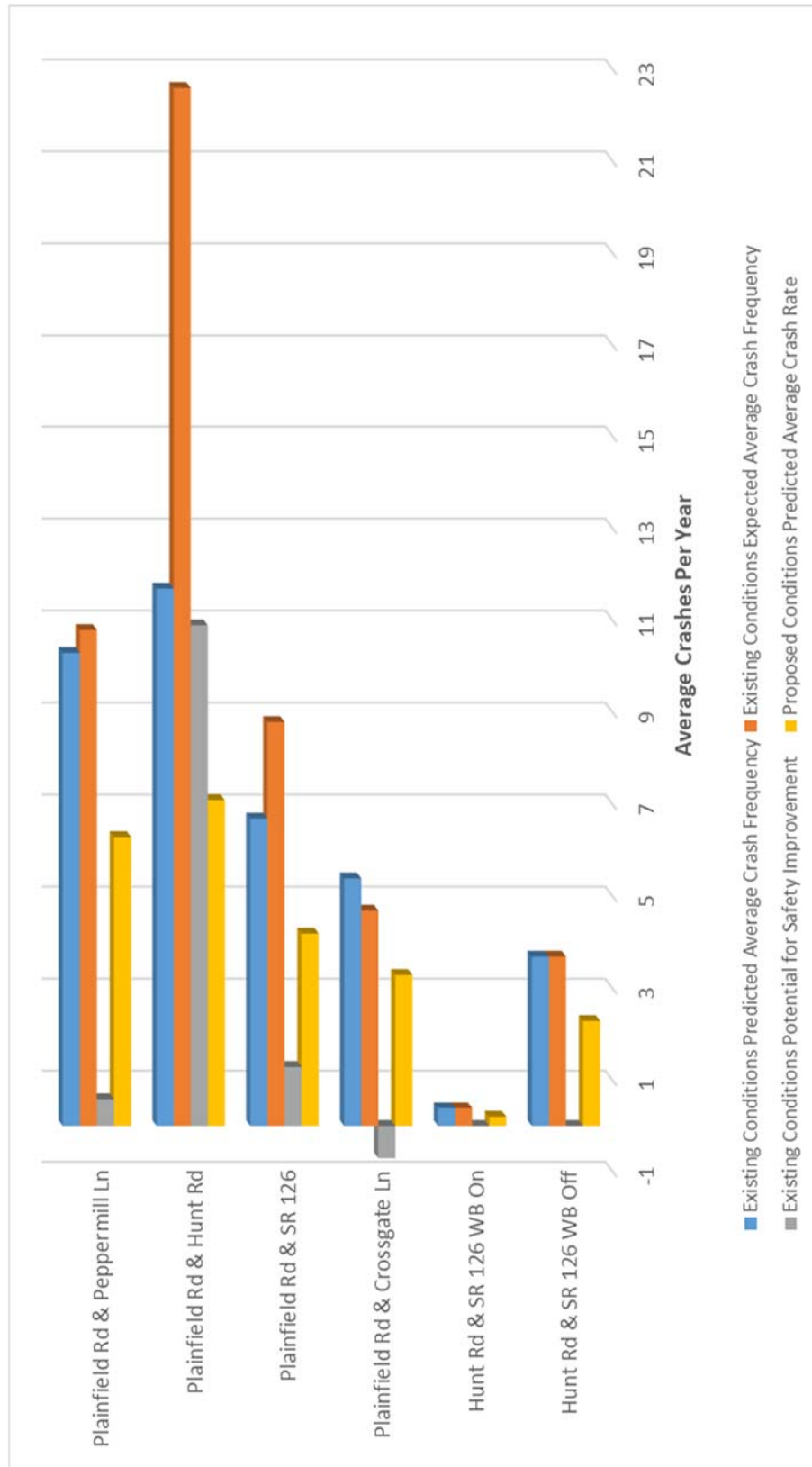


Figure 3-3 Safety Improvement Potential of Roundabouts

3.6 Conclusions

Several potential countermeasures have been identified to improve the safety of the Plainfield Road & Hunt Road corridors. These countermeasures have been evaluated in various manors in order to identify those countermeasures that provide the most safety benefit to the corridors, which can be characterized as the reduction in annual crashes. Those potential countermeasures with a reduction in annual crashes should be carried forward and evaluated from an economic standpoint. Each potential countermeasure is discussed below, with a summary provided in **Table 3.8**.

Add Back Plates to Signal Heads

The addition of back plates to signal heads was found to reduce the expected number of annual crashes. For this reason, this potential countermeasure should be evaluated from an economic standpoint.

Reconfigure Intersection as a Roundabout

Roundabouts have been evaluated as a means of reducing the crash frequencies. The crash analysis results indicate roundabouts will reduce the number of annual crashes. Roundabouts should be evaluated from an economic standpoint to help determine their feasibility.

Improving Turning Radii – Plainfield Road & Hunt Road Intersection

This countermeasure has not been evaluated from a crash standpoint, but should be included in any countermeasure that alters the curb lines of this intersection.

Reconfigure Southbound Lanes – Plainfield Road & SR 126 Intersection

Capacity analysis of this potential countermeasure indicates the proposed lane configuration would result in additional queueing. For this reason, no further evaluations of this countermeasure were performed.

Convert to Two-Way Stop Controlled Intersection – Hunt Road & SR 126 WB Entrance Ramp Intersection

Capacity analysis of this intersection as a two-way stop controlled intersection indicates the eastbound approach would experience significant delay and queuing. For this reason, no further evaluations of this countermeasure were performed.

