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OCTOBER 2011



TABERNACLE TOWNSHIP, BURLINGTON COUNTY

CONGESTION & CRASH

Analysis Program

site

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Executive Summary

The goals of the Congestion and Crash Site Analysis Program (CCSAP) are to improve the access and efficiency of the region's transportation system, improve safety and air quality, and reduce congestion through analyses of specific highway locations with demonstrated problems in both New Jersey and Pennsylvania.

Due to their many conflict points, intersections experience more crashes than midblock locations. In addition, the geometry of an intersection can present many issues for the road user. Assuring the efficient operation of intersections is an increasingly important issue as municipalities attempt to maximize roadway capacity to serve the growing demand for travel. The objective is to identify cost-effective improvements that will reduce crashes and congestion.

The intent for the Fiscal Year 2011 CCSAP is to examine either a signalized or unsignalized intersection located on a High Risk Rural Road (HRRR). A range of appropriate intersections was developed through a data-driven process, and from those the Burlington County Engineering Department suggested the intersection of CR 648 (Carranza Road) and CR 532 (Medford Lakes Road/Chatsworth Road), in Tabernacle Township, New Jersey.

With input from the advisory committee of local and county representatives, and the analyses performed by Delaware Valley Regional Planning Commission (DVRPC), some improvement strategies were developed that would increase the safety and mobility of all road users traveling through this intersection. The list of advisory committee participants is provided in [Appendix A](#).

The range of strategies included the following: adding signage, adding a dedicated right-turn lane, and constructing a roundabout. Many of the above-mentioned strategies were recommended and were immediately implemented by the county. The majority of these improvements were low-cost and short-term solutions to help improve the traffic flow and safety of all roadway users traveling through the intersection of CR 648 and CR 532.

Introduction

This technical report provides analysis and recommendations for the intersection of CR 648 (Carranza Road) and CR 532 (Medford Lakes Road/Chatsworth Road) in Tabernacle Township, New Jersey. The recommended strategies cover both safety and operational improvements. The safety improvements were developed based on professional knowledge and discussions with members of the study advisory committee. The resulting recommendations are in the final chapter of the report.

Methodology

As part of keeping the CCSAP effective in financially constrained times, the intent for this year's program was to examine an individual intersection located on a High Risk Rural Road (HRRR). The term HRRR refers to roadways functionally classified as rural major, minor collectors or rural local roads with a fatal and incapacitating injury crash rate above the statewide average for those functional classes of roadways, or likely to experience an increase in traffic volume that leads to a crash rate in excess of the average statewide rate.

As a result of preliminary data analyses performed by DVRPC, 10 intersections were identified as eligible locations in Burlington County. After conferring with the Burlington County Engineering Department, the intersection of CR 648 and CR 532 was chosen as the location to study.

The DVRPC study team conducted a field visit to observe the issues at this location. Data was then compiled and analyzed. This included crash records, Annual Average Daily Traffic (AADT) data, and turning movement counts. On June 8, 2011, a kick-off meeting was held among representatives from the following agencies: Burlington County Engineering Department, Tabernacle Township, and DVRPC. The kick-off meeting assisted in the identification of problems, with discussion of the advisory committee's observations and feedback.

Subsequently, technical analysis was performed to better understand and quantify the identified transportation problem areas. This included the preparation of a collision diagram displaying crash patterns and creating maps that highlighted the proposed improvements.

Based on the crash and Level of Service (LOS) analyses and kick-off meeting discussion, a set of potential improvements was developed that addressed the identified problems.

Findings and preliminary recommendations were presented to the advisory committee at a follow-up meeting held at the Tabernacle Township Municipal Building on June 23, 2011. The purpose

of the meeting was to discuss the recommendations and to get the advisory committee's perspectives on the practicality of the recommendations.

Level of Service (LOS) Analysis

LOS analysis is a common tool for assessment of transportation facilities and was used extensively for this project. When applied as a measure of performance for an entire or a particular component of an intersection, LOS has a precise meaning: the average delay experienced by a vehicle traveling through the intersection or a specific component of it. The parameters of delay that determine the various LOS categories for an unsignalized intersection are displayed in [Table 1](#).

A review of the existing conditions and the various potential improvement scenarios for the study intersection was conducted using Synchro software. Necessary information for determining delay and LOS measures include turning movement counts, roadway geometry, signal timing, and signal actuation plans. The turning movement counts were gathered by DVRPC staff; no signal timing, actuation data, and roadway geometrics were necessary because the study intersection is unsignalized.

For an unsignalized intersection, Synchro only utilizes control delay, for which it relies exclusively upon Highway Capacity Manual (HCM) methods.

