



QUAKER CHURCH ROAD

ROAD SAFETY AUDIT

Randolph, Morris County, New Jersey
(REPORT)

>> December 2015

RSA facilitated by the Transportation Safety Resource Center (TSRC) at the Rutgers Center for Advanced Infrastructure and Transportation (CAIT) in partnership with the North Jersey Transportation Planning Authority (NJTPA) and Morris County with funding provided by FHWA and NJDOT

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>> INTRODUCTION

WHAT IS A ROAD SAFETY AUDIT (RSA)?

The Center for Advanced Infrastructure and Transportation's (CAIT's) Transportation Safety Resource Center (TSRC) offer a statewide Road Safety Audit (RSA) service at no charge to New Jersey towns and counties. Interested parties can request road surveys which are conducted by a team of engineers, planners, and law-enforcement officers to help municipalities and counties make cost-effective safety improvements.

A multidisciplinary team of professionals offers assessments on roadway issues such as pedestrian and bicycle safety, intersection analyses, rural roads, human factors, speed management, sign visibility, and retroreflectivity standards.

RSAs include data-driven considerations and analysis of crashes. To determine the best safety solutions, RSA professionals perform incisive crash data evaluations on the target area using Plan4Safety, TSRC's award-winning crash database and software.

The RSA team provides a final report that includes long- and short-term countermeasure recommendations that fit within the requestor's budget. Furthermore, RSAs pay off. According to the Federal Highway Administration (FHWA), countermeasures applied after RSAs can reduce crashes by about 60 percent.

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DISCLAIMER

Road Safety Audit reports provided by the Center for Advanced Infrastructure and Transportation staff are not engineering reports. The agency responsible for design and construction should consult a professional engineer licensed by the State of New Jersey in preparing the design and construction documents to implement any of the safety countermeasures in this report.

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the New Jersey Department of Transportation or the Rutgers Center for Advanced Infrastructure and Transportation. This report does not constitute a standard, specification, or regulation. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of information exchange. The U.S. government assumes no liability for the contents or use thereof.

EXECUTIVE SUMMARY

The Road Safety Audit (RSA) at three intersections along Quaker Church Road in Randolph Township, Morris County, was chosen as a result of the 2015 North Jersey Transportation Planning Authority (NJTPA) network screening of crashes on county and municipal roadways. The Network Screening ranking was created utilizing the data base in Plan4Safety of the New Jersey Department of Transportation, developed and maintained by the Rutgers Transportation Safety Resource Center. The crashes were weighted according to severity. The list of the intersection rankings placed Millbrook Avenue at number one, Center Grove Road at number three and South Morris Street at number ten in Morris County. The RSA process helped to identify safety issues, evaluate risks and suggest countermeasures. This document is the final report for the RSA conducted in Randolph Township on June 30, 2015. The result, detailed in this report, is a summary of the three intersection's safety history from 2011–2013 and a list of recommended improvements that were created by the RSA team.

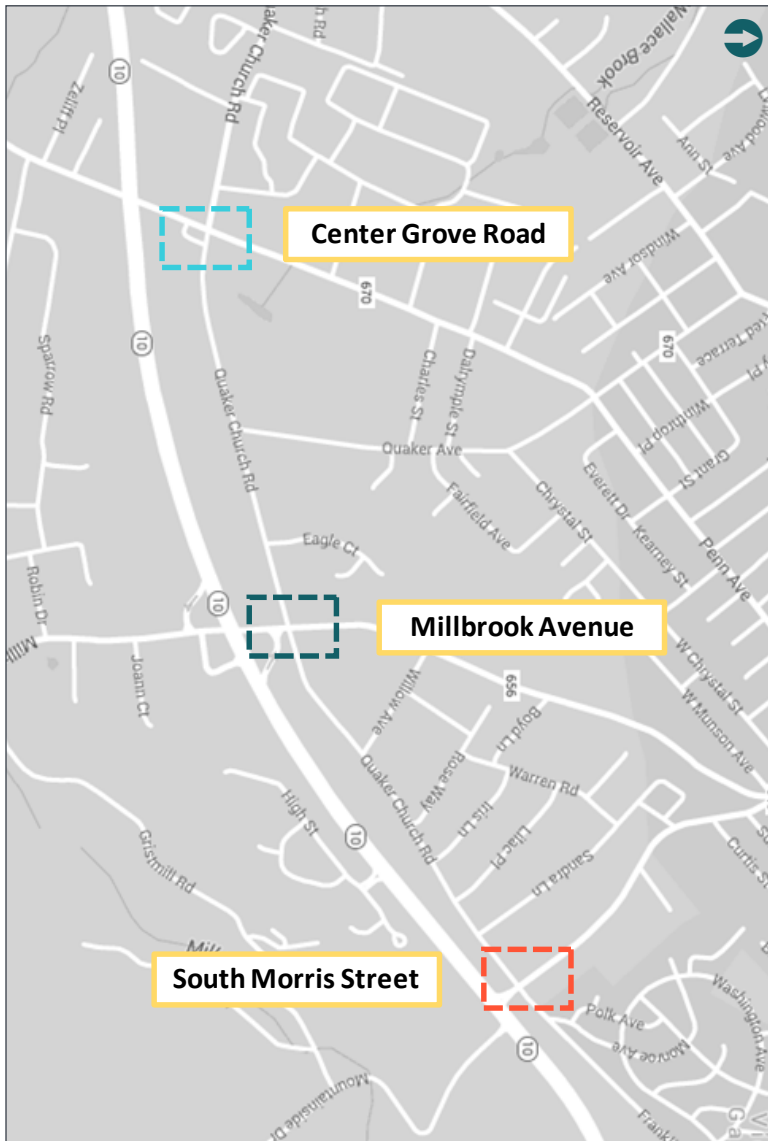
Quaker Church Road is a heavily traveled east–west roadway, an Urban Local. It is located to the north of Route 10, parallels it closely, and is significantly influenced by Route 10 congestion, as people use it as an alternative route. The three intersecting roadways—Center Grove Road, Millbrook Avenue and South Morris Street—are important north–south Urban Minor Arterial roadways. The cross section of the Quaker Church Road and the intersecting roadways is two lane, with some left-turn lanes. Most of the corridor along Quaker Church Road in the area of the RSA has no shoulders nor sidewalks; there are sidewalks at the intersection of Center Grove Road, none at Millbrook Avenue. On the south side of South Morris Street, there is a short length of sidewalk with no connectivity. The speed limit is 35 mph, while the intersecting roadways vary between 30-40 mph.

The intersection with Center Grove Road is signalized and consists of small businesses and apartment complexes, with a need for an improved pedestrian environment. The other intersections are partially stop controlled and predominantly residential. The community college is at the intersection of Route 10 and Center Grove Road and heavily influences congestion in the area. There is one NJ Transit bus that crosses the intersection of Center Grove Road. The Center Grove Road intersection has pedestrian facilities.

Although there are no pedestrian facilities at Millbrook Avenue and South Morris Street, there were no pedestrian crashes in the data set. There is an interest in improving pedestrian facilities and, while Randolph Township has a complete streets policy, it is understood that attention to pedestrian amenities will be a long-term objective. The majority of the crashes were right-turn and left-turn crashes. The short and medium term RSA recommendations focus on improving intersection safety by bringing more awareness to the intersections, and conveying clear information to the drivers about how the intersections are meant to function. A longer-term recommendation is a major geometric improvement to Millbrook Avenue, such as a roundabout, which would require the support of the NJDOT. The other long-term project would be the construction of sidewalks along the corridor.

>> 1.0 CORRIDOR DESCRIPTION AND ANALYSIS

1.1 SITE SELECTION



The intersection of Millbrook Avenue ranked number one in Morris County in the NJTPA 2015 network screening, which weights the crashes according to severity. The other two intersections, Center Grove Road and South Morris Street, also ranked within the top ten intersections in Morris County.

Figure 1 – Identified Priority High Crash Locations

Symbol	Safety Focus	NJTPA Ranking	County Ranking
	Intersection (Millbrook Avenue)	57	1
	Intersection (Center Grove Road)	120	3
	Intersection (South Morris Street)	420	10

Figure 2 – Network Screening Rankings 2011-2013

1.2 TRAFFIC VOLUMES

The traffic volumes were counted in 2015 in four locations along the corridor, including the three intersections. The volumes were between 3,000 and 5,000 in each direction. In comparison, the volumes on Route 10 were between 22,000 and 23,000 vehicles per day in each direction (2013). Route 10 volume significantly affects Quaker Church Road and the three intersecting roadways. See the map of traffic volumes in Appendix B.

1.3 TRANSIT SERVICE

There is one bus that traverses one of the RSA intersections. The NJ Transit #875 travels along Quaker Church Road west of the Center Grove intersection and travels north along Center Grove Road. There is no bus service at the other two intersections. (See Appendix B for the Transit Map)

1.4 AREA CHARACTERISTICS

Quaker Church Road is an Urban Local road that runs east-west and parallels Route 10, which is about one-tenth of a mile to the south. The three intersections in the Road Safety Audit (RSA) all have access to/from Route 10 and are significantly affected by Route 10 congestion. The RSA intersections are under Morris County jurisdiction. Quaker Church Road is a municipal roadway, and the three cross streets are county roads.

The roadway is primarily residential with a few businesses at the intersections. The environment is rural/suburban. As reflected in the crash data, there is minimal pedestrian and bicycle activity. Most of the corridor along Quaker Church Road in the area of the RSA has no shoulders nor sidewalks; there are sidewalks at the intersection of Center Grove Road, none at Millbrook Avenue, and a short length of sidewalk (with no connectivity) on the south side of South Morris Street. There is construction of a senior residence complex between Center Grove Road and Millbrook Avenue, on the south side of Quaker Church Road, that is due to open this fall. In addition, a shopping center has been approved close to the senior center. Both of these developments will significantly impact traffic volume on Quaker Church Road.