Improve Sight Distance – Hunt Road from SR 126 WB Exit Ramp to Plainfield Road

Several means of reducing the speed of westbound traffic were considered. Each was considered to be infeasible and was not evaluated from a crash standpoint. Sight distance associated with Kroger's main driveway could be improved by decreasing the grade of Hunt Road. This would require substantial earthwork and right-of-way acquisition and was not evaluated further for this reason. Prohibiting left turns from Kroger's main driveway to Hunt Road was considered to be feasible. The crash analysis of this potential countermeasure indicates a slight reduction in the expected number of annual crashes. For this reason, an economic evaluation of this potential countermeasure should be performed.

Table 3.8 Potential Countermeasures

Countermeasure	Expected Annual Crash Adjustment (Avg. crashes/year)	Economic Evaluation Necessary
Plainfield Rd & Peppermill Ln		
Add back plates to signal heads	-1.626	Yes
Reconfigure intersection as a roundabout	-3.983	Yes
Plainfield Rd & Georgetown Rd		
Add back plates to signal heads	-1.571	Yes
Plainfield Rd & Hunt Rd		
Add back plates to signal heads	-3.385	Yes
Improve turning radii	n/a	No
Reconfigure intersection as a roundabout	-4.516	Yes
Plainfield Rd & SR 126		
Add back plates to signal heads	-1.202	Yes
Reconfigure southbound lanes	n/a	No
Reconfigure intersection as a roundabout	-2.477	Yes
Plainfield Rd & Crossgate Ln		
Add back plates to signal heads	-0.704	Yes
Reconfigure intersection as a roundabout	-2.082	Yes
Hunt Rd & SR 126 WB Entrance Ramp		
Add back plates to signal heads	-0.058	Yes
Convert to a two-way stop controlled intersection	n/a	No
Reconfigure intersection as a roundabout	-0.177	Yes
Hunt Rd From SR 126 WB Exit Ramp to Plainfield Rd		
Reduce prevailing speed of traffic	n/a	No
Improve sight distance by reducing the grade of Hunt Road	n/a	No
Prohibit left turns out of Kroger's main driveway	-0.070	Yes
Hunt Rd & SR 126 WB Exit Ramp		
Add back plates to signal heads	-0.550	Yes
Reconfigure intersection as a roundabout	-1.375	Yes

4.0 Relevant Traffic Studies

Three studies of the Plainfield Road corridor have been conducted since 2007. These studies are summarized in the following sections and provided in full in **Appendix H**.

4.1 Reed Hartman/ Plainfield Road Corridor Long Term Study (2007)

Study Purpose and Scope

In 2007, the City of Blue Ash initiated a study to evaluate the long term (20 year) needs of the Plainfield Road / Reed Hartman Highway corridor. This study identified several future developments that were expected to occur along the corridor and the impact these developments would have on the corridor. The limits of this study spanned from south of Larchview Drive to north of Malsbary Road.

The study considered the following three scenario:

- **Scenario 1:** Maintain two through lanes per direction along the corridor. Add turn lane and modify traffic control method as necessary to achieve acceptable operating conditions.
- **Scenario 2:** Provide three through lanes per direction from SR 126 to Malsbary Road. Add turn lanes and modify traffic control methods as necessary to achieve acceptable operating conditions.
- **Scenario 3:** Provide a new loop road to connect the Hunt Road & SR 126 intersections to Plainfield Road at the Georgetown Road intersection. Add turn lanes, through lanes and modify traffic control methods as necessary to achieve acceptable operating conditions.

Traffic Forecast

Background traffic was forecasted by growing 2007 volumes to the design year. Trips associated with future developments were estimated using the ITE *Trip Generation Manual*.

Capacity Analysis

Capacity analysis was prepared using Synchro and reported based on HCM 2000 methodologies. The capacity analysis was used to determine the improvements necessary to address the congestion issues of the corridor, which were largely focused on the intersections of Plainfield Road & SR 126 and Plainfield Road & Hunt Road.

Findings and Recommendations

The study identified Scenario 2 as having the most significant reduction in congestion. This scenario was also identified as being the most expensive scenario, with an estimated construction cost of \$17M, which does not include utility relocation or right-of-way costs. No recommended scenario was identified by the study.

4.2 Hunt Road at Plainfield Road Safety Study (2013)

Study Purpose and Scope

The Plainfield Road & Hunt Road intersection had the most crashes of any intersection in the City of Blue Ash for the analysis period of 2009 through 2011. The City initiated this study to identify countermeasures for reducing the crash rate of this intersection.

The study used a combination of crash analysis and capacity analysis to develop a series of short term and long term improvements. A rate of return on investment was then determined for each of these countermeasures. Countermeasures with large rates of return were recommended for implementation.

Findings and Recommendations

The study recommended the following short term countermeasures:

- Install reflectorized back plates where the existing strain poles can accommodate them
- Increase the All Red timing values for all phases
- Close the westernmost access point to Marathon Oil, located along Hunt Road

The study recommended the following long term countermeasures:

- Add a second southbound right-turn lane
- Add a second northbound left-turn lane (requires widening of the bridge over SR 126)
- Add a second westbound receiving lane to Hunt Road, west of Plainfield Road
- Replace the existing signal supports with mast arms
- Increase the intersection radii

As of September 2015, none of the countermeasures listed above have been implemented.