Table 1: LOS Designations and Associated Delays

LOS	Unsignalized Intersection Total Delay per Vehicle (seconds/vehicle)
A - Desirable	≤ 10
B - Desirable	> 10 and ≤ 15
C - Desirable	> 15 and ≤ 25
D - Acceptable	> 25 and ≤ 35
E - Undesirable	> 35 and ≤ 50
F - Unsatisfactory	> 50

Source: Highway Capacity Manual, 2000

Study Location

The focus of the study as shown in [Figure 1](#) is the intersection of CR 648 and CR 532. CR 648 provides access to Wharton State Forest, connects directly to US 206, and serves as a coastal evacuation route. On a regional level, CR 532 provides access to Medford Lakes Borough and connects with several key roads, including CR 541, NJ 72, and US 206. During the summer months, CR 532 serves as a major thoroughfare for motorists heading to and from the Jersey Shore.

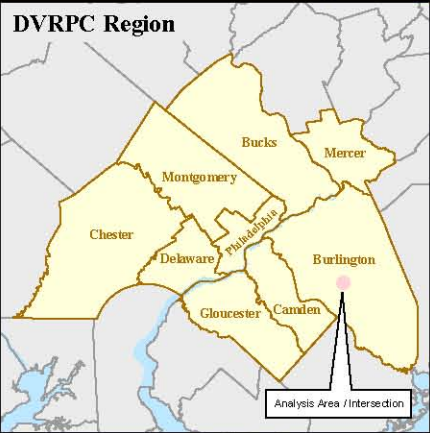
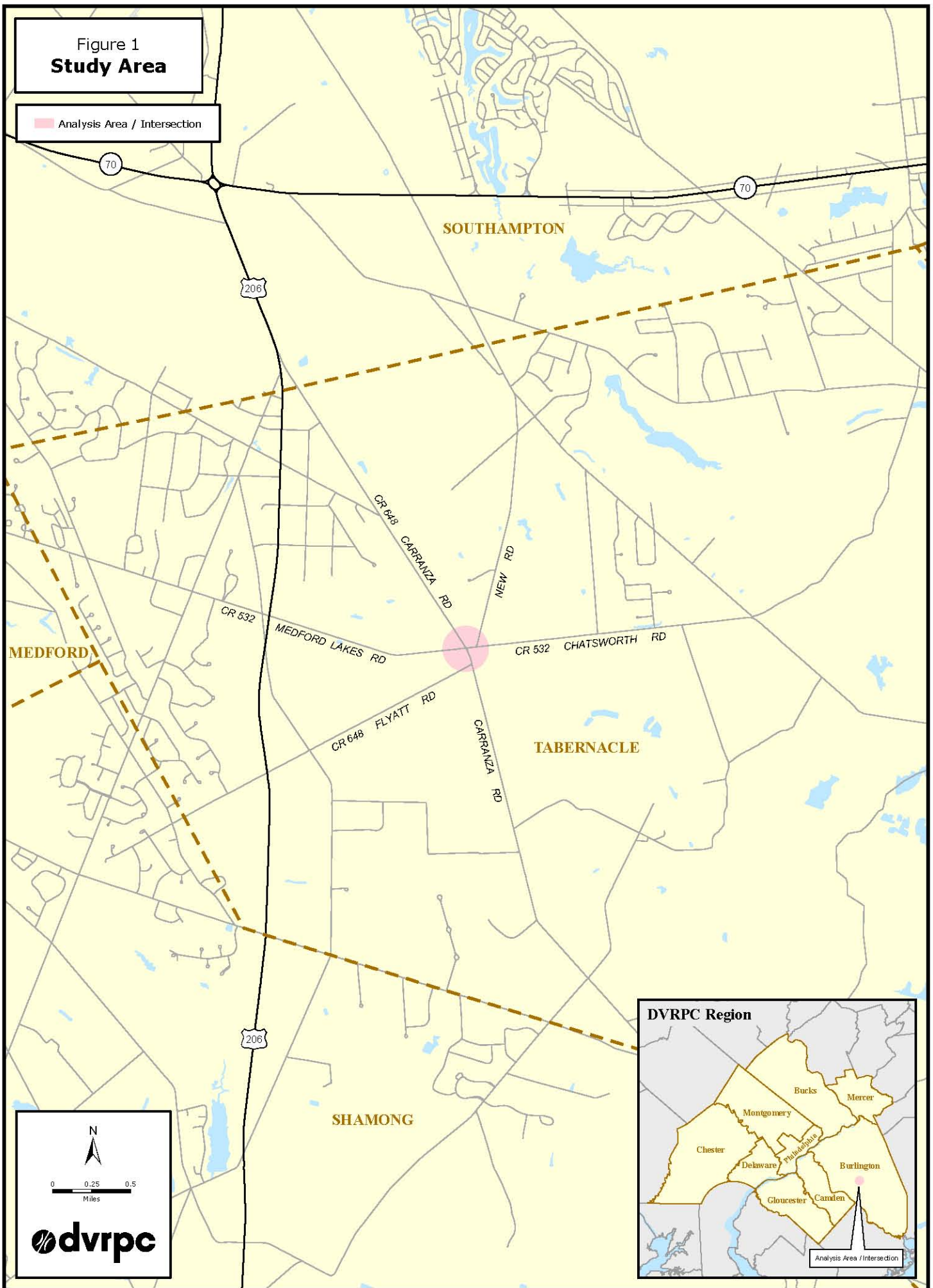
CR 648 runs in a northwesterly and southeasterly direction. For the purposes of this document, the orientation of CR 648 will be referenced as north and south. CR 532 runs in an east-west direction.