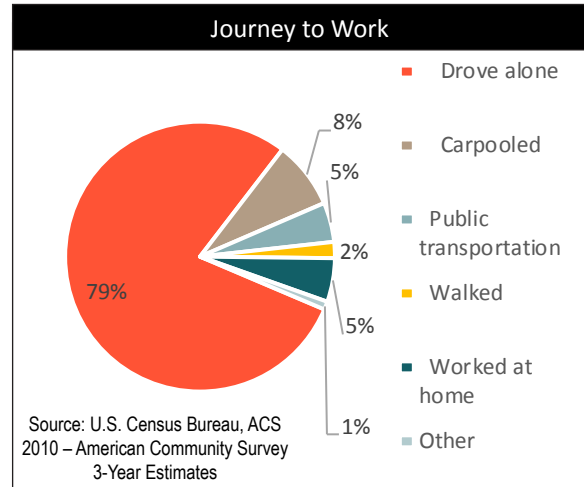


Figure 3 – Journey to Work

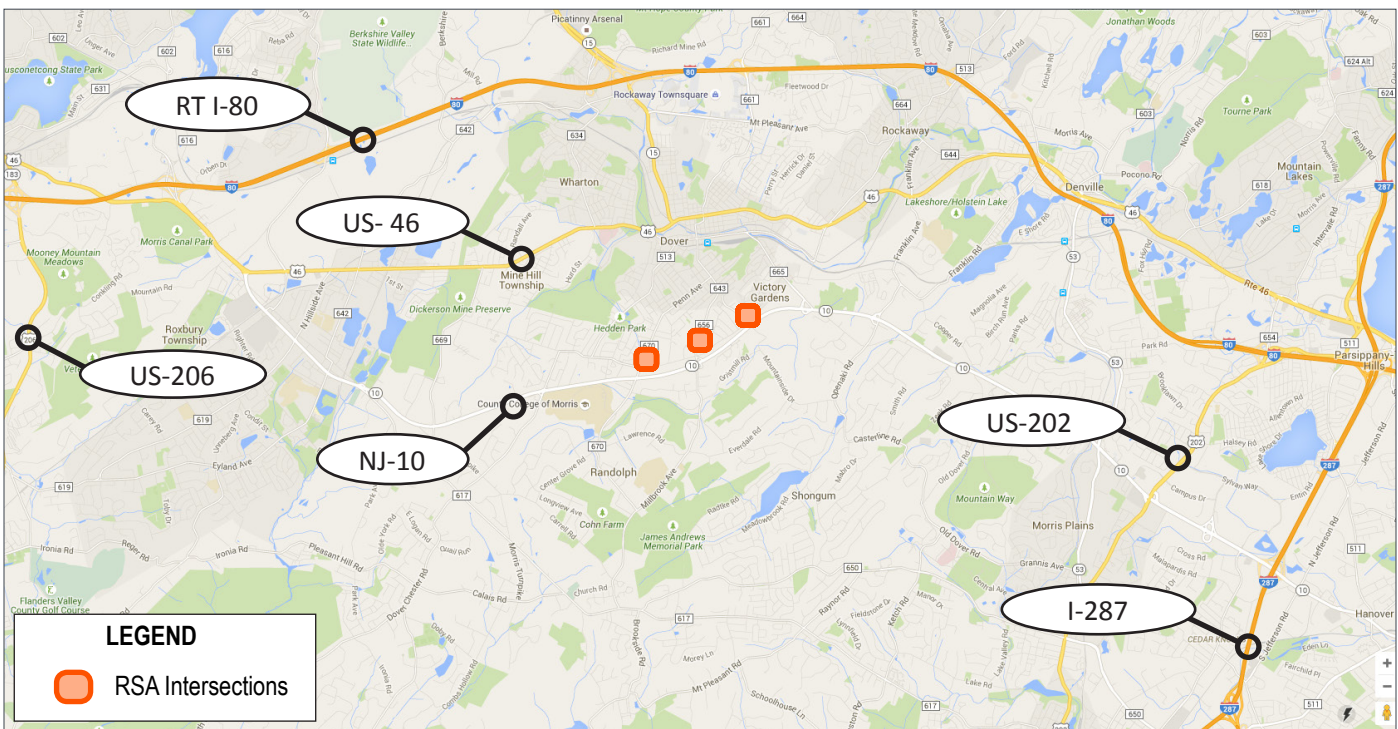


Figure 4 – Location of RSA in region

1.5 RSA CRASHES

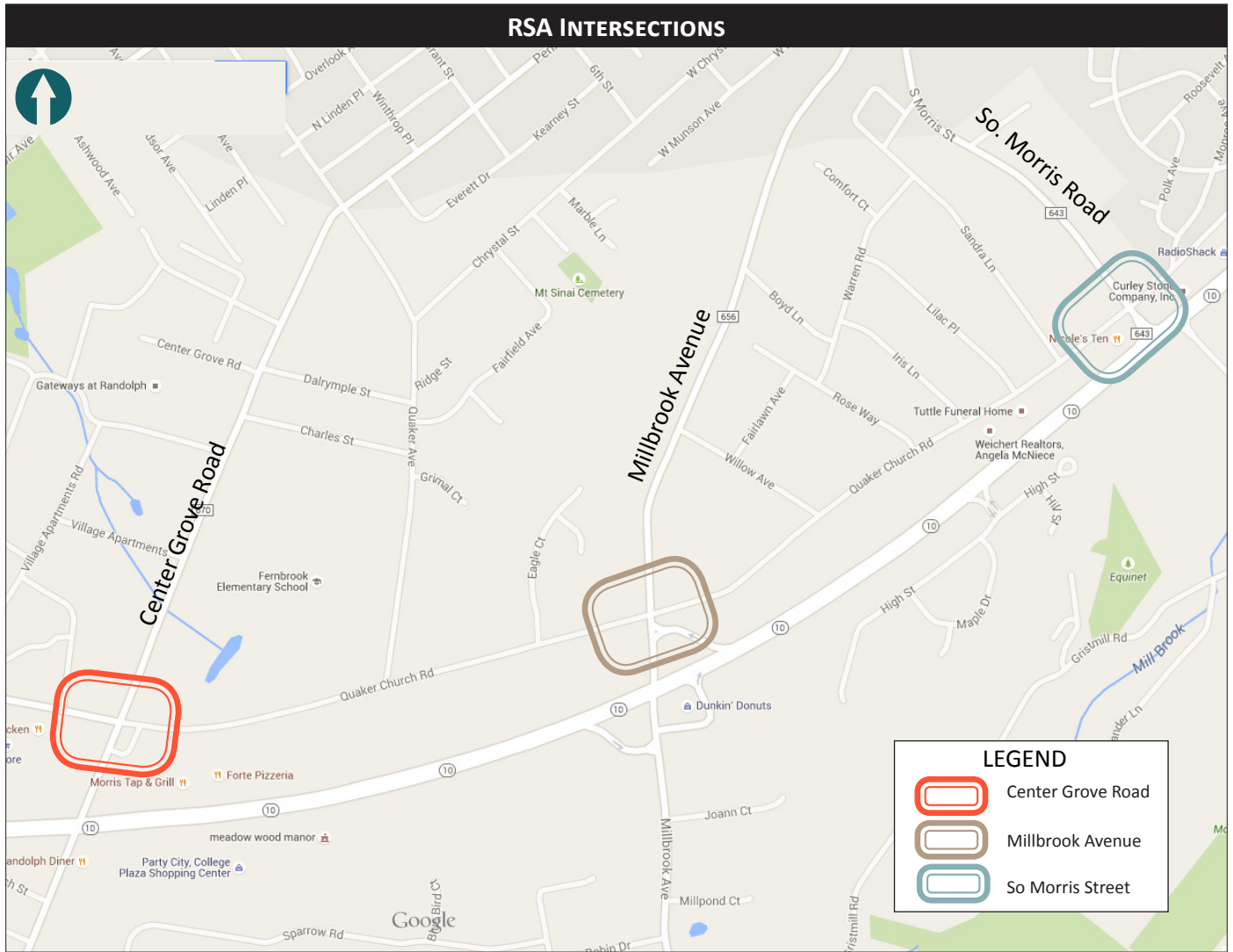


Figure 5 – Location of RSA intersections

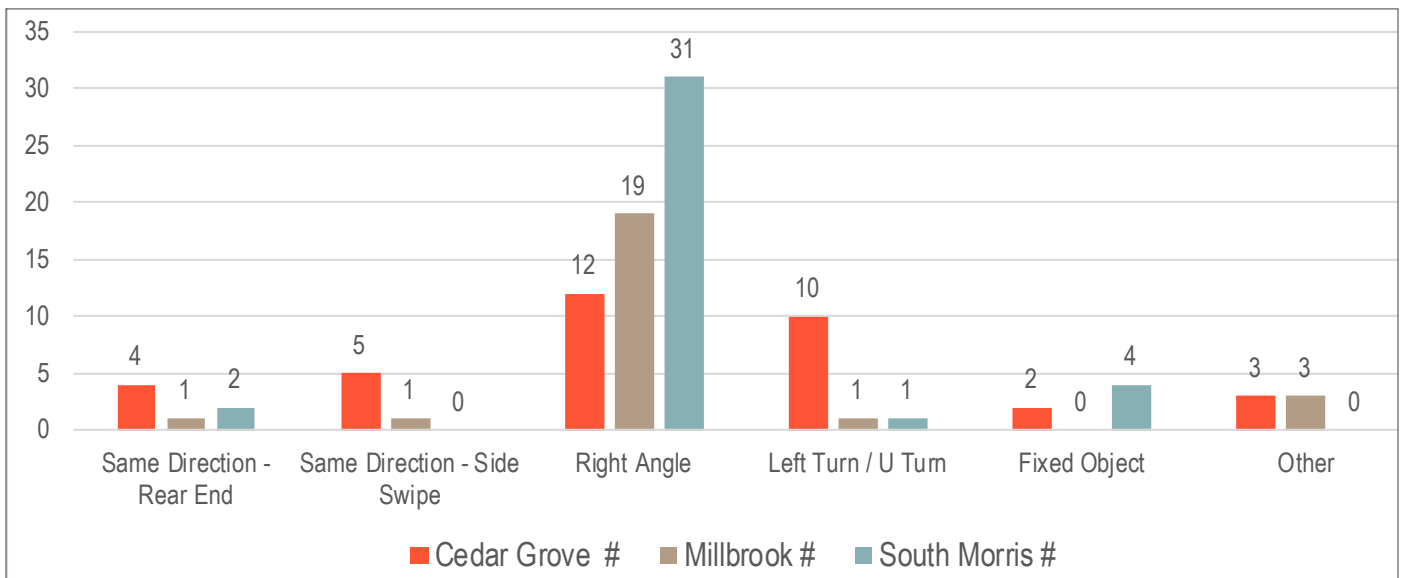


Figure 6 – Crash Type by Intersection

1.6 INTERSECTION CHARACTERISTICS



Figure 7 – Intersection with Center Grove Road

Center Grove Road:

- Center Grove Road—two lanes in each direction
- Quaker Church Road—one through-lane in each direction
- Signalized intersection
- No shoulders
- Some sidewalks
- Marked crosswalks across Quaker Church Road
- Actuated pedestrian push buttons across Center Grove
- Multiple apartment complexes on west side of Center Grove Road
- Center Grove Road is a main school bus route

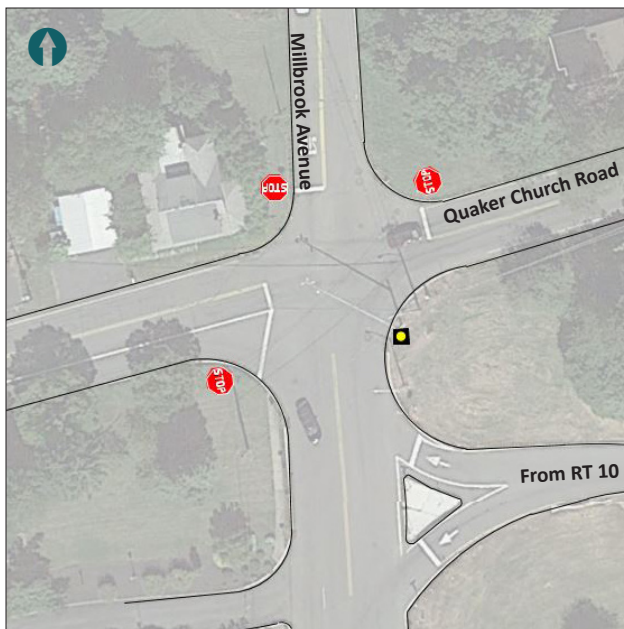


Figure 8 – Intersection with Millbrook Avenue

Millbrook Avenue:

- Millbrook Avenue—one lane in each direction
- Quaker Church Road—one through-lane in each direction
- Stop controlled on Quaker Church Road
- Amber flashing light on Millbrook Avenue
- No shoulders
- Partial sidewalks
- No marked crosswalks
- Exit from Rt. 10 is less than 50 feet south of the intersection



Figure 9 – Intersection with South Morris Street

South Morris Street

- South Morris Street—one lane in each direction
- Quaker Church Road / Franklin Road—one through-lane in each direction
- Stop controlled on Quaker Church Road
- Stop controlled southbound So. Morris Street
- Amber flashing light on northbound South Morris Street
- No shoulders
- No sidewalks
- No marked crosswalks
- South leg of intersection is access to/from Rt. 10

>> 2.0 CRASH FINDINGS—CENTER GROVE ROAD

2.1 TEMPORAL TRENDS 36 CRASHES IN THREE YEARS

The following charts compare the Center Grove Road crashes to Morris County crashes during 2011–2013, to give a frame of reference. In terms of the time of day, crashes were overrepresented from 6–8 p.m. Crashes occurred more frequently on Fridays, and crashes occurred more frequently during the month of January. The crash frequency decreased in 2012 and 2013.

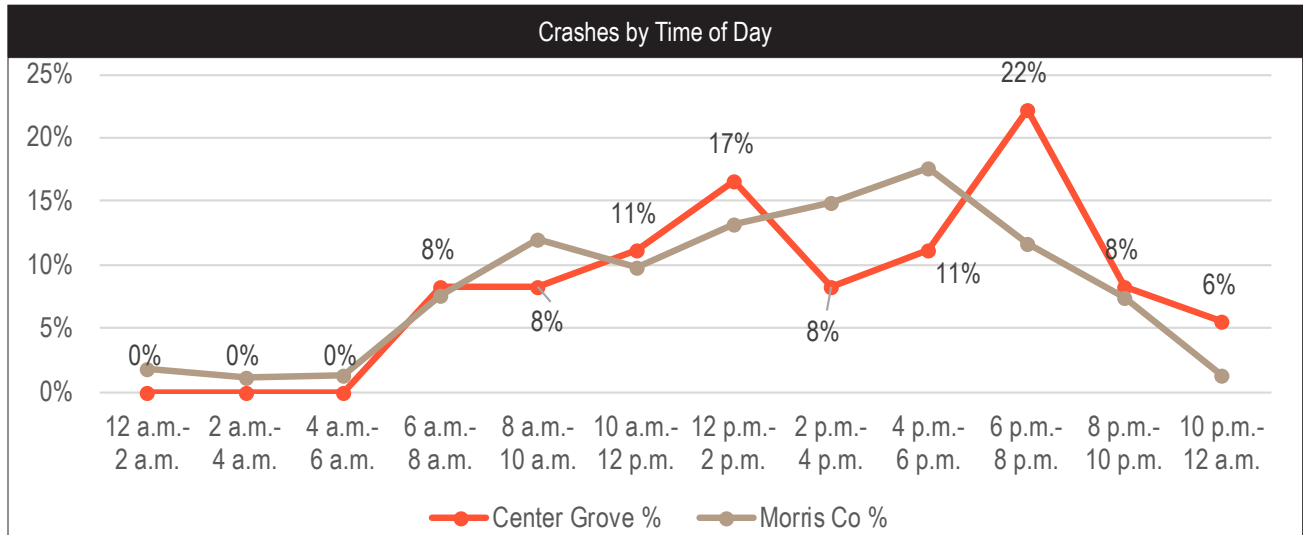


Figure 11 – Crashes by Time of Day

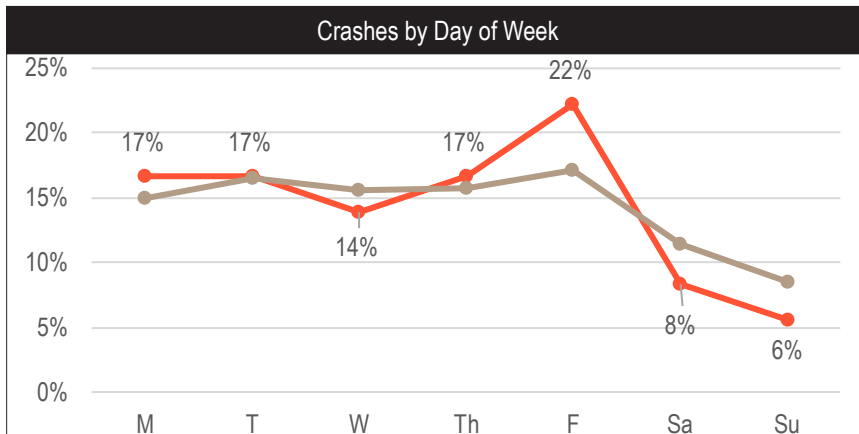


Figure 12 – Crashes by Day of Week

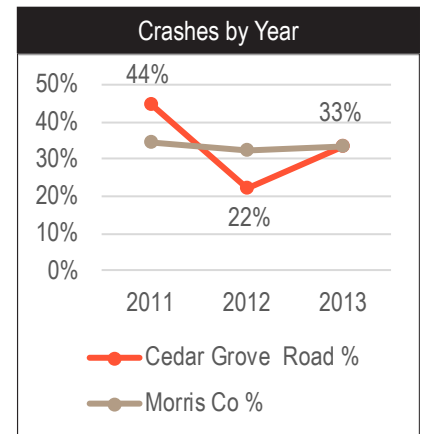


Figure 13 – Crashes by Year

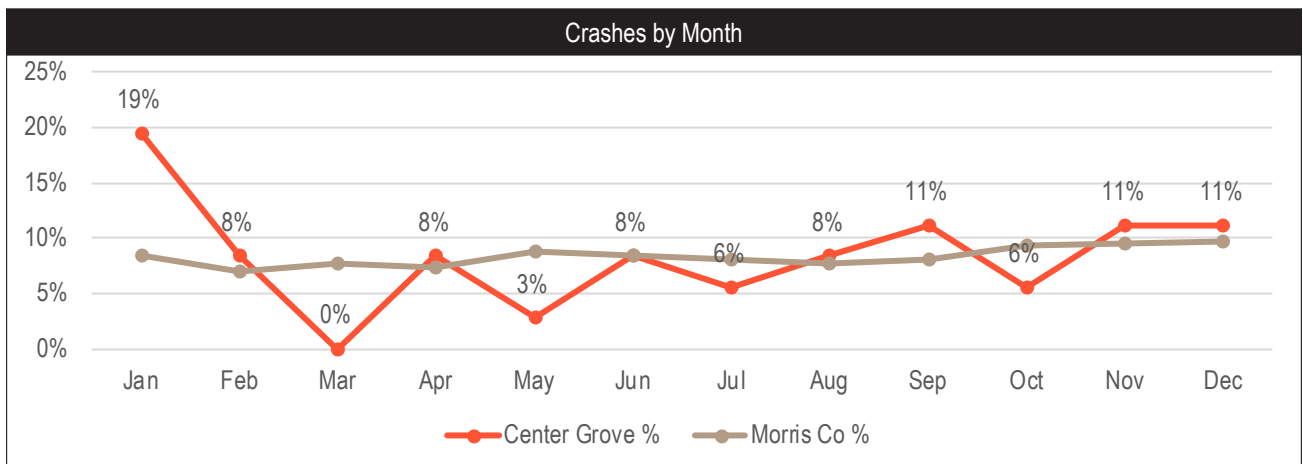


Figure 14 – Crashes by Month

2.2 CRASH TYPE AND SEVERITY

The predominant crash types are right-angle and left-turn crashes. They are both significantly overrepresented when compared to Morris County during the same time period. There were no pedestrian nor bicycle crashes.

(Many of the right-angle crashes had been coded incorrectly, and were reassigned as left-turn crashes for analysis).

Crash Type	Cedar Grove #	Cedar Grove %	Morris Co %
Same Direction - Rear End	4	11%	31%
Same Direction - Side Swipe	5	14%	12%
Right Angle	12	33%	11%
Opposite Direction - Head On/Angular	0	0%	2%
Opposite Direction - Side Swipe	1	3%	1%
Left Turn / U Turn	10	28%	1%
Backing	0	0%	9%
Fixed Object	2	6%	13%
Non-fixed Object	1	3%	2%
Other	1	3%	18%
TOTAL	36	100%	100%

Figure 15 – Crash Type compared to Morris County

Severity	Cedar Grove #	Cedar Grove %	Morris Co %
Fatal	-	-	-
Incapacitated	-	-	-
Moderate Injury	2	6%	3%
Complaint of Pain	10	28%	15%
Property Damage Only	24	67%	81%

The two moderate injuries were both right-angle crashes. In one of them, the westbound vehicle went through the intersection on an amber light. The southbound vehicle crashed and overturned. In the second crash, the southbound vehicle went through a red light.

Figure 16 – Severity compared to Morris County

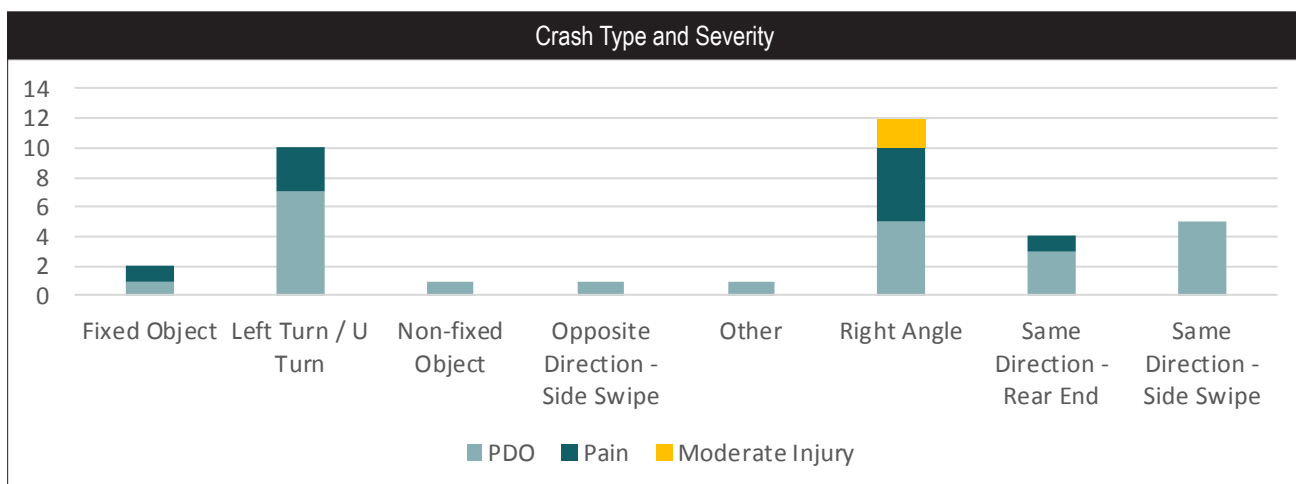


Figure 17 – Crash type vs. severity

>> 3.0 CRASH FINDINGS—MILLBROOK AVENUE

3.1 TEMPORAL TRENDS 25 CRASHES IN THREE YEARS

The following charts compare the Millbrook Avenue crashes to Morris County crashes during 2011–2013, to give a frame of reference. In terms of the time of day, crashes between 4–6 pm were most frequent, similar to Morris County. There was no obvious pattern for day of the week; crashes occurred more frequently during, May, June, September and November. Crashes decreased in 2012 and then increased in 2013.