4.3 Plainfield Road Corridor Study (2014)

Study Purpose and Scope

The Plainfield Road - Reed Hartman Highway corridor is a major commuter route within the City of Blue Ash. The southern end of this corridor connects to the Ronald Reagan Cross County Highway (SR 126). In the vicinity of this interchange, severe congestion is common during peak hours. This congestion results in queues that extend north from the Plainfield Road & Hunt Road intersection and frequently exceed one-half mile in length in the PM peak hour. Substantial queueing frequently occurs in the vicinity of the SR 126 interchange. Said queues interfere with the operations of the Plainfield Road & SR 126 interchange, and result in queues on the eastbound exit ramp that spill back on to the mainline lanes of SR 126.

In 2014, the City of Blue Ash initiated a study to evaluate the feasibility of installing a multi-lane roundabout at the intersection of Plainfield Road & Hunt Road as a possible solution to this congestion. Roundabouts are also being considered for the Plainfield Road & SR 126, Plainfield Road & Crossgate Lane and Hunt Road & SR 126 intersections. Prior studies of the corridor have shown the need for several additional lanes to provide acceptable operating conditions with the current signalized intersections. The purpose of this study was to evaluate the Plainfield Road/ Reed Hartman Highway corridor, from Larchview Road to Carver Road, under existing and proposed conditions in an effort to identify improvements necessary to provide acceptable intersection operations and travel times through the study corridor, as depicted in **Figure 4-1**. An evaluation of the Hunt Road & SR 126 intersections is also included in this study to determine methods of reducing congestion. The following scenarios were developed to perform this evaluation:

- **Scenario 1:** Evaluate existing conditions and identify short term, low cost improvements where feasible

- **Scenario 2:** Evaluate the existing signalized intersections to identify improvements necessary to alleviate the existing congestion
- **Scenario 3:** Evaluate roundabouts at the intersections of Hunt Road, SR 126 Eastbound, Crossgate Lane, and SR 126 Westbound as a means to alleviate the existing congestion
-

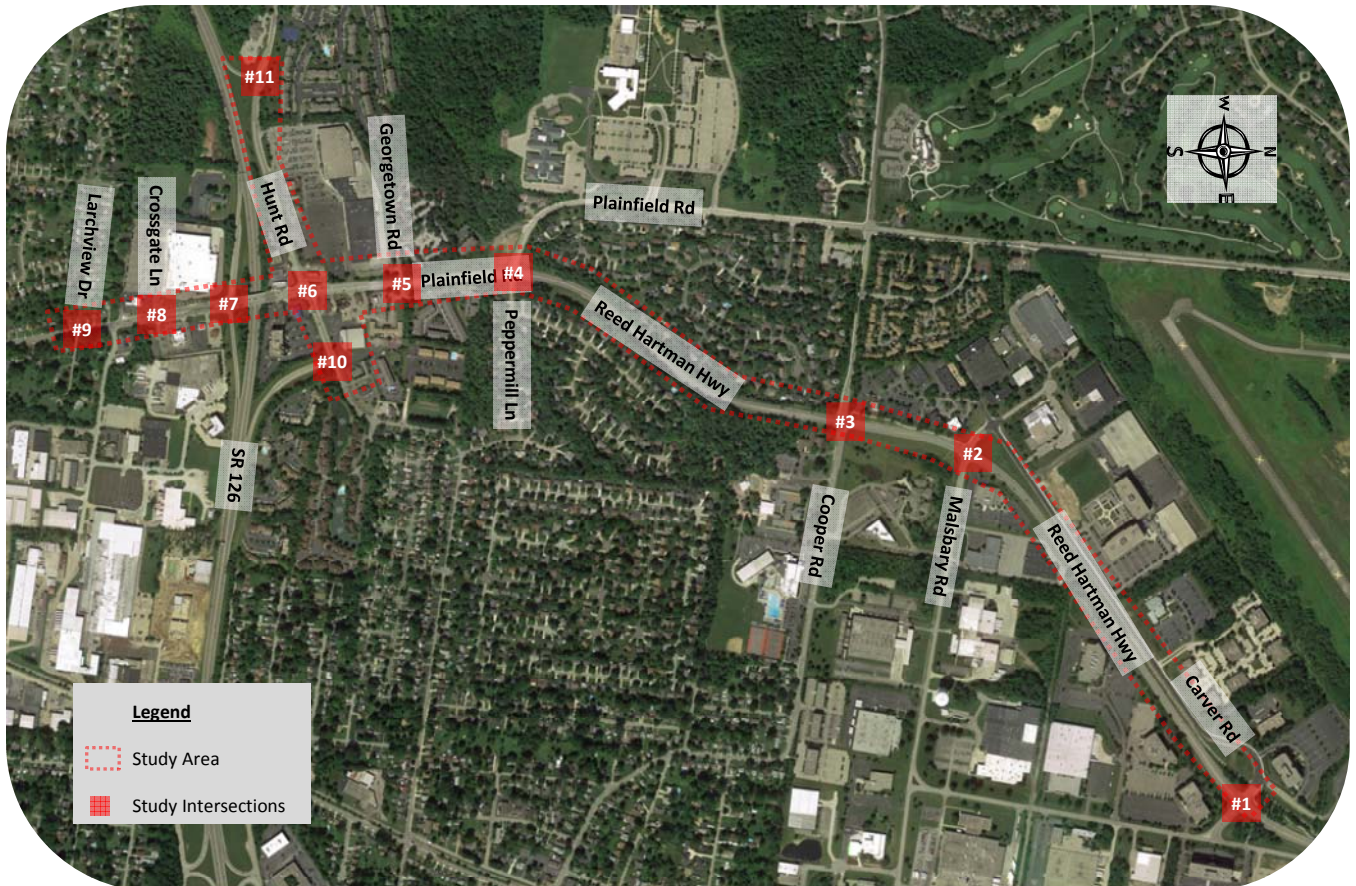


Figure 4-1 Study Area

Traffic Forecast

Traffic was forecasted by determining the base year (2014) traffic volumes using existing traffic data collected by American Structurepoint, Inc., then applying a background traffic growth rate to obtain design year (2034) background traffic volumes. A growth rate of 0.25% per year was calculated and applied to the existing traffic counts to develop the background traffic volumes.