CR 648 and CR 532 Intersection

Northbound CR 648 is classified as a rural local roadway. It contains one shared through and left-turn lane, and a channelized right-turn lane that provides access to eastbound CR 532. Southbound CR 648 is classified as an urban collector and contains one shared through, left-turn, and right-turn lane. Eastbound and westbound CR 532 is classified as a principal arterial. The lane configuration is the same in both directions, consisting of one shared through, left-turn, and right-turn lane. This intersection is four-way stop-controlled, with shoulders, and bike lanes along CR 532.

Figure 1
Study Area

Analysis Area / Intersection



Existing Conditions

The study intersection serves local, commuter, and summer shore traffic. In the area east of the study intersection, older traffic counts taken in 1995 on CR 532 showed an AADT volume of 1,892 vehicles. 2009 counts taken west of the intersection on CR 532 showed an AADT volume of over 2,000 vehicles in each direction. No AADT data was available for CR 648.

The following bullets summarize some of the issues and comments made by the study advisory committee at the kick-off meeting concerning existing traffic conditions at the study intersection.

General Comments

- ◆ This intersection is part of the Burlington County bicycle network.
- ◆ The intersection has a wide layout.
- ◆ Farm tractors and heavy vehicle trucks travel through the intersection.
- ◆ Although schools and a crosswalk are located in the vicinity of the intersection, township officials stated that they had seen no pedestrian traffic.
- ◆ This intersection performs at optimal conditions throughout the day.
- ◆ Given the current traffic volumes, this intersection does not meet the criteria for a traffic signal.

Issues Discussed

- ◆ Motorists regularly fail to stop at the intersection.
- ◆ Several motorists speed through the intersection.
- ◆ The stop bar on the southbound CR 648 approach is located too far back from the intersection.
- ◆ The stop bar on the westbound CR 532 approach is located too far back from the intersection.
- ◆ The southbound CR 648 approach is wide enough for two separate approach lanes; however, it is currently striped as a single lane for all traffic movements. According to the county engineer, there is sufficient pavement between the curb and centerline to provide two 10 foot lanes and one 4 foot shoulder.
- ◆ There are heavy westbound right-turning movements during the morning peak period.
- ◆ The passing zone on CR 648 is located too close to the intersection (located approximately 150 feet north of the stop bar from the intersection).
- ◆ There are multiple driveway openings at Russo's Fruit and Vegetable Farm along CR 532, which may cause driver confusion.

Peak Hour Turning Movement Counts

Manual turning movement counts at the intersection were taken on May 10, 2011, between the hours of 6:00 AM and 9:00 AM, and between 3:00 PM and 6:00 PM. A peak hour turning movement diagram is shown in [Figure 2](#). The morning peak hour is 7:00 AM to 8:00 AM and the afternoon peak hour is 4:30 PM to 5:30 PM.

During the morning peak hour, 1,068 vehicles traveled through this intersection. The dominant movements in the morning were the northbound through movement on CR 648 (208 vehicles) and westbound CR 532 traffic turning right (199 vehicles). There were also 144 vehicles turning left from eastbound CR 532. Vehicles traveling north on CR 648 may be going to Seneca High School just north of the intersection, or to US 206. These heavier movements represented nearly 52 percent of the intersection's volume.

During the afternoon peak period, traffic flow in the area decreased slightly from traffic conditions in the morning. In the afternoon, 955 vehicles traveled through the intersection. The dominant movements were the eastbound (169 vehicles) and westbound (154 vehicles) through traffic along CR 532. Both movements represented 34 percent of the intersection's volume. The northbound right-turn and westbound left-turn movements were fairly even, with 103 and 100 vehicles, respectively. The eastbound right-turn and northbound left-turn movements were under 25 vehicles.