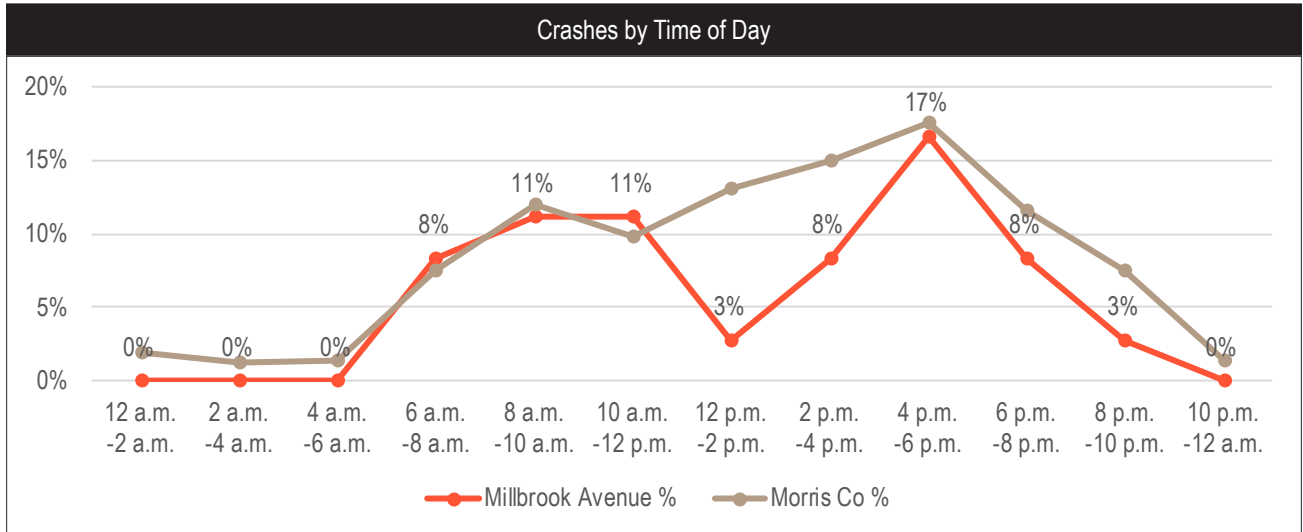


Figure 18 – Crashes by Time of Day

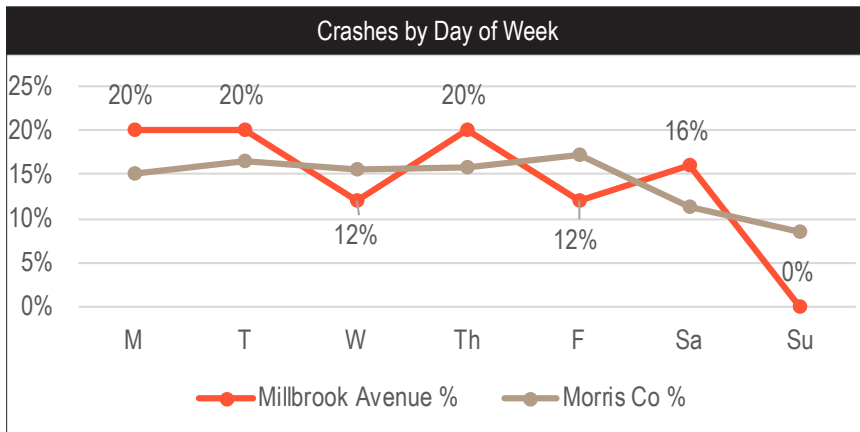


Figure 19 – Crashes by Day of Week

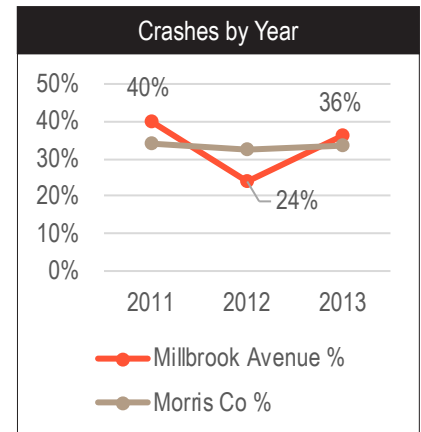


Figure 20 – Crashes by Year

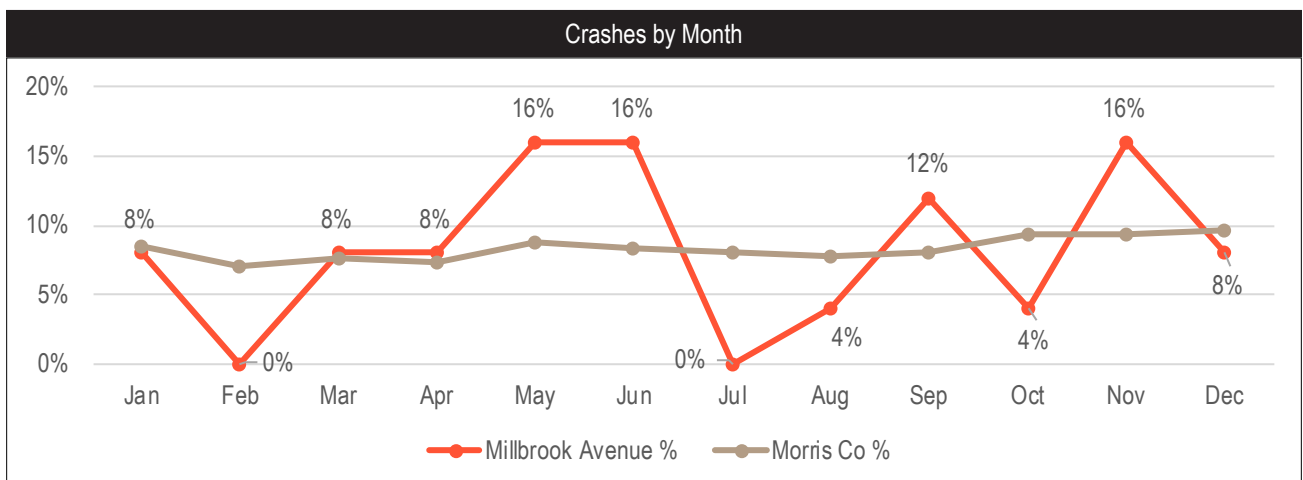


Figure 21 – Crashes by Month

3.2 CRASH TYPE AND SEVERITY

The predominant crash type is the right-angle crash, and they are significantly overrepresented when compared to Morris County during the same time period. There were no pedestrian nor bicycle crashes.

Crash Type	Millbrook Ave. #	Millbrook Ave. %	Morris Co %
Same Direction - Rear End	1	4%	31%
Same Direction - Side Swipe	1	4%	12%
Right Angle	19	76%	11%
Opposite Direction - Head On/Angular	1	4%	2%
Opposite Direction - Side Swipe	2	8%	1%
Left Turn / U Turn	1	4%	1%
Backing	0	0%	9%
Fixed Object	0	0%	13%
Non-fixed Object	0	0%	2%
Other	0	0%	18%
TOTAL	25	100%	100%

Figure 22 – Crash Type compared to Morris County

Severity	Millbrook Ave. #	Millbrook Ave. %	Morris Co %
Fatal	-	-	-
Incapacitated	-	-	-
Moderate Injury	3	12%	3%
Complaint of Pain	7	28%	15%
Property Damage Only	15	60%	81%

The three moderate injury crashes were all right-angle crashes. In two of the crashes, after stopping at the stop sign going eastbound, the vehicle didn't yield to the northbound vehicle. In the third crash, the eastbound vehicle didn't stop at the stop sign.

Figure 23 – Severity compared to Morris County

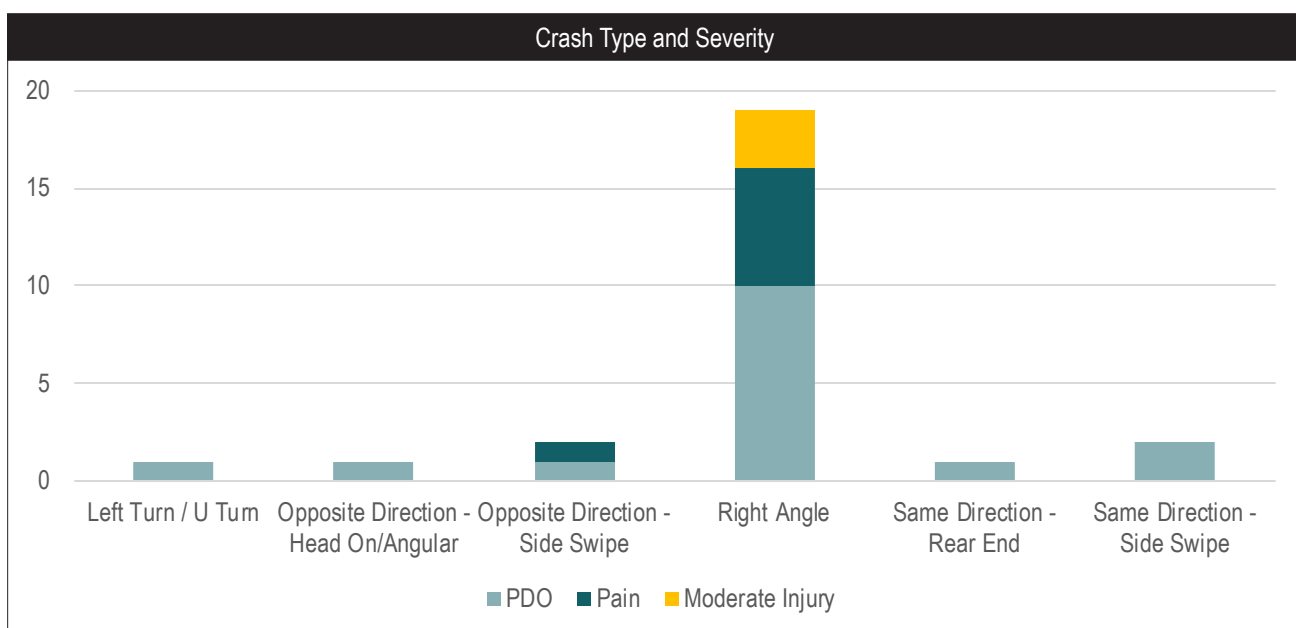


Figure 24 – Crash type vs. severity

>> 4.0 CRASH FINDINGS – SOUTH MORRIS STREET

4.1 TEMPORAL TRENDS 38 CRASHES IN THREE YEARS

The following charts compare the South Morris Street crashes to the Morris County crashes during 2011–2013 in order to give a frame of reference. In terms of the time of day, crashes between 6–8 p.m. were most frequent. Crashes occurred more frequently on Fridays and there was no obvious pattern for the month in which crashes occurred. Crashes decreased in 2013.

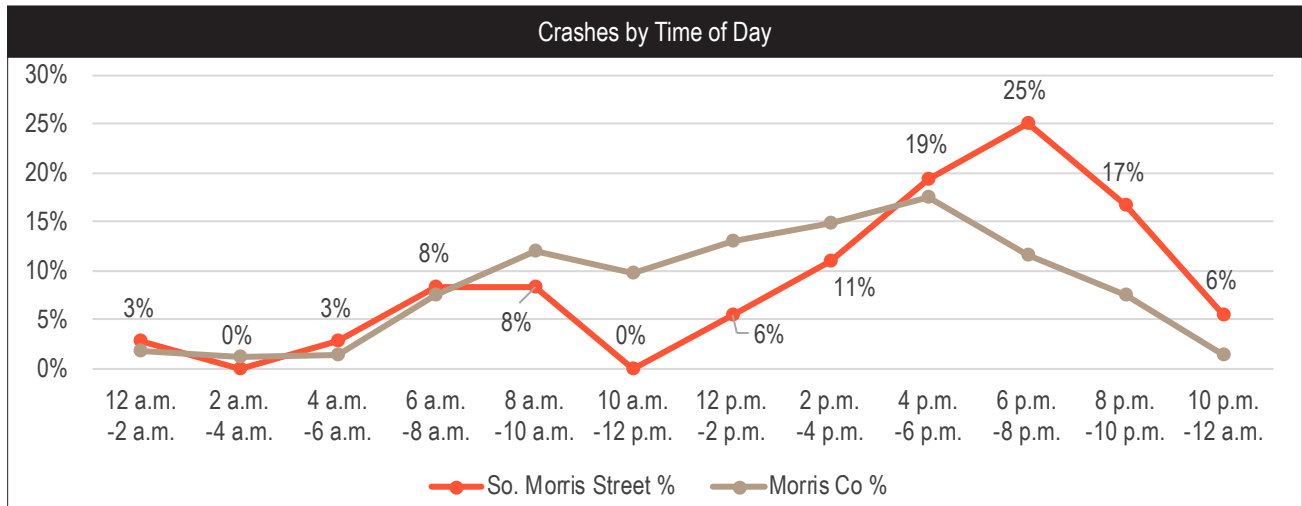


Figure 25 – Crashes by Time of Day

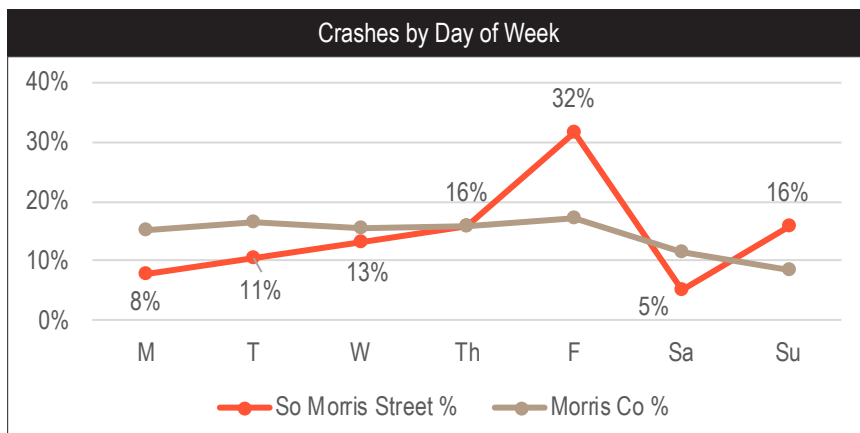


Figure 26 – Crashes by Day of Week

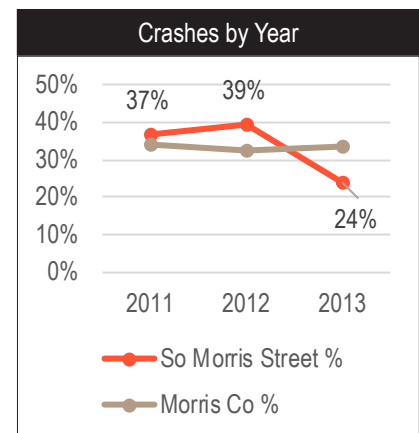


Figure 27 – Crashes by Year

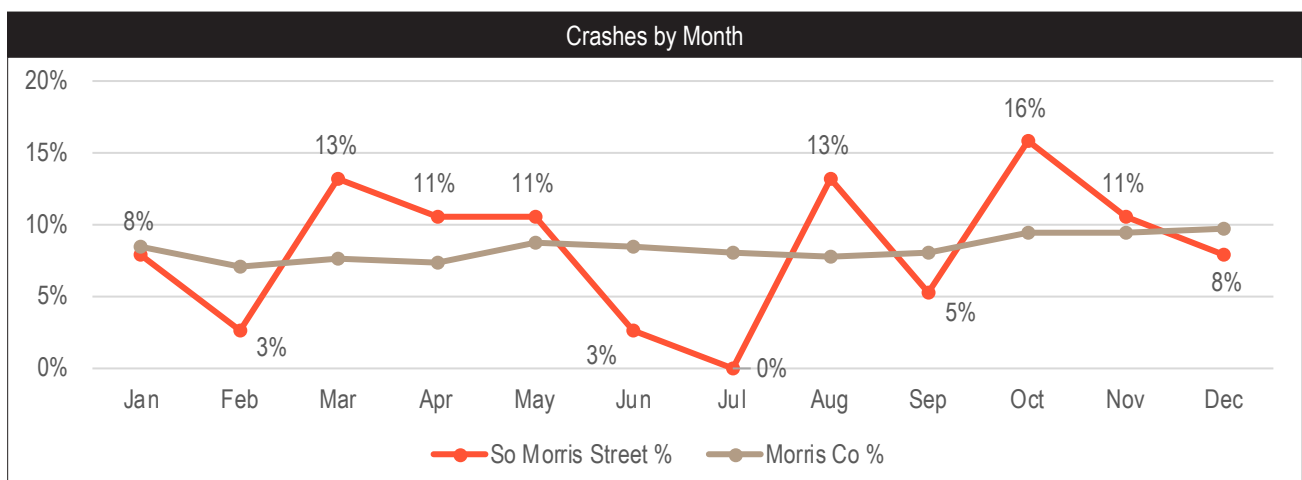


Figure 28 – Crashes by Month

4.2 CRASH TYPE AND SEVERITY

The predominant crash type is right angle, and they are significantly overrepresented when compared to Morris County during the same time period. There were no pedestrian nor bicycle crashes.

Although there were fewer right-angle crashes at Center Grove and Millbrook (12 and 19 respectively), they resulted in fewer injuries and therefore the intersection was not ranked as high as the others.

Crash Type	South Morris #	South Morris %	Morris Co %
Same Direction - Rear End	2	5%	31%
Same Direction - Side Swipe	-	-	12%
Right Angle	31	82%	11%
Opposite Direction - Head On/Angular	-	-	2%
Opposite Direction - Side Swipe	-	-	1%
Left Turn / U Turn	1	3%	1%
Backing	-	-	9%
Fixed Object	4	11%	13%
Non-fixed Object	-	-	2%
Other	-	-	18%
TOTAL	38	100%	100%

Figure 29 – Crash Type compared to Morris County

Severity	South Morris #	South Morris %	Morris Co %
Fatal	-	-	-
Incapacitated	-	-	-
Moderate Injury	4	11%	3%
Complaint of Pain	10	26%	15%
Property Damage Only	24	63%	81%

Figure 30 – Severity compared to Morris County

Of the four moderate injury crashes, two were right angle, one left-turn crash and one fixed object crash (no explanation given).

One of the right-angle crashes didn't notice the stop sign on Franklin Road and crashed into a vehicle coming off the Route 10 ramp. The second right-angle crash occurred when a westbound vehicle didn't have enough time to cross the intersection.

The left-turn crash appeared to be caused by driver confusion of the stop control.