Capacity Analysis

Capacity analysis is based on the methodology outlined in the *Highway Capacity Manual* (TRB 2010). The computer software SIDRA was used to evaluate all roundabouts, while SYNCHRO was used to evaluate all signalized intersections. Micro simulation models of the corridor were developed using the SimTraffic software for Scenarios 1 and 2 and VISSIM for Scenario 3 to assess corridor operations.

Findings and Recommendations

The capacity analysis results of the existing conditions indicate that overall the study intersections operate acceptably in both AM and PM peak hours. The travel times obtained from simulation models of the corridor more accurately depict the existing conditions, in which severe congestion occurs primarily in the southbound approach to Hunt Road during the PM peak hour. Congestion also occurs south of Hunt Road in the northbound direction in both peak hours.

The congestion observed in Scenario 1 can be relieved by adding turn lanes at several intersections. These turn lanes, detailed in Scenario 2, will improve the operating speeds of all segments to acceptable levels. The exception to this statement is the northbound segment between Crossgate Lane and the SR 126 eastbound ramps. Improving the operating conditions of this segment can only be accomplished by adding capacity to the north approach of the Plainfield Road & Hunt Road intersection. Adding capacity to this approach would require widening the bridge over SR 126, which is considered infeasible at this time. The improvements of Scenario 2 will decrease most queues to lengths that will not interfere with adjacent intersections. The exception to this is the westbound queues of the Plainfield Road & Hunt Road intersection, which will spill into the Hunt Road & SR 126 WB Exit Ramp and increase northbound queues on the Exit Ramp.

Another option for relieving the congestion of Scenario 1 is to replace several signalized intersections as roundabouts. This alternative, which is represented in Scenario 3, results in travel speeds along the Plainfield Road/ Reed Hartman Highway corridor that are greater than those of Scenario 2. The improved segment speeds of Scenario 3 result largely from queues being significantly reduced from those of Scenarios 1 or 2. The most notable of these queue reductions is the southbound queues at the Plainfield Road & Hunt Road intersection, where Scenario 1 queues extend approximately ½ mile in the PM Peak hour are reduced to approximately 100 feet in length. The Hunt Road roundabouts of Scenario 3 also reduce queues along Hunt Road, which significantly improves operations between the SR 126 WB Exit Ramp and Plainfield Road. Queue lengths for Scenarios 1, 2 and 3 are provided in **Figure 4-2**.

Based on the higher travel speeds and reduced queue lengths associated with the proposed roundabouts, Scenario 3 is the recommended method for alleviating congestion along the Plainfield Road/ Reed Hartman Highway corridor. These roundabouts are expected to improve travel times in the peak hours by up to 43%.

Consideration should be given to converting the intersection of Plainfield Road/ Reed Hartman Highway & Peppermill Lane to a multi-lane roundabout. A comparison of capacity analysis results indicates the roundabout will result in less delay in both peak hours and shorter PM Peak hour queues than the signalized alternative.

The signalized intersection of Plainfield Road & Georgetown Road was found to function acceptably in the peak hours of all scenarios. Removal of the traffic signal at this intersection would require the Plainfield Road & Georgetown Road intersection to be converted to right-in/right-out access only. This right-in/right-out configuration will increase the U-turn traffic volumes at the Peppermill Lane and Hunt Road intersections. Such increases in the traffic volumes of these intersections are not suggested regardless of their intersection control types. For this reason, it is recommended that this intersection remain signalized regardless of the selected intersection control types of adjacent intersections.

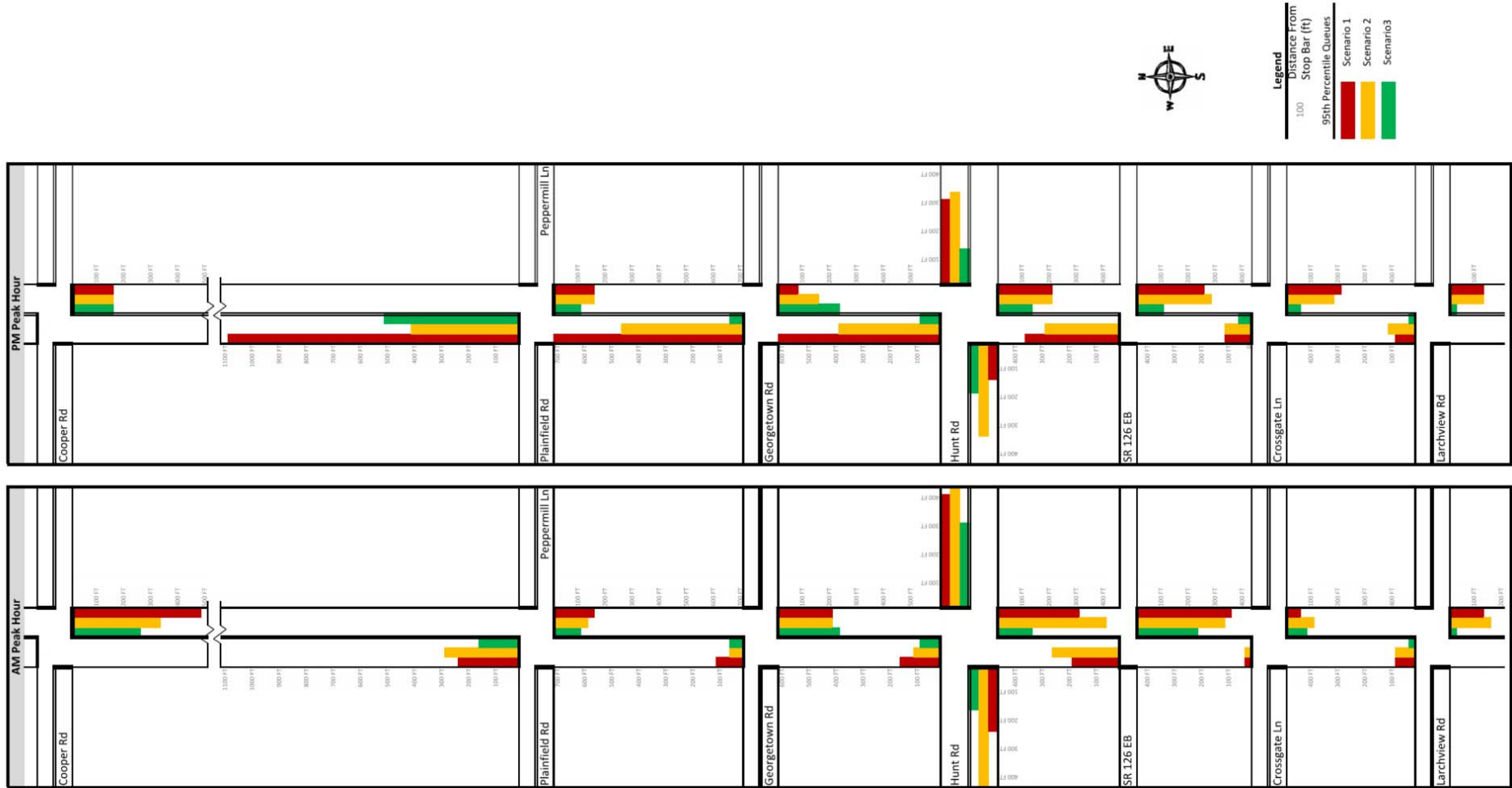


Figure 4-2 Queue Comparisons (All Scenarios)

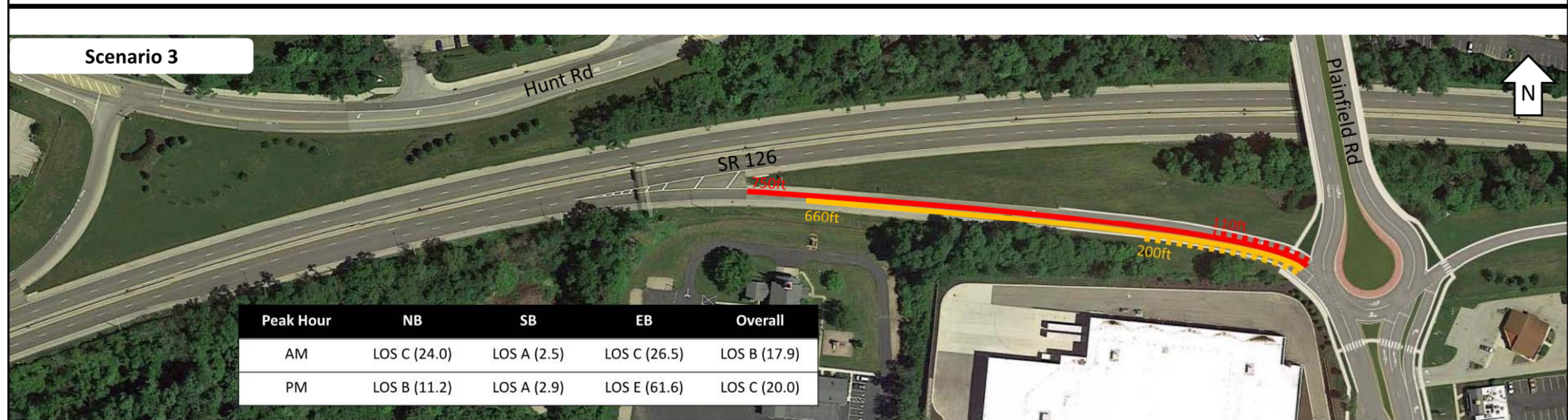
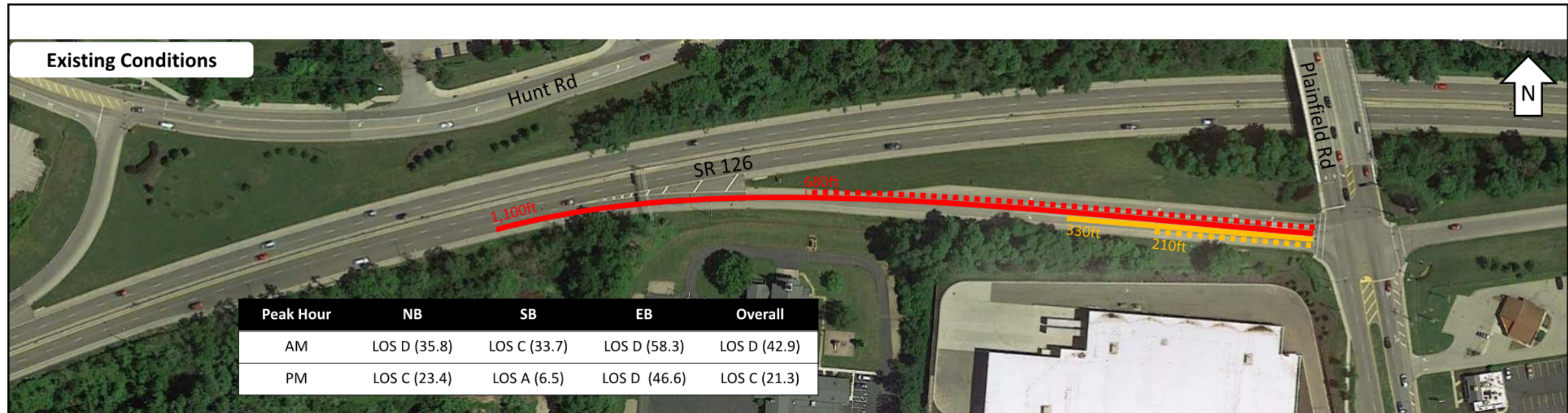
Concerns regarding the ability of the proposed roundabout to accommodate the traffic demand of the SR 126 eastbound exit ramp lead to a more detailed analysis of the Plainfield Road & SR 126 intersection. The eastbound exit ramp frequently queues onto the mainline lanes of SR 126 during the AM peak hours of the existing conditions, creating both operational and safety issues. To be considered a viable alternative, the proposed roundabout of this intersection should alleviate this queueing in addition to providing acceptable intersection operations.