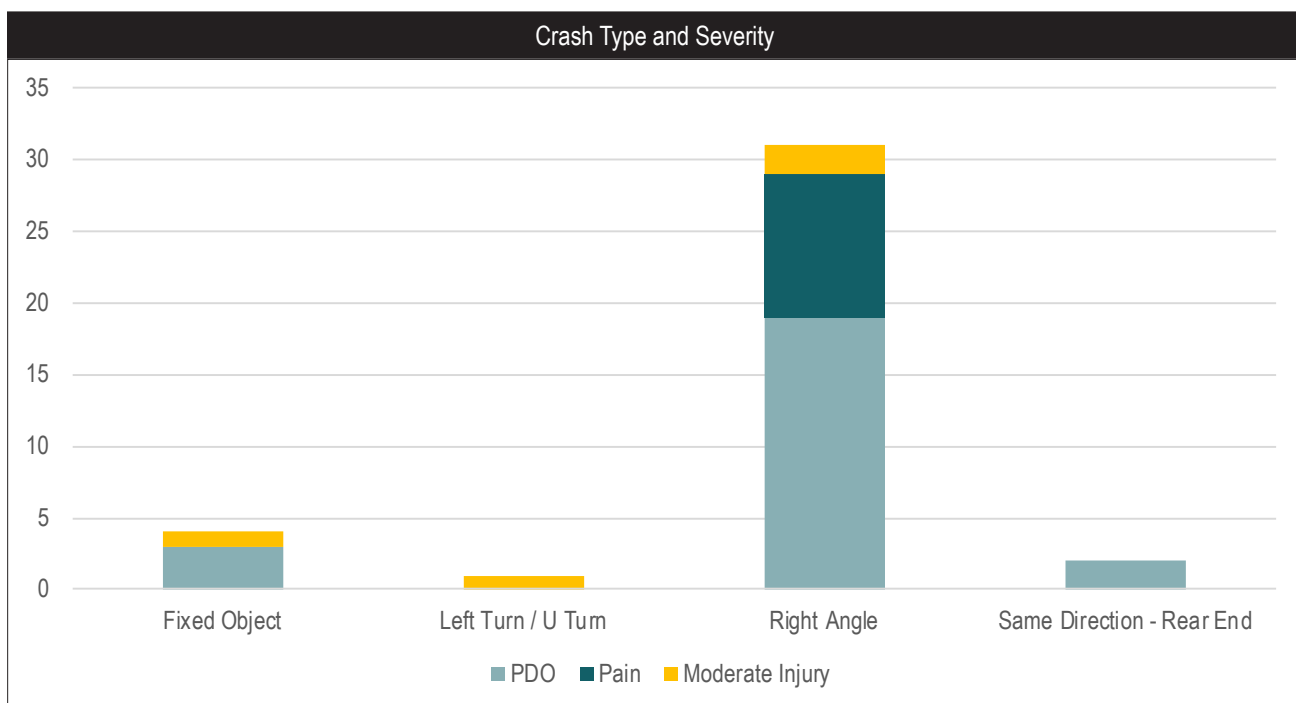


Figure 31 – Crash type vs. severity

>> 5.0 IDENTIFIED ISSUES

5.1 CENTER GROVE ROAD

Ref #	Issues List
Traffic Operations	
1	A heavy volume of cut-through traffic is generated from Route 10 congestion.
2	Hills on Quaker Church Road may contribute to speeding.
3	The skewed intersection may increase driver confusion.
4	There is a high frequency of right-angle and left-turn crashes.
5	The two lanes of northbound traffic merge just north of the intersection
Signage	
6	There are contradictory “No Turn on Red” signs.
7	Height of signs is not optimal.
8	Many signs are lacking retroreflectivity.
9	Some signs do not have breakaway posts.
Visibility	
10	The visibility of westbound vehicles is compromised by landscaping and by the Bank of America sign.
11	The vertical curve for southbound Center Grove Road reduces visibility.
12	Pedestrian signal heads are not clearly visible.
13	Visibility for left turning vehicles on all legs is reduced, due to the shadow effect.
Pedestrians	
14	Lack of ADA facilities (e.g., curb ramps and truncated domes)
15	Pedestrian push buttons are misaligned—it is not clear which roadway they are for.
16	Sidewalk is deteriorating, creating tripping hazards.
17	No marked crosswalks across Center Grove Road
18	No sidewalk on the southwest corner, adjacent to the bank
19	Inadequate number of pedestrian signal heads
Traffic Signal	
20	The signal heads facing Quaker Church Road are 8” and not readily visible.
21	Southbound traffic signal lenses are off color.
22	There are insufficient traffic signal heads for optimal operation, and their placement is not standard.
23	The close proximity between the signals at Rt. 10 and Quaker Church Road may confuse southbound drivers.
Pavement Condition	
24	Quaker Church Road near Bank of America is in poor condition.

ISSUE VISUALS - CENTER GROVE ROAD



Figure 32 – Many right-angle and left-turn crashes



Figure 33 – Sidewalks are in poor condition



Figure 34 – No indication of which roadway this governs



Figure 35 – Pavement and markings in poor condition



Figure 36 – Vertical curve may affect intersection visibility

5.2 MILLBROOK AVENUE

Ref #	Issues List
Traffic Operations	
1	The skewed intersection creates issues with sight lines and operations.
2	Northbound, the south leg is wide enough for two lanes, but not demarcated; the north leg has room for one lane only.
3	Southbound, there is an unmarked merge on the south leg.
4	The three-way stop control is ambiguous, creating confusion among drivers.
5	Traffic backs up from Route 10 and creates confusion at the intersection, as to who has the right of way
6	When drivers intend to turn left onto Quaker Church Road, after exiting from the Route 10 ramp, they often travel in a diagonal direction (instead of making a right turn/left turn movement) and roll through the stop sign at the end of the ramp.
7	The short stretch of roadway between Quaker Church Road and Route 10 includes a lot of activity, stimulation, and distraction.
8	The roadway is very wide at the eastbound approach of Quaker Church Road
Signage	
9	Stop signs are not the optimal height and some are tilted.
10	Sign layout and use of bright sticks is inconsistent.
11	Traffic coming off the Route 10 ramp often ignores the stop sign.
Visibility	
12	Roadway lighting may be insufficient.
13	The flashers have 8" heads and are not clearly visible.
14	The sight distance on the northwest corner limits visibility for eastbound and southbound vehicles.
15	The vertical curve on southbound Millbrook Avenue may affect sight distance.
16	Vegetation between the Route 10 ramp and Quaker Church Road limits visibility.
Pedestrians	
17	There are no pedestrian amenities; safety issues are exacerbated by the lack of shoulders and the steep slope adjacent to the curb.
Pavement Conditions and Pavement Markings	
18	The stop bar on eastbound Quaker Church Road is faded.
Other	
19	Neglected, old signal foundation with wires creates hazard (located on the southwest corner).
20	Inlets do not have bicycle-safe grates.

ISSUE VISUALS - MILLBROOK AVENUE



Figure 37 – Vehicles from ramp shoot straight across to Quaker Church westbound



Figure 38 – Poor visibility on northwest corner

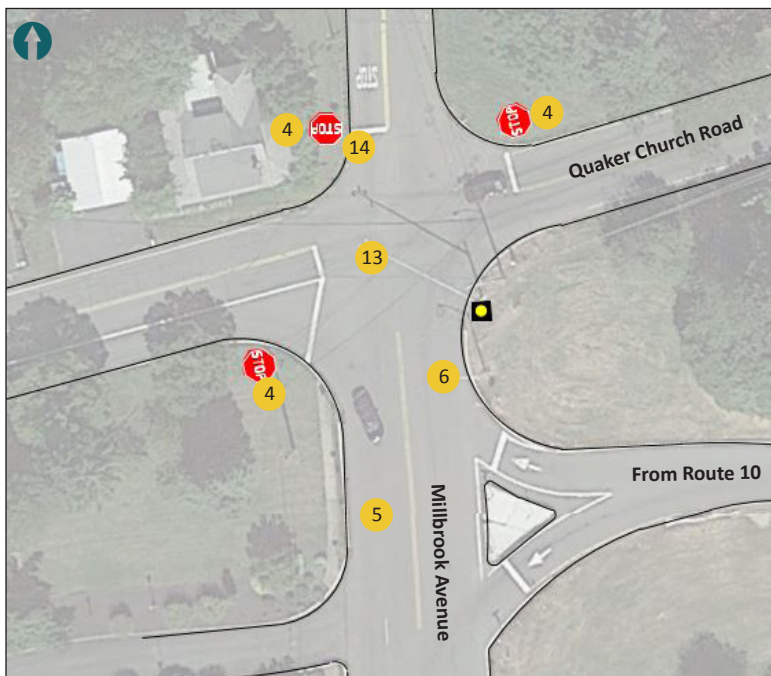


Figure 39 – 3-way stop is confusing for drivers



Figure 40 – Flashers are small and not clearly visible



Figure 41 – Traffic backs up from the Rt. 10 intersection

5.3 SOUTH MORRIS STREET

Ref #	Issues List
Traffic Operations	
1	Wide cross section along South Morris Street encourages speeding.
2	Traffic exiting from Route 10 approaches the intersection a high speed, unexpected by drivers at the intersection.
3	Southbound vehicles turning left onto Franklin often cut the corner and encroach on the westbound lane.
Signage	
4	Stop sign on Franklin Road is small.
5	Stop control visibility on Franklin is compromised by vegetation, large trees, and vertical curve.
6	The southbound approach has limited visibility of speeding traffic exiting from Route 10.
7	There are no speed limit signs, especially for traffic coming off the Route 10 ramp.
Visibility	
8	The 8" flashers are hard to see, especially with the configuration of the flasher arms.
9	Lighting may be inadequate.
10	The sight triangle at the northeast corner offers insufficient visibility for westbound and southbound vehicles.
11	Visibility of the stop sign on Franklin is limited by vegetation, large trees, and the vertical curve.
12	The vertical curve on South Morris Street and Franklin Road may affect visibility of the intersection.
Pedestrians	
13	There are no pedestrian amenities; safety issues are exacerbated by the lack of shoulders and the steep slope adjacent to the curb.

5.4 ALL RSA INTERSECTIONS

Ref #	Issues List
Traffic Operations	
1	There is heavy volume of cut through traffic generated from Route 10 congestion.
2	Vehicles back up to the RSA intersections from traffic waiting at Route 10

ISSUE VISUALS - SOUTH MORRIS STREET



Figure 42 – High speed coming off Route 10



Figure 43 – Vertical curves may affect visibility



Figure 44 – Poor visibility on eastbound approach



Figure 45 – Visibility of flashers is limited



Figure 46 – Encroaching vehicles due to poor sight triangle

>> 6.0 RECOMMENDATIONS

6.1 ALL RSA INTERSECTIONS

Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
	Location					
	Traffic Operations					
1	Conduct formal traffic analysis, including the traffic patterns for the college access and cut-through traffic from Route 10	Medium	Medium	\$\$	Morris Co.	*CG-1
	Visibility					
2	Professional staff should conduct a formal engineering review of existing lighting conditions to evaluate where lighting can be enhanced.	Medium/High	Medium	\$\$	Morris Co.	*M-11, *SM-11
	Pavement Markings					
3	Refresh all faded pavement markings	Medium	Short	\$	Morris Co.	

* CG=Center Grove Road; M=Millbrook Avenue; SM=South Morris Street

6.2 CENTER GROVE ROAD

Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
	Traffic Operations					
1	Consider implementing a road diet on Center Grove Road.	High	Short	\$	Morris Co.	2, 3, 4
2	Implement split phasing on Center Grove Road to decrease left-turn conflicts.	High	Medium/Long	\$\$	Morris Co.	4
3	Install head-to-head left-turn lanes with lead left-turn signal.	High	Medium	\$	Morris Co.	3, 4
4	For northbound traffic, the merge to one lane of travel should occur prior to the intersection.	Medium/High	Short	\$	Morris Co.	5
	Traffic Signal					
5	Consider a full signal upgrade including 12" heads and traffic signals over each lane.	High	Long	\$\$\$	Morris Co.	3, 20, 21, 22
6	Install back plates with retroreflective borders on all signal heads.	Medium	Short	\$	Morris Co.	20, 22
7	Evaluate the placement of signal heads in relation to the traffic signal on Route 10 to avoid confusion between them.	Medium	Long	\$\$	Morris Co.	23
	Pedestrians					
8	Install marked crosswalks across Center Grove Road.	Medium	Short	\$	Morris Co.	17
9	Upgrade all pedestrian facilities to be ADA compliant.	Medium/Low	Medium	\$\$	Morris Co.	12, 14, 19
10	Clearly specify that the pedestrian push buttons are for the crossing of Center Grove Road, and correctly orient the push buttons.	Medium/Low	Short	\$	Morris Co.	15
11	Replace all broken sidewalks.	Medium	Medium	\$\$	Randolph Twp.	16
12	Install sidewalk on Center Grove Road and Quaker Church Road along Bank of America property.	Medium/Low	Long	\$\$	Randolph Twp.	18
	Signage					
13	Review all sign content , including the "NO TURN ON RED" signs.	Medium	Short	\$	Morris Co.	6
14	Replace signs that are undersized, not the proper height, lack retroreflectivity, or lack breakaway posts.	Medium	Medium/Short	\$	Morris Co.	7, 8, 9

6.2 CENTER GROVE ROAD (CONTINUED)

Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
	Visibility					
15	Trim vegetation and modify location of Bank of America sign to improve the sight triangle	Medium/Low	Short	\$	Randolph Twp.	10
	Pavement Conditions					
16	Replace pavement that is in poor condition	Medium/Low	Medium	\$\$	Morris Co.	24

6.3 MILLBROOK AVENUE

Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
	Traffic Operations					
1	Consider creating a left-turn lane on the southern leg.	Medium/High	Short	\$	Morris Co.	2
2	Consider shifting the receiving lane of northbound Millbrook to the east, creating one clearly delineated lane.	Medium	Short	\$	Morris Co.	2
3	Add head-to-head left turns on Millbrook Avenue (if acquiring property on the northwest corner).	Medium/High	Long	\$\$	Morris Co.	1
4	Evaluate the possibility of constructing a roundabout.	High	Long	\$\$\$	Morris Co.	1, 4, 5, 6, 7
5	Construct island on eastbound approach to better channelize traffic, and locate stop sign closer to the stop bar.	Medium/High	Medium	\$\$	Morris Co.	8
6	Consider initiating a conversation with NJDOT regarding the feasibility of the following alternatives: (a) closing right turn from Route 10 slip ramp; or (b) reconfiguring jughandle geometry, possibly using area between ramp and Quaker Church Road; (c) squaring off ramp to construct clear right and left turns; or (d) consider signaling the intersection in connection with Route 10.	High	Long	\$\$\$	NJ DOT with Morris Co.	1, 6, 7
	Pedestrians					
7	Install ADA-compliant pedestrian facilities.	Medium/Low	Long	\$\$	Morris Co.	17
8	Install sidewalks.	Medium/Low	Long	\$\$\$	Randolph Twp.	17
	Signage					
9	Replace stop signs with consistent layout; install additional left-side sign, bright sticks, and "stop ahead" sign.	Medium/High	Short	\$	Morris Co.	9, 10, 11
10	Consider installing "intersection ahead" signs.	Medium	Short	\$	Morris Co.	4, 11
11	Replace signs that are undersized, not the proper height, lack retroreflectivity, and lack breakaway posts.	Medium	Short	\$	Morris Co.	9, 10, 11

6.3 MILLBROOK AVENUE (CONTINUED)

Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
12	Consider adding signage to indicate that northbound Millbrook Avenue traffic does not stop.	Medium/High	Short	\$	Morris Co.	4
	Visibility					
13	Trim vegetation to improve visibility between the Route 10 ramp and Quaker Church Road.	High	Short	\$	Randolph Twp.	16
14	Consider adding flashers to the stop signs to increase visibility.	High	Medium	\$\$	Morris Co.	4
15	Increase flashers to 12" heads.	Medium/High	Medium	\$\$	Morris Co.	13
16	Consider the acquisition of the property on the northwest corner, for improved sight triangle.	High	Long	\$\$\$	Morris Co.	14
	Pavement Markings					
17	Consider adding lane line extensions along the edge of the Millbrook Avenue travel lane (to clearly define for Quaker Church Road), making it possible to move the stop bar closer to the intersection.	High	Short	\$	Morris Co.	14
18	Consider adding painted STOP AHEAD markings on the roadway	Medium	Short	\$	Morris Co.	4
	Misc.					
19	Replace existing inlet grate with bicycle-safe grate.	Medium	Short	\$	Morris Co.	20
20	Remove old signal foundation from southwest corner.	Low	Short	\$	Morris Co.	19

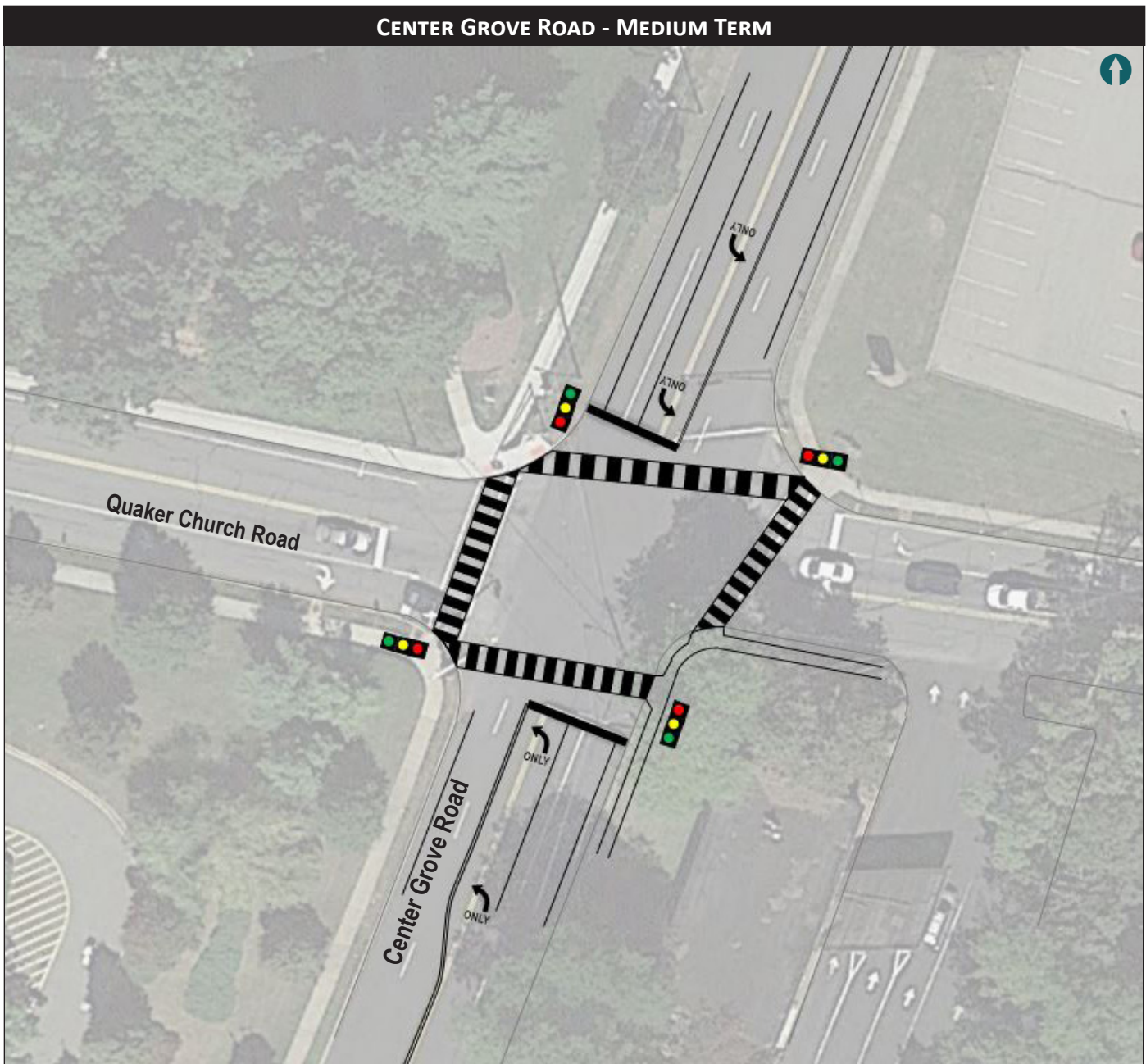
6.4 SOUTH MORRIS STREET

Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
	Location					
	Traffic Operations					
1	Construct mountable island on westbound approach, especially for southbound vehicles turning left onto eastbound Franklin Road	Medium	Medium	\$\$	Morris Co.	3
2	Consider painting edge of travel lane lines on So. Morris Street to visibly reduce roadway width and reduce speeding.	Medium	Short	\$	Morris Co.	1
3	Utilize "Your speed is..." to rein in speeding	Medium	Short	\$	Randolph Twp.	1, 2
	Signage					
4	Replace stop signs with consistent layout; add additional left-side sign, bright sticks, "stop ahead" sign.	Medium	Short	\$	Morris Co.	4
5	Install "intersection ahead" signs.	Medium	Short	\$	Morris Co.	11, 12
6	Upgrade signs to be: properly sized (or oversize), proper height, retroreflective, and with breakaway posts.	Medium	Short	\$	Morris Co.	4, 5, 6, 7
7	Conduct formal signage study.	Medium	Medium	\$\$	Morris Co.	2, 4, 6, 7
	Visibility					
8	Consider adding flashers to the stop signs to increase visibility	High	Medium	\$\$	Morris Co.	8
9	Increase flashers to 12" heads	Medium/High	Medium	\$	Morris Co.	8
10	Install retroreflective backplates to flashing signals.	Medium/High	Medium	\$	Morris Co.	8

6.4 SOUTH MORRIS STREET(CONTINUED)

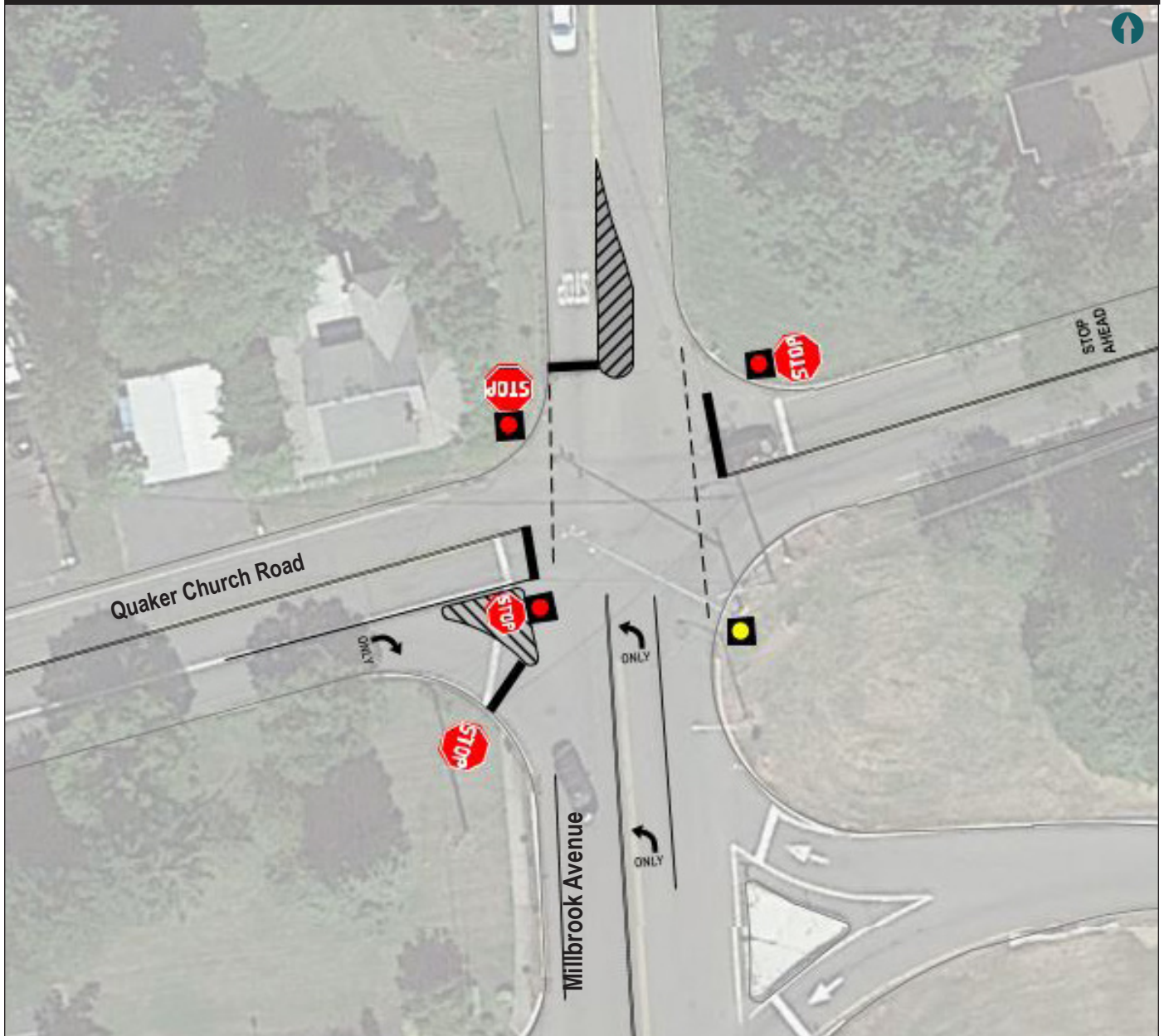
Rec. #	Recommendations List	Safety Benefit	Time Frame	Cost	Jurisdiction	Issue Ref. #
11	Consider the construction of an intersection table to create an intersection that stands out as well as reducing speed	High	Long	\$\$\$	Morris Co.	1, 2
	Pedestrian					
12	Install ADA compliant pedestrian facilities	Medium	Long	\$\$	Morris Co.	13
13	Install sidewalks.	Medium	Long	\$\$\$	Randolph Twp.	13
	Pavement Markings					
14	Consider lane line extensions through the intersection.	Medium/High	Short	\$	Morris Co.	10
15	Consider adding painted STOP AHEAD markings on the roadway	Medium	Short	\$	Morris Co.	11, 12

>> 7.0 RECOMMENDATION GRAPHICS



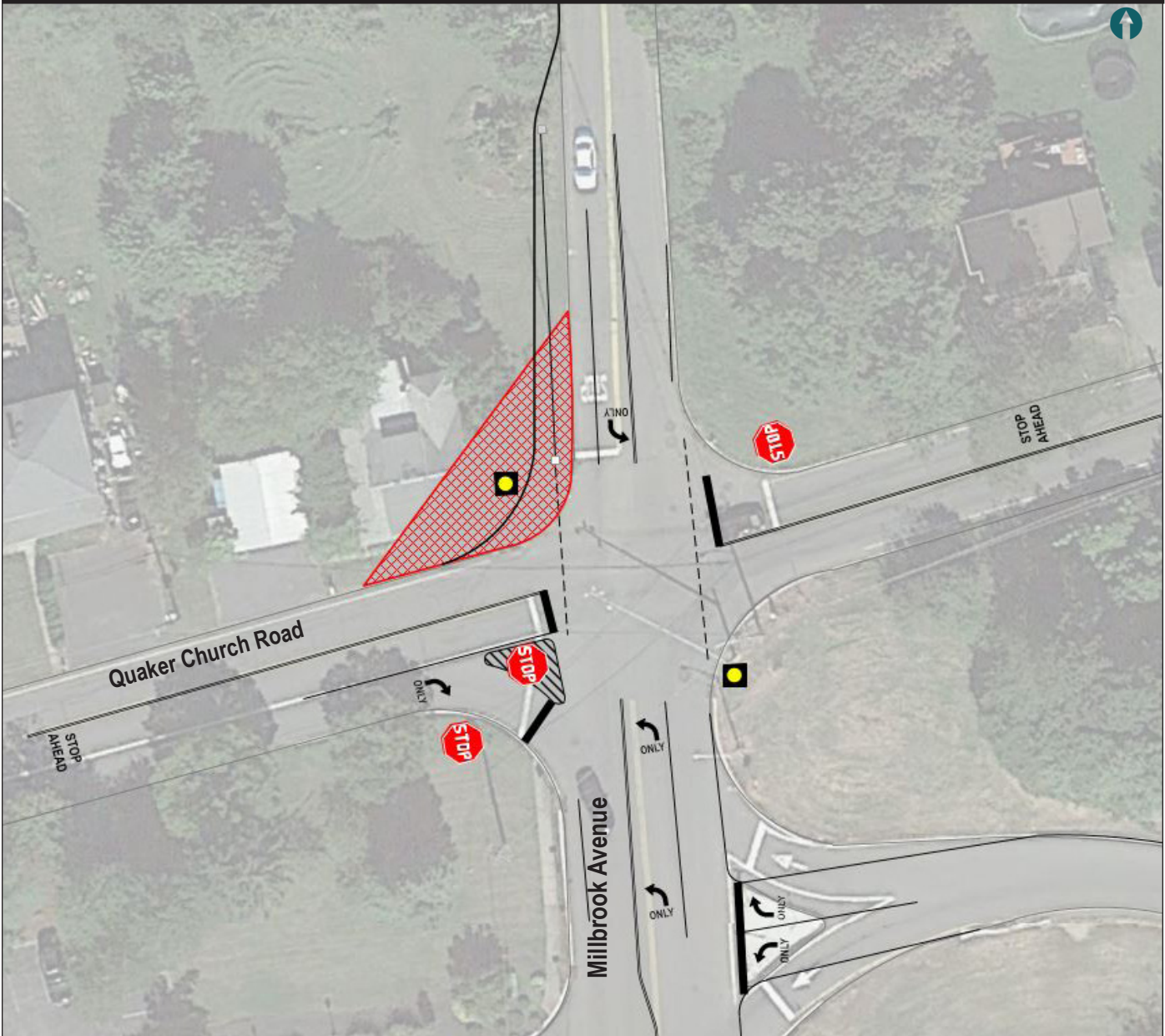
- Full traffic signal upgrade
- Road diet on Center Grove Road
- Head-to-head left-turn lanes on Center Grove Road
- Add missing crosswalks across Center Grove Road
- Add missing sidewalk on southeast corner

MILLBROOK AVENUE - MEDIUM TERM



- Dedicated left-turn lane on northbound Millbrook Avenue;
- Painted island in the north leg
- Improve visibility of stop signs
- Increase visibility of intersection
- Add lane line extensions to improve visibility for vehicles on Quaker Church Road
- Add island on west leg to improve channelization; additional stop sign adjacent to stop bar.

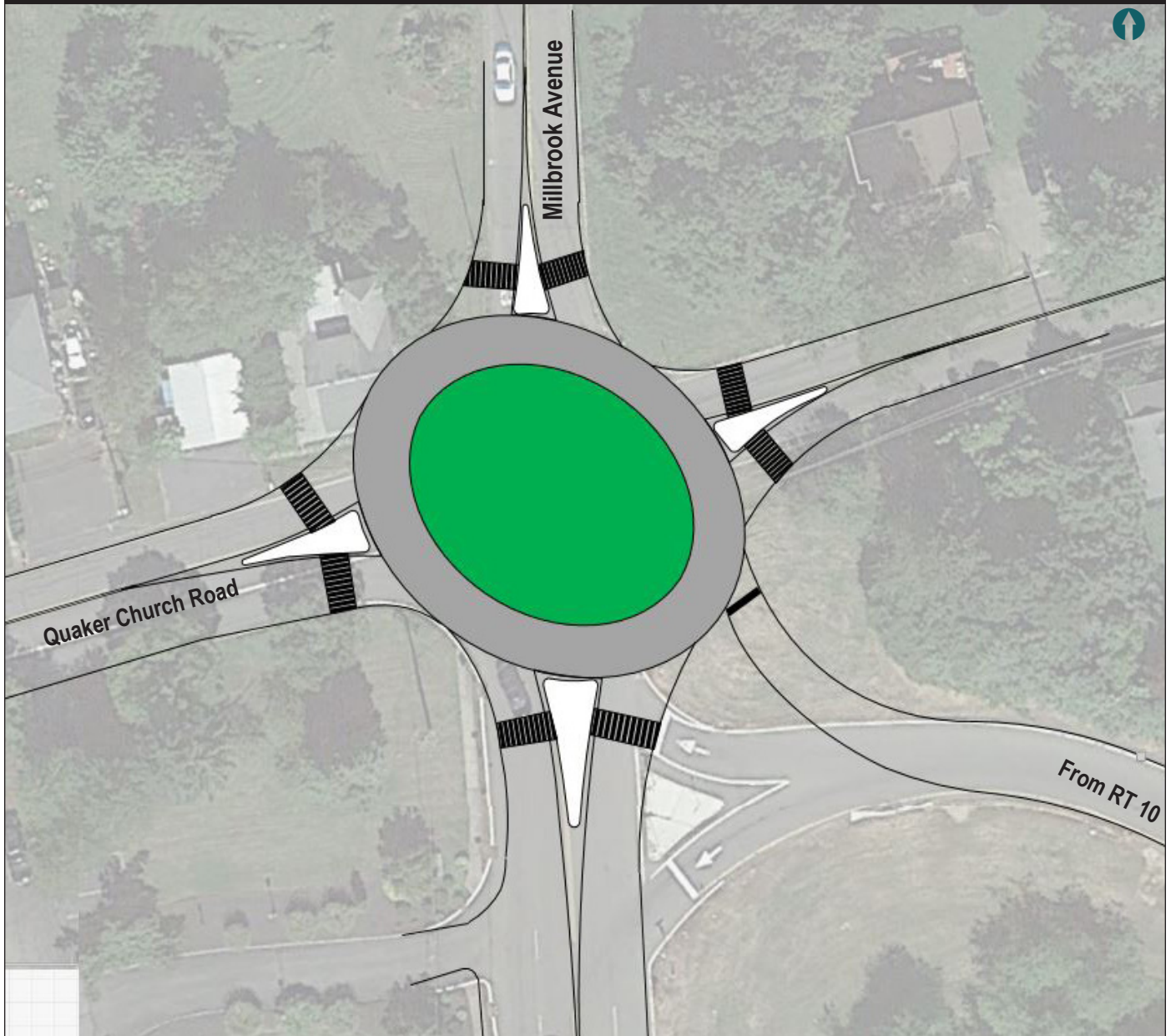
MILLBROOK AVENUE - LONG TERM A



In addition to the medium term recommendations:

- Improve access from the Route 10 ramp; the above image is one possible improvement
- Acquiring the property on the northwest corner would significantly improve sight distance.
- Consider construction of a roundabout, incorporating the four legs of the intersection as well as the ramp from Route 10

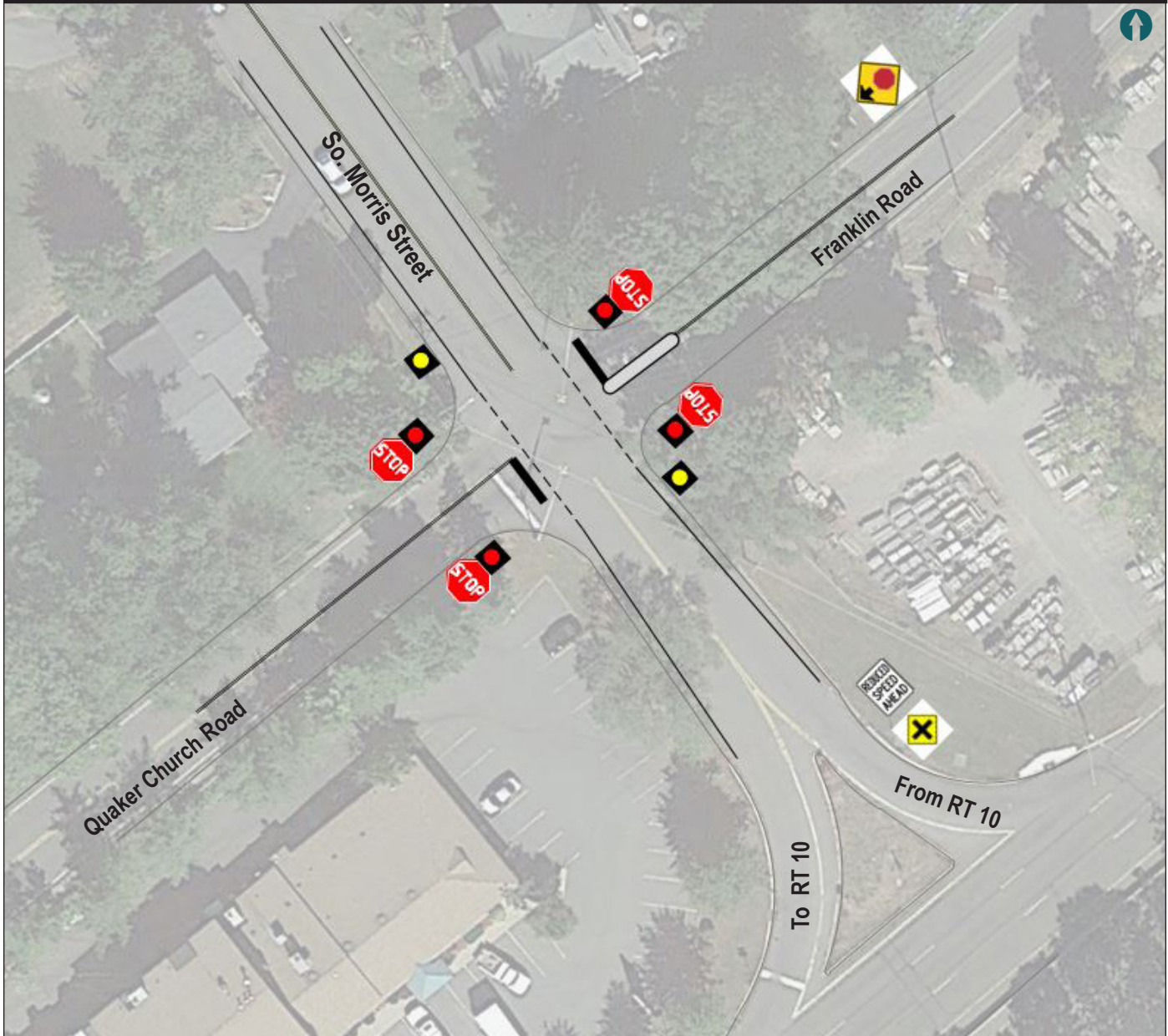
MILLBROOK AVENUE - LONG TERM B



The roundabout is conceptual only and not to scale. This major change would require the support of the NJDOT.