The simulation model of the existing conditions was found to accurately represent queueing on the eastbound exit ramp. This model reflected a 95th percentile queue of approximately 1,100 feet in the AM peak hour, with 50th percentile (average) queue of 680ft in this same time period and average intersection delays of 42.9 seconds per vehicle. PM peak hour queues are substantially shorter at 330 feet (95th Percentile) and 210ft (50th percentile), as the intersection much more efficiently than in the AM peak hour.

The simulation model of the proposed roundabout produced 95th percentile queues in the AM peak hour are approximately equal to the 50th percentile queues of the existing conditions. In the PM peak hour, the roundabout produces a 50th percentile queue that is equal to that of the existing conditions, while the 95th percentile queue is double that of the existing conditions. Despite this increase in queue length, the overall intersection operations of the roundabout are nearly identical to those of the existing conditions.

Queues associated with a roundabout differ significantly from those of a traffic signal. Motorists waiting to be serviced at a traffic signal spend a large majority of their wait at a complete stop, while motorists queued at a roundabout are almost constantly in motion and are seldom forced to completely stop. Roundabout queueing characteristics are beneficial at freeway exit ramps as the likelihood of a motorist existing the freeway and encountering a standing queue is substantially reduced from that of a signalized intersection. This reduces both the likelihood of a crash occurring and the crash severity of crashes that do occur.

The comparison of intersection operations and queue lengths for both intersection types is provided in **Figure 4-3**.



50th Percentile ■ AM Queue ■ PM Queue
 95th Percentile ■ ■

Figure 3.8
Plainfield Road & SR 126 Intersection
Comparison

5.0 Proposed Countermeasure Evaluation

5.1 Back Plates

The cost of adding back plates to the existing signal equipment has been estimated at \$6,000 per intersection. These costs were used in combination with the safety benefit of back plates at each intersection to determine the benefit to cost ratios contained in **Table 5.1**.

Table 5.1 Benefit to Cost Ratios for Back Plates

Intersection	Net Present Value of Safety Benefits	Net Present Value of Project	B/C Ratio
Plainfield Rd & Peppermill Ln	\$326,909	\$6,000	54.5
Plainfield Rd & Georgetown Rd	\$340,102	\$6,000	56.7
Plainfield Rd & Hunt Rd	\$496,362	\$6,000	82.7
Plainfield Rd & SR 126	\$202,067	\$6,000	33.7
Plainfield Rd & Crossgate Ln	\$154,777	\$6,000	25.8
Hunt Rd & SR 126 WB On	\$16,748	\$6,000	2.8
Hunt Rd & SR 126 WB Off Ramp	\$106,090	\$6,000	17.7

After receiving the benefit to cost ratios listed in the table above, the City of Blue Ash evaluated the signal supports for each intersection to determine if these supports can accommodate back plates. It was discovered that none of the existing signal supports could accommodate back plates. Back plates were then eliminated as a potential countermeasure for this reason.

5.2 Kroger Main Driveway

Prohibiting the exiting left-turn movement at the main Kroger driveway is considered to be a low cost improvement with an estimated cost of \$24,000 for constructing a directional island. This cost results in a cost to benefit ratio greater than 1.0, as shown in **Table 5.2**. Based on this ratio, these modifications should occur as soon as funding is available.

Table 5.2 Benefit to Cost Ratios for Driveway Modifications

Countermeasure	Net Present Value of Safety Benefits	Net Present Value of Project	B/C Ratio
Prohibit left turns out of Kroger's main driveway	\$29,647	\$24,000	1.24

The cost of this countermeasure is less than the \$50,000 threshold that is desired for the use of ODOT safety funds. As such, no ODOT funds are requested for this recommended countermeasure.