- Constraints include the slope on the southwest corner (grading the slope to meet proposed roadway) and the property on the northeast corner (constructing the roundabout within the existing ROW)
- Acquire property on the northwest corner.

SOUTH MORRIS STREET - MEDIUM TERM

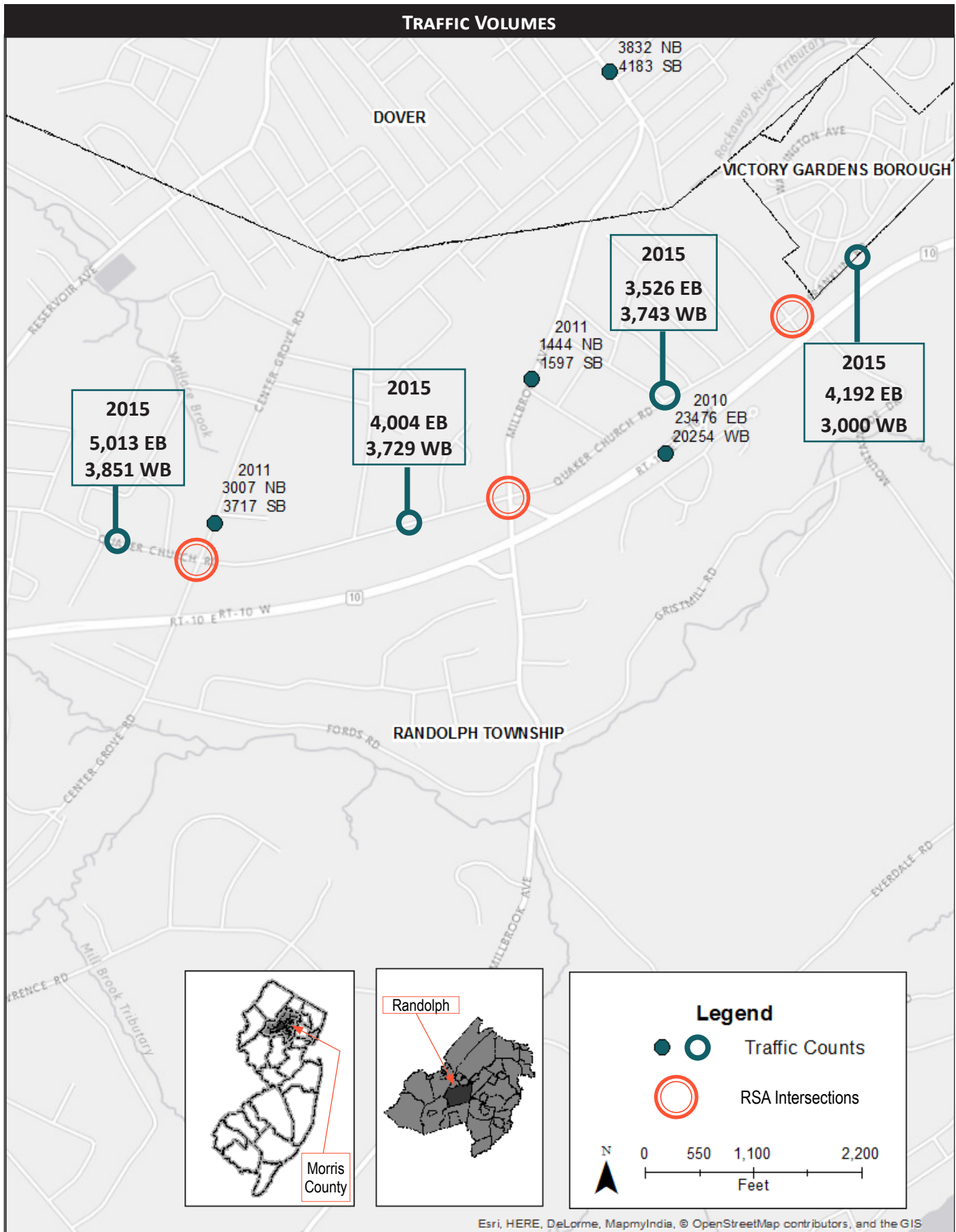


- Increase visibility of the stop signs
- Increase visibility of the intersection
- Add lane line extensions so vehicles on Quaker Church Road have improved sight distance of South Morris Street traffic
- Mountable median island on east leg
- Painted travel lane edge on South Morris Street

>> APPENDIX A – RSA TEAM

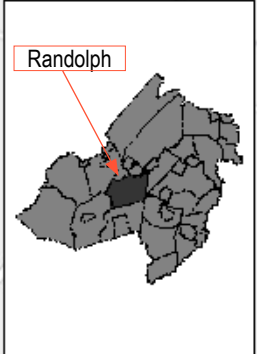
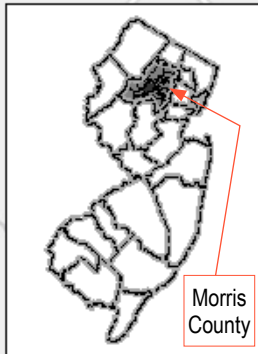
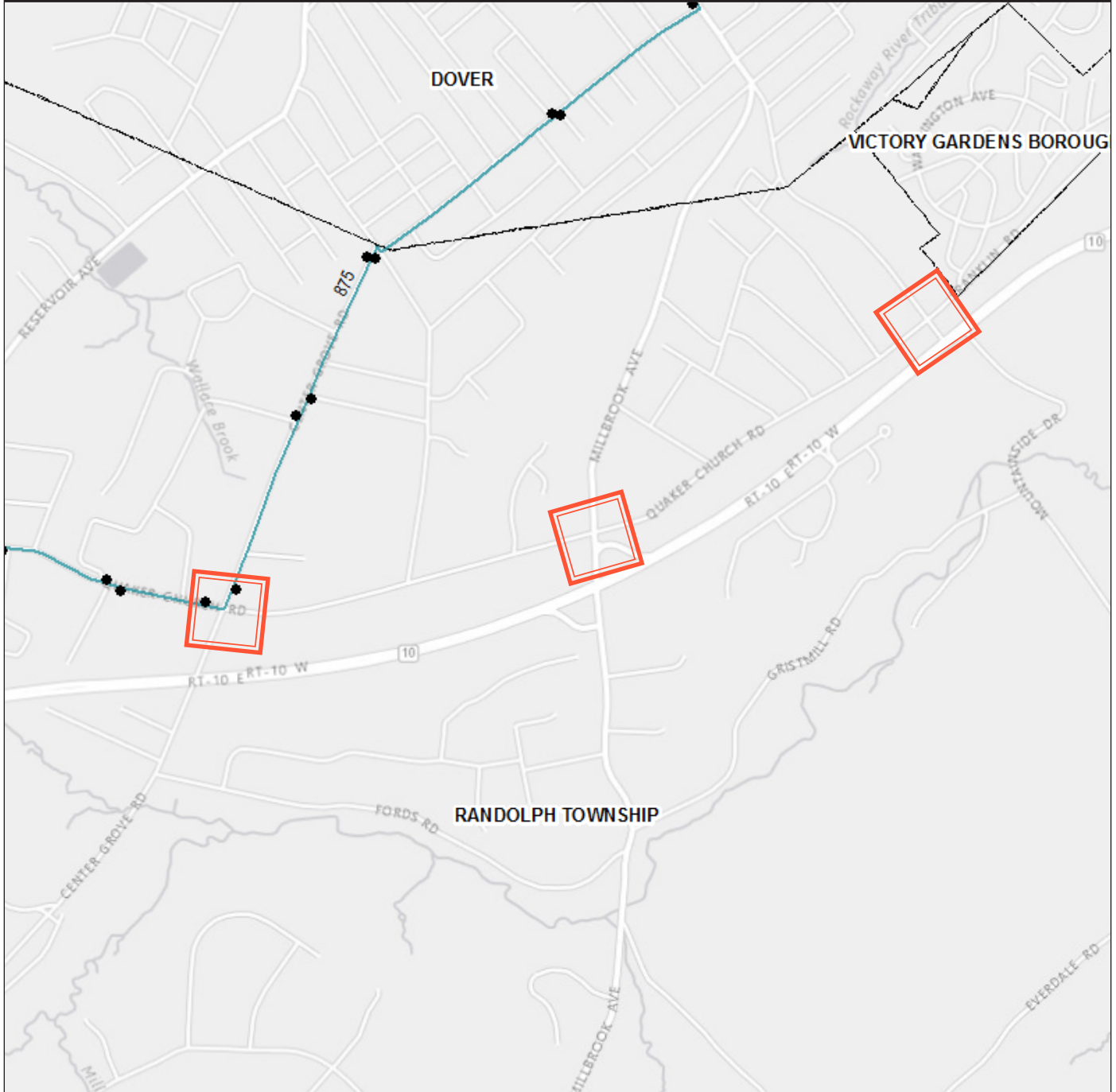
Name	Representing	E-mail
Debra A. Dellagiacomma	Morris County Engineering	ddellagiacomma@co.morris.nj.us
Amon Boucher	NJDOT	amon.boucher@dot.nj.gov
Joseph Birchenough	NJDOT	joseph.birchenough@dot.state.nj.gov
Christine Mittman	NJTPA	cmittman@njtpa.org
Elizabeth Thompson	NJTPA	ethompson@njtpa.org
Rich Biase	Randolph PD	rbiase@randolphnj.org
Carl LeMarble	Randolph PD	clmarble@randolph.nj.org
Jason Gould	Randolph PD	jgould@randolph.nj.org
Steve Mountain	Randolph Township	smountain@randolphnj.org
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Aimee Jefferson	Rutgers TSRC	aimee.jefferson@rutgers.edu
Joseph Weiss	Rutgers/DHTS	joseph.weiss@rutgers.edu
Andrew Lappitt	TransOptions	alappitt@transoptions.org
James Sinclair	VTC	james.sinclair@ejb.rutgers.edu

>> APPENDIX B – AREA MAPS



Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS

AREA TRANSIT



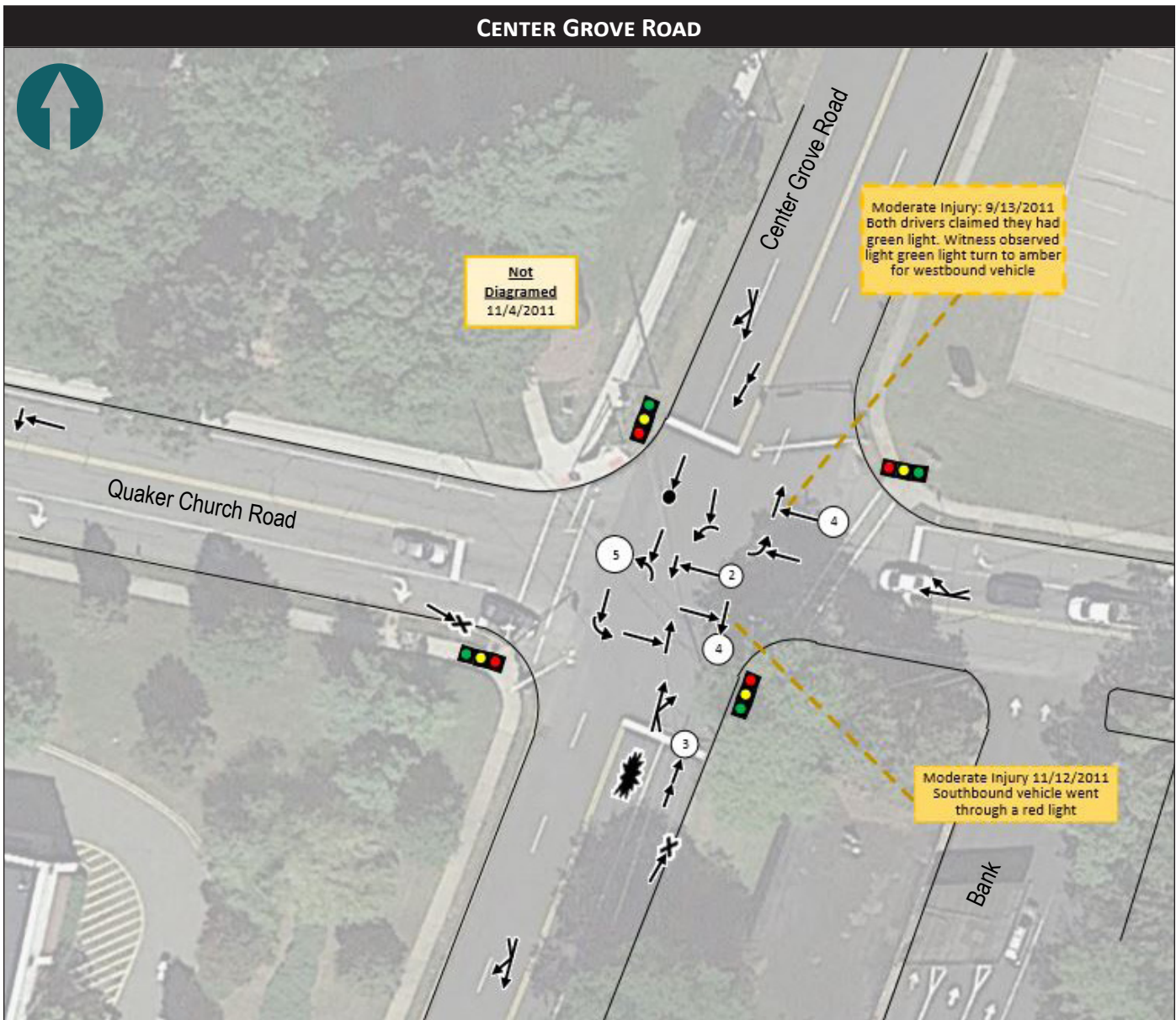
Legend

- NJ Transit Bus Stop
- NJ Transit Buses
- RSA Intersections

N 0 550 1,100 2,200
Feet

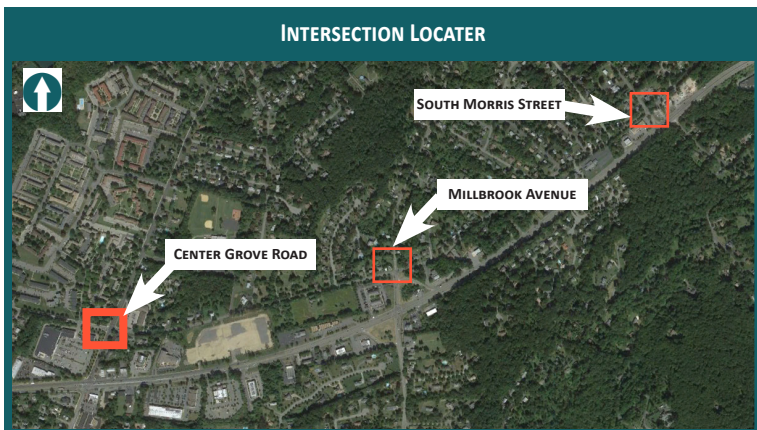
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

>> APPENDIX C – CRASH DATA & DIAGRAMS



All pedestrian and cyclist crashes from 2009–2013 have a brief crash narrative included in the diagram and are color coded by severity.