5.3 Roundabouts

A Preliminary Engineering (PE) study has been conducted to determine the feasibility of the proposed roundabouts and to provide an estimate of project costs. This study is documented in the *Plainfield Road Alternative Evaluation Report*. This PE study indicates that construction of the proposed roundabouts is feasible; however, substantial right-of-way acquisition will be required at the intersection of Plainfield Road & Hunt Road to accommodate the multi-lane roundabout of this intersection. The study provides project costs for the proposed roundabouts which include right-of-way costs as estimated by the engineer.

The ECAT tool was used to obtain the monetary value of the safety benefit and the cost to benefit ratio for each roundabout. These ratios are based on the estimated project costs obtained from the Preliminary Engineering Report. The resulting ratios are summarized in **Table 5.3**, with ECAT reports provided in **Appendix G** and cost estimates for each roundabout provided in **Appendix J**. These cost estimates were obtained from the *Plainfield Road & Hunt Road Alternative Evaluation Report (April 2016)*.

Table 5.3 Safety Benefit to Cost Ratios for Roundabouts

Intersection	Net Present Value of Safety Benefits	Project Cost	B/C Ratio
Plainfield Rd & Peppermill Ln	\$2,180,000	\$3,639,400	0.60
Plainfield Rd & Hunt Rd	\$2,471,600	\$6,899,700	0.36
Plainfield Rd & SR 126	\$1,255,200	\$3,120,000	0.40
Plainfield Rd & Crossgate Ln	\$1,126,000	\$4,119,200	0.27
Hunt Rd & SR 126 WB Entrance Ramp	\$121,000	\$2,262,900	0.05
Hunt Rd & SR 126 WB Exit Ramp	\$705,528	\$2,622,600	0.27

Although the benefit to cost ratios of each roundabout are less than 1.0, which suggests that safety funding should not be the sole source of funding for these roundabouts. The Plainfield Road Corridor Study identified the roundabouts of the Hunt Road & SR 126 ramp intersections as providing very little congestion relief. As such, these two roundabouts are considered to be a low priority and are not recommended for implementation at this time.

The Plainfield Road Corridor Study did identify a substantial congestion relieve benefit associated with the roundabouts along Plainfield Road. These roundabouts are expected to relieve congestion in the Plainfield Road corridor and as such will reduce travel times for motorists. Travel time savings were estimated from intersection delay values obtained from the capacity analysis and are provided in **Appendix I**. Pairing the safety and congestion relieve benefits of the roundabouts significantly improves the benefit to cost ratios of these three roundabouts, as indicated in **Table 5.4**.

Table 5.4 Total Benefit to Cost Ratios for Roundabouts

Intersection	Congestion Relief Benefit	Safety Benefit	Total Benefit	Project Cost Estimate	B/C Ratio
Plainfield Rd & Peppermill Ln	\$2,682,100	\$2,180,000	\$4,862,100	\$3,639,400	1.34
Plainfield Rd & Hunt Rd	\$4,769,000	\$2,471,600	\$7,240,600	\$6,899,700	1.05
Plainfield Rd & SR 126	\$4,094,169	\$1,255,200	\$5,349,369	\$3,120,000	1.71
Plainfield Rd & Crossgate Ln	\$774,900	\$1,126,000	\$1,900,900	\$4,119,200	0.46

Although the Crossgate Lane roundabout provides a substantial congestion relief benefit, the cost of constructing this roundabout outweighs the total benefit provided by the roundabout. For this reason the Crossgate Lane roundabout is not recommended for implementation at this time.

The roundabouts of the Peppermill Lane, Hunt Road and SR 126 intersections all have benefit to cost ratios in excess of 1.0 when the congestion relief benefit is accounted for. These roundabouts are recommended for implementation based on these ratios.