Additionally, any other crash type having a severity of “moderate injury” or greater has a color-coded narrative. = Moderate injury



LEGEND

- Right angle
- Left-turn
- Other
- Non-fixed object
- Same direction - Side swipe
- Same direction - Rear End
- Fixed-object
- Opposite direction - Side Swipe

Google Imagery, 2014

Crash diagrams based on reports retrieved from NJDOT

INTERSECTION NAME – CRASH SUMMARY (2011 – 2013)

Crash Type	#
Same Direction – Rear End	4
Same Direction – Side Swipe	5
Right Angle	12
Opposite Direction – Head On/ Angular	-
Opposite Direction – Side Swipe	1
Struck Parked Vehicle	-
Left Turn / U-Turn	10
Backing	-
Encroachment	-
Overtaken	-
Fixed Object	2
Animal	-
Pedestrian	-
Pedalcyclist	-
Non-fixed Object	1
Railcar – Vehicle	-
Other	1
Total	36

Month	#
January	7
February	2
March	-
April	3
May	1
June	2
July	2
August	3
September	4
October	2
November	4
December	4
Total	34

Severity	#
Property Damage Only (PDO)	24
Pain	10
Moderate Injury	2
Incapacitating Injury	-
Fatal	-
Total	36

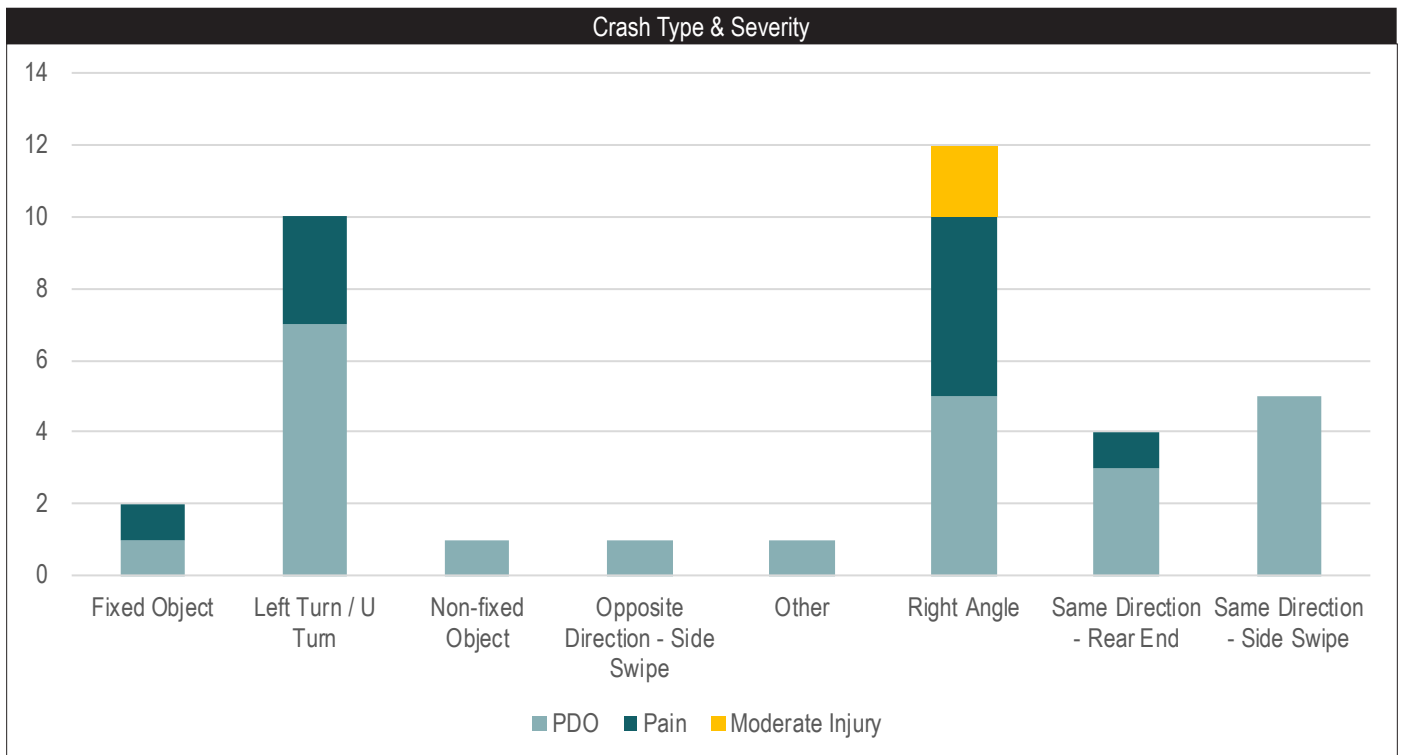
Crash Year	#
2011	16
2012	8
2013	12
Total	36

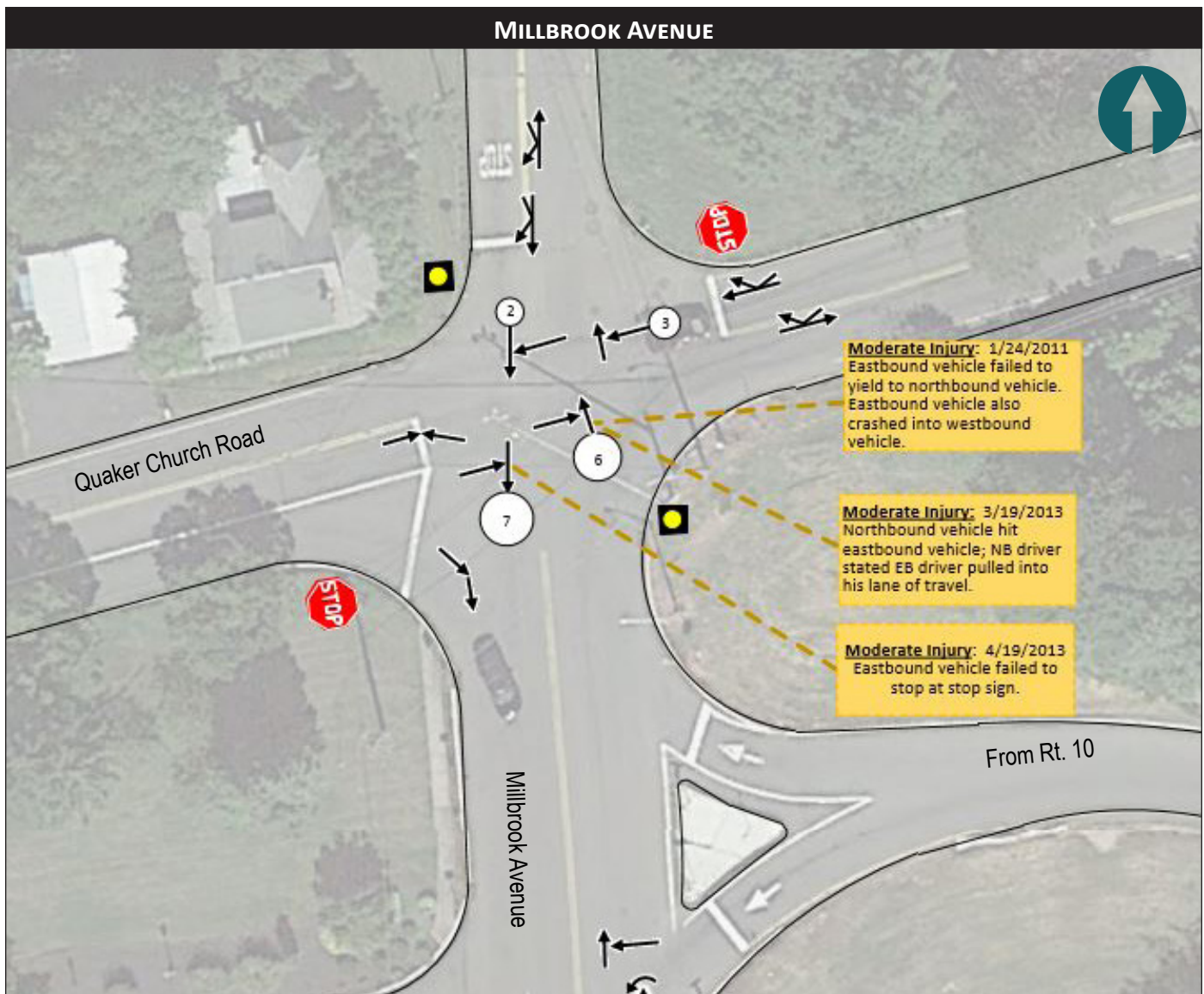
Intersection	#
At intersection	20
Not at intersection	16
At or Near Railroad	-
Total	36

Surface Condition	#
Dry	28
Wet	7
Snowy	0
Icy	1
Slush	-
Water – Standing/ Moving	-
Sand, Mud, Dirt	-
Oil	-
Total	36

Light Condition	#
Daylight	24
Dawn	-
Dusk	2
Dark – No Street Lights	1
Dark – Street Lights On/ Continuous	7
Dark – Street Lights On/ Spot	2
Dark – Street Lights Off	-
Other	-
Total	36

Day	#
Monday	6
Tuesday	6
Wednesday	5
Thursday	6
Friday	8
Saturday	3
Sunday	2
Total	36





All pedestrian and cyclist crashes from 2009–2013 have a brief crash narrative included in the diagram and are color coded by severity.

Additionally, any other crash type having a severity of “moderate injury” or greater has a color-coded narrative. ■ = Moderate injury



LEGEND

Right angle	Same direction - Side swipe
Left-turn	Same direction - Rear End
Other	Fixed-object
Non-fixed object	Opposite direction - Side Swipe

Google Imagery, 2014
Crash diagrams based on reports retrieved from NJDOT

INTERSECTION NAME – CRASH SUMMARY (2011 – 2013)

Crash Type	#
Same Direction – Rear End	1
Same Direction – Side Swipe	1
Right Angle	19
Opposite Direction – Head On/ Angular	1
Opposite Direction – Side Swipe	2
Struck Parked Vehicle	-
Left Turn / U-Turn	1
Backing	-
Encroachment	-
Overtaken	-
Fixed Object	-
Animal	-
Pedestrian	-
Pedalcyclist	-
Non-fixed Object	-
Railcar – Vehicle	-
Other	-
Total	25

Month	#
January	2
February	-
March	2
April	2
May	4
June	4
July	-
August	1
September	3
October	1
November	4
December	2
Total	25

Severity	#
Property Damage Only (PDO)	15
Pain	7
Moderate Injury	3
Incapacitating Injury	-
Fatal	-
Total	25

Crash Year	#
2011	10
2012	6
2013	9
Total	25

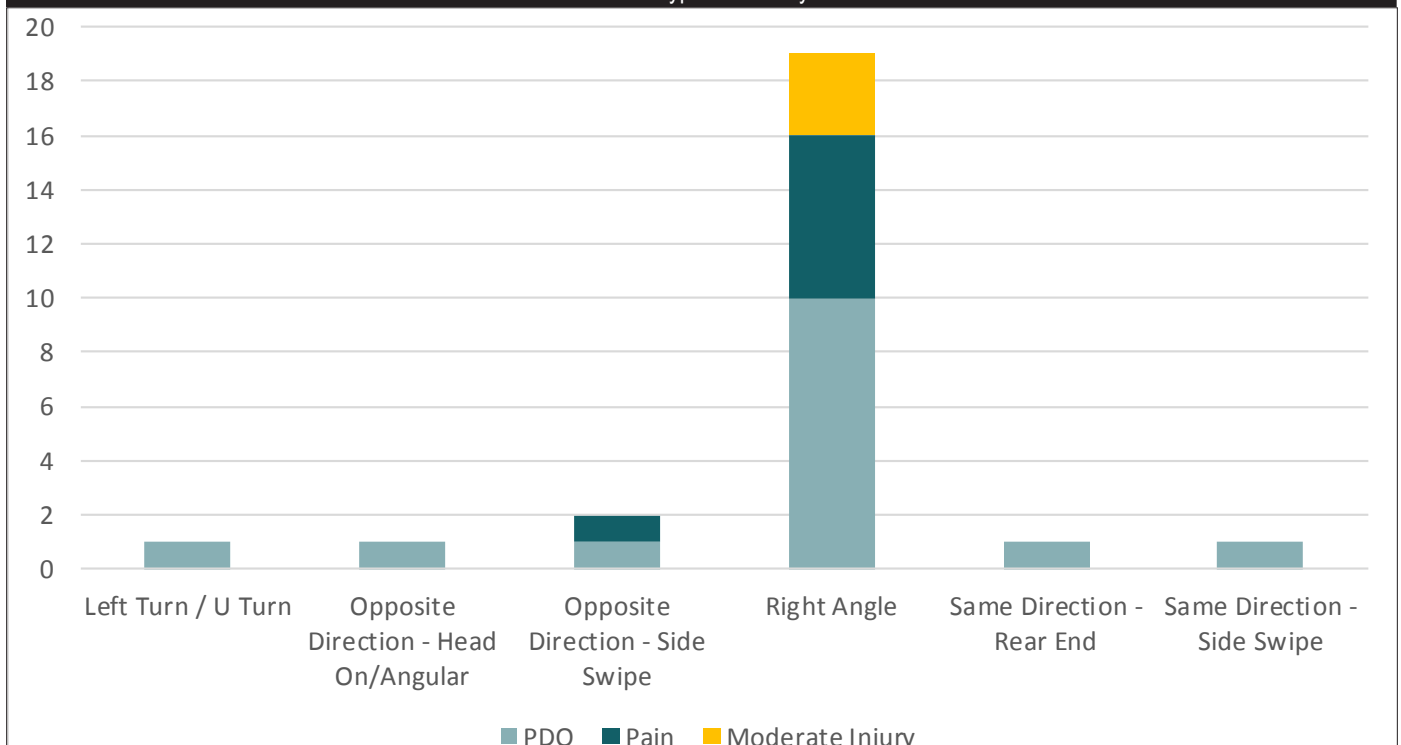
Intersection	#
At intersection	18
Not at intersection	7
At or Near Railroad	-
Total	25

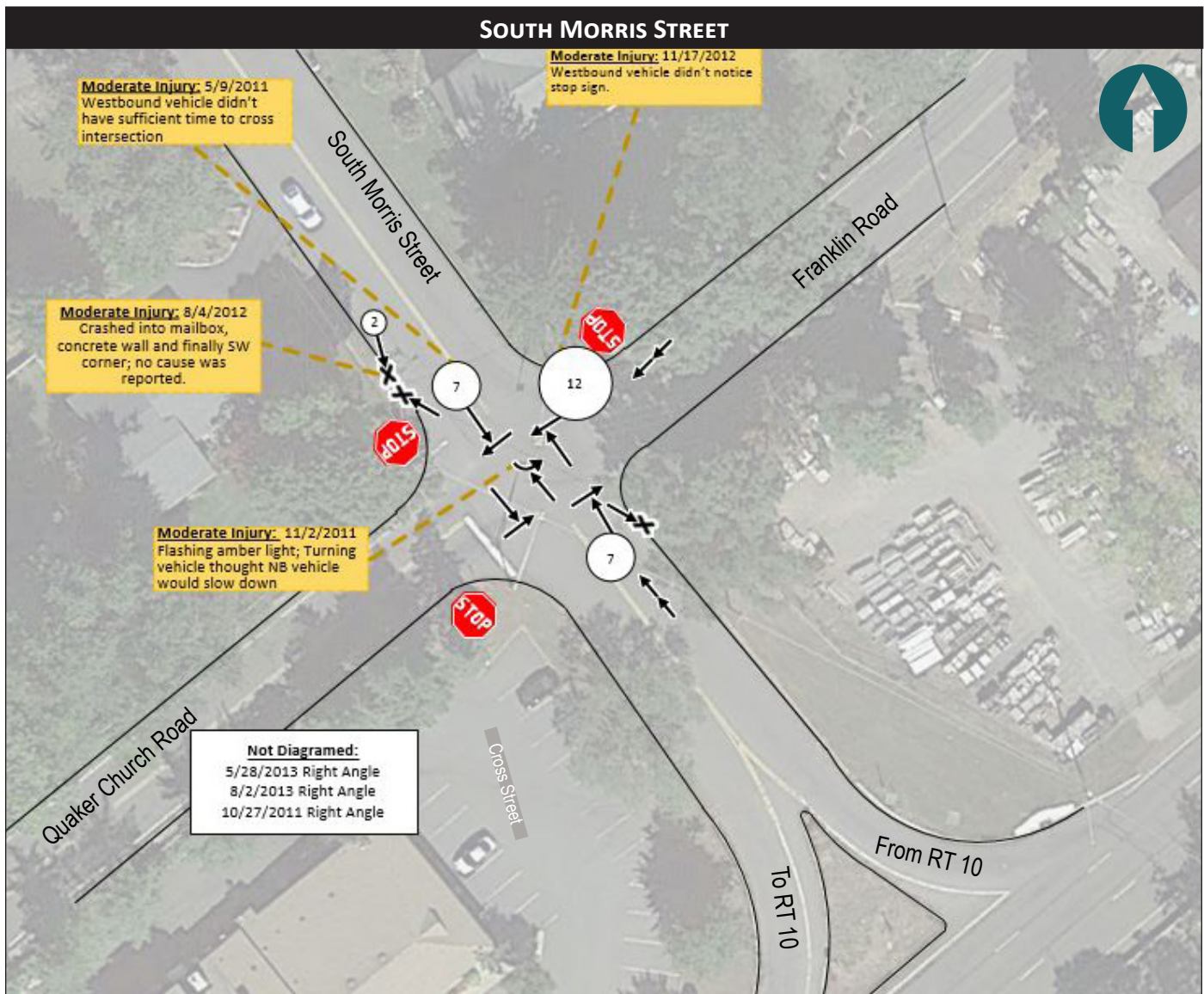
Surface Condition	#
Dry	20
Wet	5
Snowy	-
Icy	-
Slush	-
Water – Standing/ Moving	-
Sand, Mud, Dirt	-
Oil	-
Total	25

Light Condition	#
Daylight	21
Dawn	-
Dusk	1
Dark – No Street Lights	1
Dark – Street Lights On/ Continuous	1
Dark – Street Lights On/ Spot	1
Dark – Street Lights Off	-
Other	-
Total	25

Day	#
Monday	5
Tuesday	5
Wednesday	3
Thursday	5
Friday	3
Saturday	4
Sunday	-
Total	25

Crash Type & Severity





All pedestrian and cyclist crashes from 2009–2013 have a brief crash narrative included in the diagram and are color coded by severity.

Additionally, any other crash type having a severity of "moderate injury" or greater has a color-coded narrative. = Moderate injury



LEGEND

Right angle	Same direction - Side swipe
Left-turn	Same direction - Rear End
Other	Fixed-object
Non-fixed object	Opposite direction - Side Swipe

Google Imagery, 2014
Crash diagrams based on reports retrieved from NJDOT

INTERSECTION NAME – CRASH SUMMARY (2011 – 2013)

Crash Type	#
Same Direction – Rear End	2
Same Direction – Side Swipe	-
Right Angle	31
Opposite Direction – Head On/ Angular	-
Opposite Direction – Side Swipe	-
Struck Parked Vehicle	-
Left Turn / U-Turn	1
Backing	-
Encroachment	-
Overtaken	-
Fixed Object	4
Animal	-
Pedestrian	-
Pedalcyclist	-
Non-fixed Object	-
Railcar – Vehicle	-
Other	-
Total	38

Month	#
January	3
February	1
March	5
April	4
May	4
June	1
July	-
August	5
September	2
October	6
November	4
December	3
Total	38

Severity	#
Property Damage Only (PDO)	24
Pain	10
Moderate Injury	4
Incapacitating Injury	-
Fatal	-
Total	38

Crash Year	#
2011	14
2012	15
2013	9
Total	38

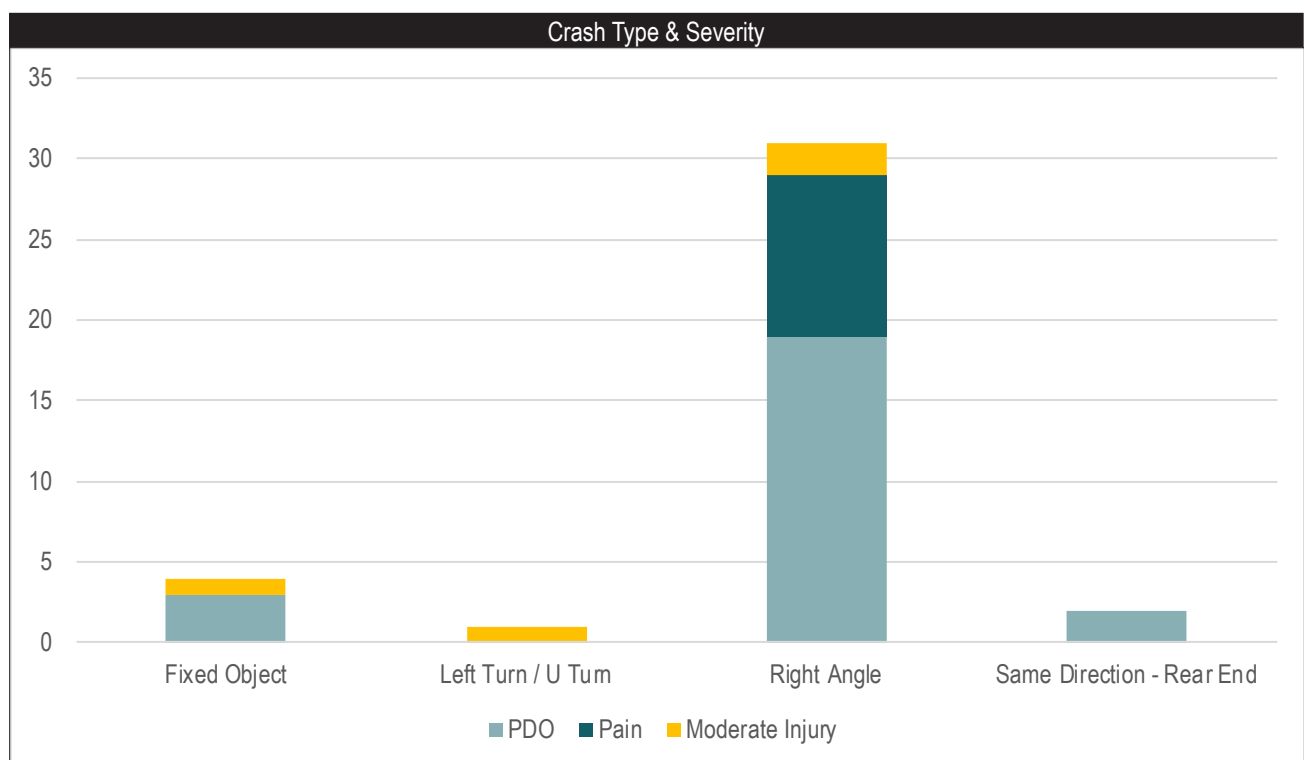
Intersection	#
At intersection	34
Not at intersection	4
At or Near Railroad	-
Total	38

Surface Condition	#
Dry	25
Wet	10
Snowy	3
Icy	-
Slush	-
Water – Standing/ Moving	-
Sand, Mud, Dirt	-
Oil	-
Total	38

= Fatal

Light Condition	#
Daylight	21
Dawn	1
Dusk	-
Dark – No Street Lights	3
Dark – Street Lights On/ Continuous	9
Dark – Street Lights On/ Spot	4
Dark – Street Lights Off	-
Other	-
Total	38

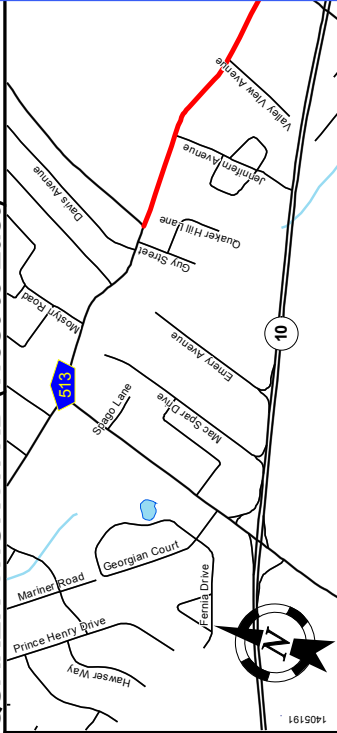
Day	#
Monday	3
Tuesday	4
Wednesday	5
Thursday	6
Friday	12
Saturday	2
Sunday	6
Total	38



APPENDIX D – STRAIGHT LINE DIAGRAMS

Mile Posts: 0.000 - 2.000

QUAKER CHURCH RD (West to East)



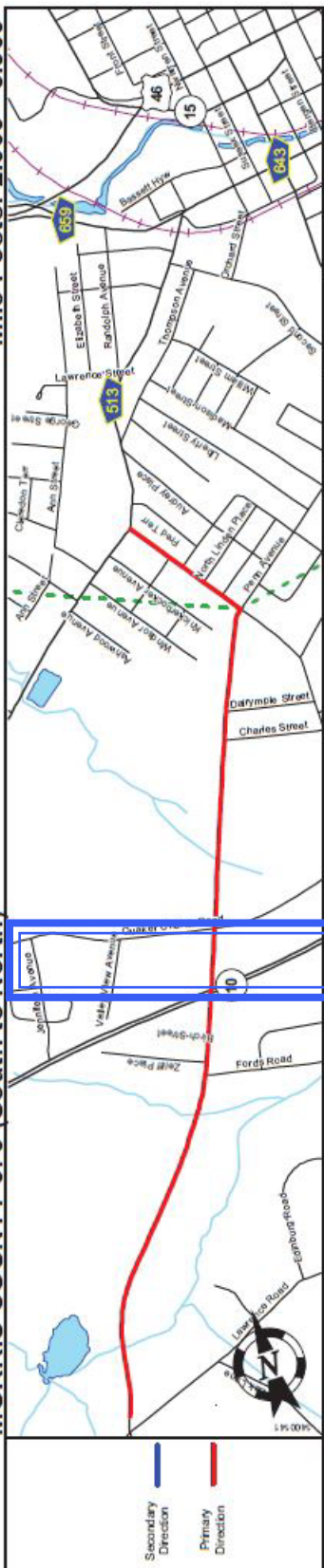
Pavement	Shoulder	Number of Lanes	Speed Limit	Street Name	Street Name	Jurisdiction	Functional Class	Federal Aid - NHS Sy	Control Section	Speed Limit	Number of Lanes	Med. Type	Med. Width	Pavement	Shoulder	Traffic Volume	Traffic Sta. ID	Structure No.	Enlarged Views
				Center (0.54)	Grove Rd (0.54)	Quaker Church Road	Urban Local				35	2	None			24			
				Quaker Ave (0.86)	Milbrook (1.17)	Quaker Church Road	Municipal				2	None				0			
				Eagle Ct (1.04)	Willow Ave (1.39)	Quaker Church Road	Urban Local				2	None				0			
				Sandra La (1.72)	South (1.82)	Quaker Church Road	Urban Local				2	None				0			
				Valley View Ave (0.36)	Jennifer Ave (0.18)	Quaker Church Road	Urban Major Collector		STP		2	None				0			
				Reservoir (0.00)	Valley View Ave (0.36)	Quaker Church Road	Urban Major Collector		STP		2	None				0			
				Begin Quaker Church Rd MP=0.00	Valley View Ave (0.36)	Quaker Church Road	Urban Major Collector		STP		2	None				0			

Date last inventoried: December 2002

SRI = 14321001

Mile Posts: 2.000 - 3.900

MORRIS COUNTY 670 (South to North)



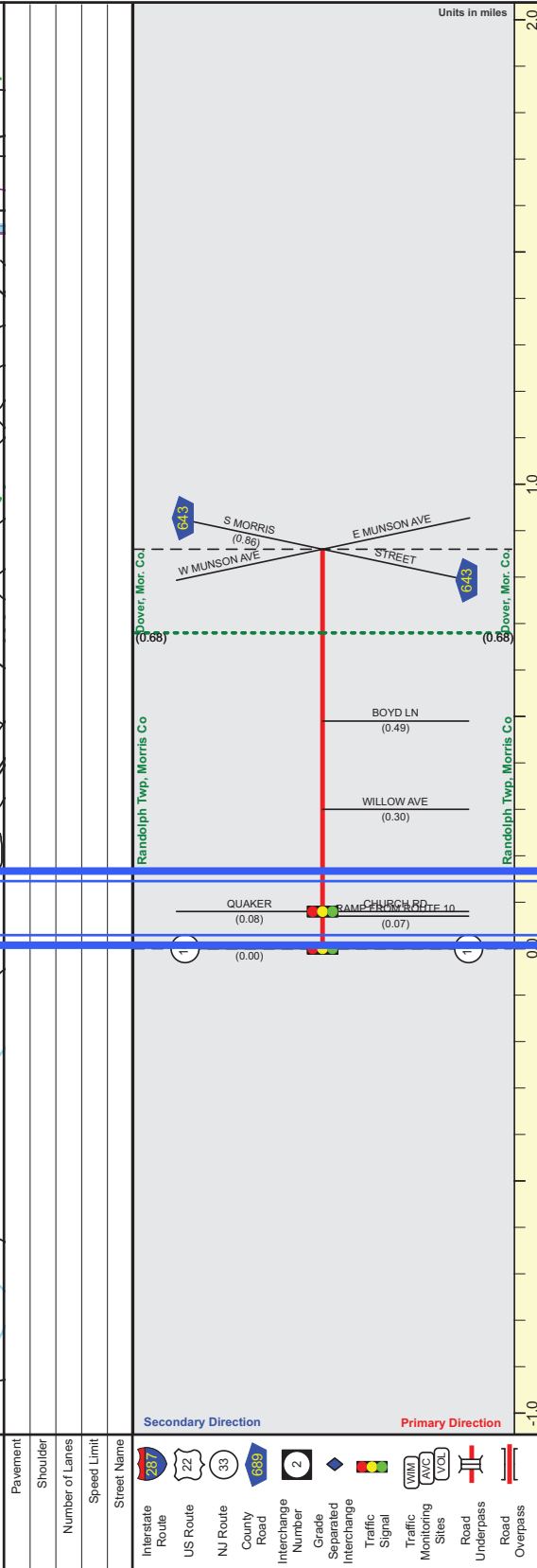
Street Name	Justification	Functional Class	Federal Aid - NIS Sy	Control Section	Speed Limit	Number of Lanes	Med. Type	Med. Width	Pavement	Shoulder	Traffic Volume	Traffic Sta. ID	Structure No.	Enlarged Views
Van Nostrand Avenue	County	Urban Street	Arterial	Typ		2	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							
Center Grove Road	County	Urban Street	Arterial	Typ		4	None							

Date last inventoried: May 2011

SRI = 14000670

MORRIS COUNTY 656 (South to North)

Mile Posts: 0.000 - 0.860



Street Name	Millbrook Avenue
Jurisdiction	County
Functional Class	Urban Minor Arterial
Federal Aid - NHS Sy	STP
Control Section	
Speed Limit	35
Number of Lanes	2
Med. Type	None
Med. Width	0
Pavement	24
Shoulder	1
Traffic Volume	
Traffic Sta. ID	
Structure No.	
Enlarged Views	

Date last inventoried: May 2011

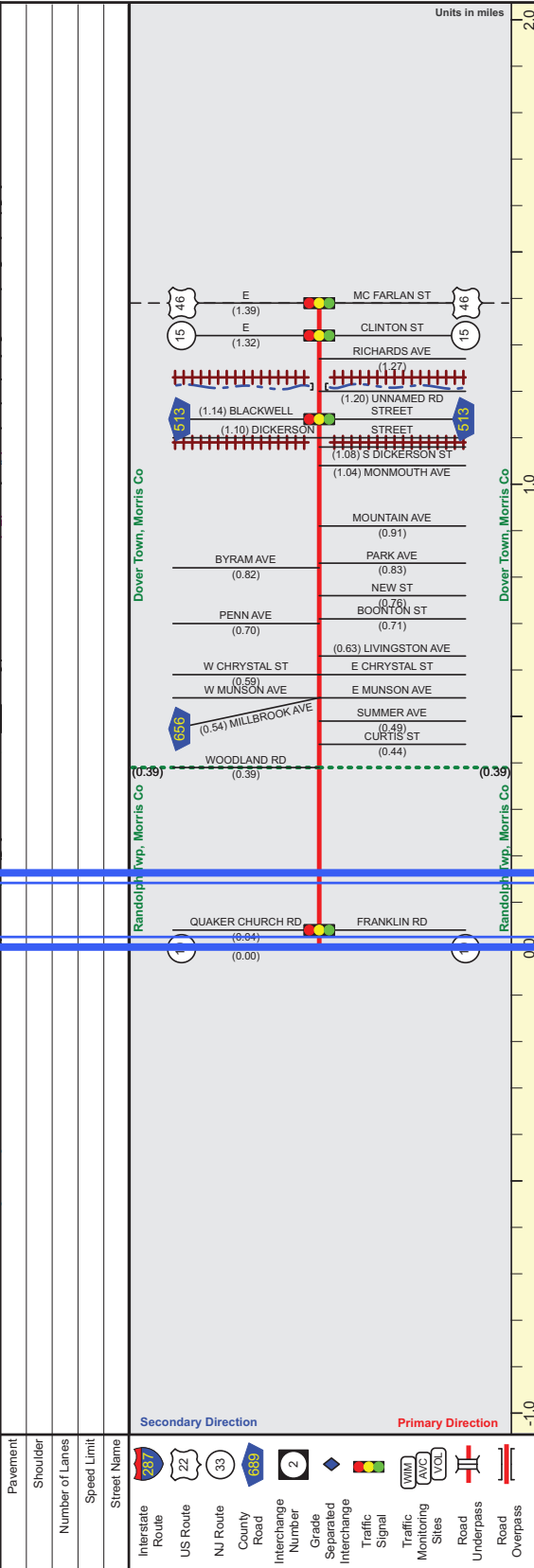
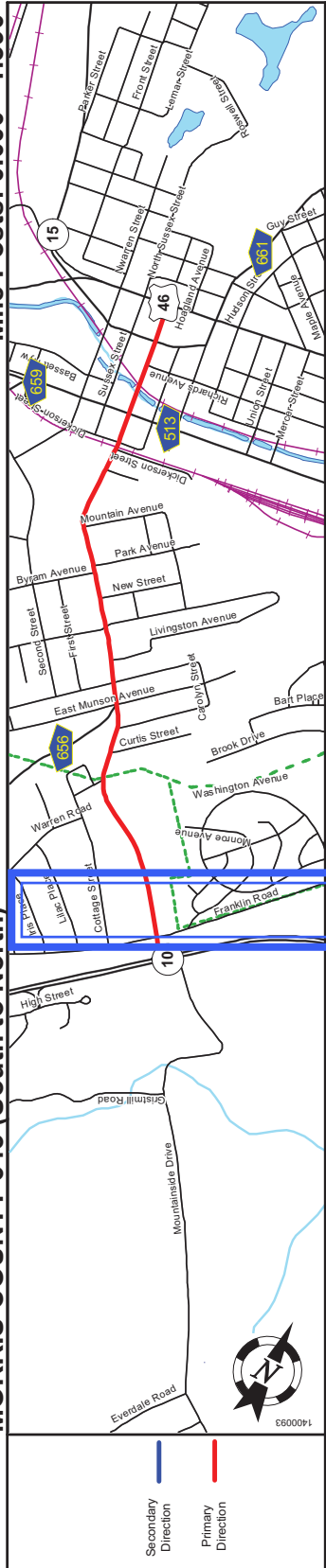
SRI = 14000656

Begin Morris County 656 MP=0.00

End Morris County 656 MP=0.86

Mile Posts: 0.000 - 1.390

MORRIS COUNTY 643 (South to North)



Street Name	South Morris Street
Jurisdiction	County
Functional Class	Urban Minor Arterial
Federal Aid - NHS Sy	STP
Control Section	
Speed Limit	25
Number of Lanes	2
Med. Type	None
Med. Width	0
Pavement	35
Shoulder	0
Traffic Volume	
Traffic Sta. ID	
Structure No.	
Enlarged Views	

Date last inventoried: October 2000

SRI = 14000643