6.0 Recommendations and Prioritization

6.1 Countermeasure Recommendations

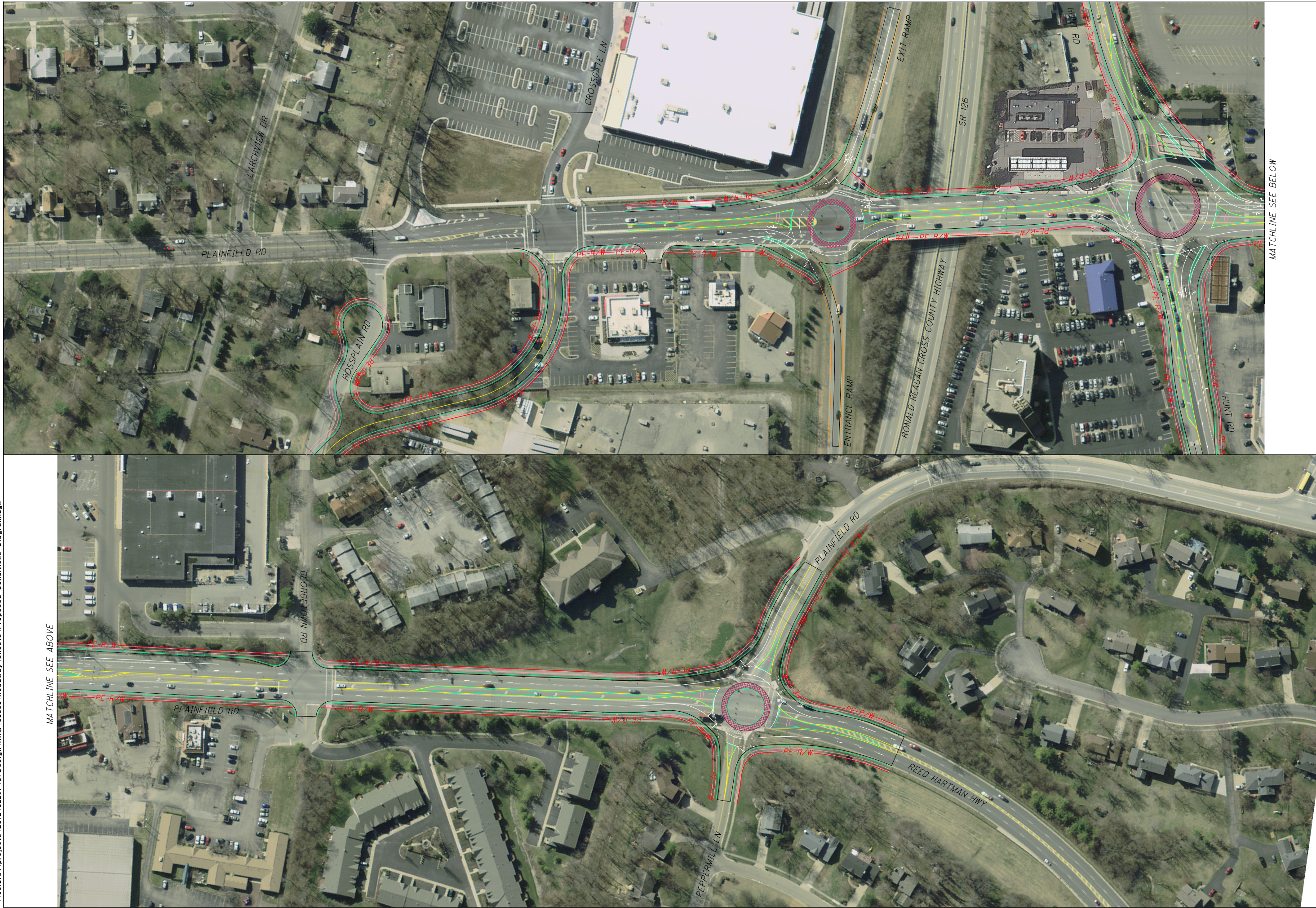
The potential to improve the safety of the study area has been documented by this study. This potential is present at several intersections and one segment within the study area, but is the greatest at the intersection of Plainfield Road & Hunt Road.

Several potential countermeasures have been evaluated in this study. Of these countermeasures, only those listed in **Table 6.1** have potential for improving safety within the study area and are therefore recommended for implementation.

Table 6.1 Recommended Countermeasures

Location	Recommended Countermeasure
Plainfield Rd & Peppermill Ln	Reconfigure intersection as a roundabout
Plainfield Rd & Hunt Rd	Reconfigure intersection as a roundabout
Plainfield Rd & SR 126	Reconfigure intersection as a roundabout
Hunt Road at Kroger's main driveway	Prohibit left turns exiting Kroger

The proposed roundabouts at SR 126, Hunt Road & Peppermill Lane are depicted in **Figure 6-1**.



6.2 Requested HSIP Funding

The totals of the safety benefit associated with each roundabout is the HSIP funding amount requested for this project. This amount is provided in **Table 6.2**.

Table 6.2 Requested HSIP Funding

Location	Requested HSIP Funding
Plainfield Rd & Peppermill Ln	\$2,180,000
Plainfield Rd & Hunt Rd	\$2,471,600
Plainfield Rd & SR 126	\$1,255,200
Hunt Road at Kroger's main driveway	\$0
Total	\$5,906,800

6.3 Funding Sources

The recommended countermeasures to the Kroger driveway located on Hunt Road will be entirely funded by the City. As such, no HSIP funds are requested for this improvement. The roundabouts of the Plainfield Road, Hunt Road and SR 126 intersections will be funded through several sources.

In late 2015, the City was awarded \$3.8M in CMAQ funding for construction of these three roundabouts. These funds will be available in Fiscal Year 2021 and will be applied to the construction phase of this project. HSIP funds are requested for these roundabouts in the amounts listed in **Table 6.2**. The shortfall between the project cost and the combined amounts received from CMAQ and HSIP sources will be funded by the City via a combination of the City's general fund and a Tax Increment Financing (TIF) district. The City may pursue STP funds to further reduce the City's share; however the amounts to request are dependent on the amount of HSIP funding that is awarded and thus STP request amounts have not yet been established. **Table 6.3** provides a summary of the funding sources for this project.

Table 6.3 Funding Summary

	Plainfield Rd & Peppermill Ln	Plainfield Rd & Hunt Rd	Plainfield Rd & SR 126	Totals
Project Cost	\$3,639,400	\$6,899,700	\$3,120,000	\$13,659,100
CMAQ Funds (Awarded)*	\$1,266,667	\$1,266,667	\$1,266,667	\$3,800,000
STP Funds (TBD)	\$0	\$0	\$0	\$0
HSIP Funds (Requested)	\$2,180,000	\$2,471,600	\$1,255,200	\$5,906,800
Blue Ash Contribution	\$192,733	\$3,161,433	\$598,133	\$3,952,300

Safety Funding Request Percentage 43.2%

Note: STP Funding will be applied for in May 2016. Requested amounts are yet to be determined.