Figure 2

Peak Hour Turning Movement Counts

Intersection of CR 648 (Carranza Road) and CR 532 (Medford Lakes Road)

Tabernacle Municipal Complex

CR 532 (Medford Lakes Road)

76 / 76
46 / 95
26 / 58

144 / 35
98 / 169
7 / 21

AM Peak Hour: 7:00 – 8:00 AM
PM Peak Hour: 4:30 – 5:30 PM

Tabernacle Memorial Cemetery

CR 532 (Chatsworth Road)

199 / 73
97 / 154
69 / 100

Sequoia Alternative Program School

CR 648 (Carranza Road)

78 / 103
208 / 58
20 / 13

Russo's Fruit and Vegetable Farm

Existing LOS

LOS analysis was conducted for the study intersection in order to determine the operational quality in terms of vehicle delay. [Table 2](#) summarizes the LOS of the intersection under existing conditions.

As the table shows, during the morning and afternoon peak periods, the intersection is currently operating at desirable conditions of LOS B. The morning westbound approach experiences the greatest amount of delay at 17 seconds. The remaining approaches experience delays ranging between eight and 14 seconds.

Table 2: Existing LOS Analysis

CR 648 and CR 532 Intersection				
Direction	Morning		Afternoon	
	Delay (s)	LOS	Delay (s)	LOS
Northbound CR 648	11	B	8	A
Southbound CR 648	12	B	12	B
Eastbound CR 532	14	B	12	B
Westbound CR 532	17	C	14	B
Total Intersection	14	B	12	B

Source: DVRPC, 2011

Land Use

The land use surrounding the immediate intersection is mixed use. As shown in [Figure 3](#), the Tabernacle Municipal Complex and Tabernacle Memorial Cemetery are located north of the intersection. Russo's Fruit and Vegetable Farm and the Sequoia Alternative Program School are located south of the intersection.



View of bicyclists traveling through the intersection
(Source: DVRPC)



View from Russo's Fruit and Vegetable Farm of Tabernacle Memorial Cemetery
(Source: DVRPC)

Figure 3
Analysis Area



Tabernacle Memorial Cemetery

Sequoia Alternative Program (School)

Tabernacle Municipal Complex

Russo's Fruit and Vegetable Farm

0 25 50
Feet

Aerial Imagery: DVRPC, 2010

Bicyclists and Pedestrians

Bicyclist activity is evident in the study area. The eastbound and westbound CR 532 segments of the intersection are part of Burlington County's existing on-road bicycle network. Several bicyclists were observed traveling through the intersection during a field visit to the site location.

Although schools are located in the vicinity of the intersection, and there is a crosswalk located approximately 350 feet east of the intersection, pedestrian activity in the area is reportedly nonexistent. According to township officials the crosswalk is underutilized because students in the area are currently bussed or driven to schools and the surrounding area isn't conducive to pedestrian traffic. While pedestrians may not travel through the area, provision for their safety should always be considered.

Crash Analysis

This analysis includes all crashes that occurred at the intersection of CR 648 and CR 532 from 2008 through 2010. The main goals of this analysis are to highlight crash trends and determine causal factors. The collision diagram (Figure 4) is a graphic representation of the location, collision type, and frequency of vehicular crashes within the study area.

Data Description

The crash summaries and collision diagram used in this analysis were derived from reportable crash records provided by the New Jersey State Police, Red Lion Station. In New Jersey, a crash is considered reportable if it results in an injury, fatality, or property damage of \$500 or more as determined by the responding officer. Select statistics are summarized in Table 3. There were five reportable crashes recorded during the study period. There were no non-reportable crashes.

Crash History

Of the five reportable crashes recorded, there were no fatalities, one injury crash, and four property-damage-only crashes.

During the study period, there were four crashes recorded in 2008 and one recorded in 2010. Crashes fell within the following four collision categories: hit fixed object (2); angle (1); sideswipe opposite direction (1); and hit animal (1). The two hit-fixed-object crashes reported involved hitting a tree. Three of the five crashes occurred in February. One crash involved the use of a cell phone. Three of the five crashes were single-vehicle incidents. None of the crashes involved the use of alcohol.

Table 3: Crash Summary for CR 648 and CR 532 Intersection

Collision Type	Reportable
Angle	1
Opposite Direction Sideswipe	1
Hit-Fixed-Object	2
Hit Animal	1
Total	5

Source: DVRPC, 2011

Figure 4

Collision Diagram

Intersection of CR 648 (Carranza Road) and
CR 532 (Medford Lakes Road)

Crash Data Years = 2008 - 2010

Total Crashes = 5

**Tabernacle
Municipal Complex**

CR 532 (Medford Lakes Road)

CR 532 (Chatsworth Road)

**Tabernacle
Memorial Cemetery**

**Sequoia Alternative
Program School**

CR 648 (Carranza Road)

**Russo's Fruit and
Vegetable Farm**

Legend

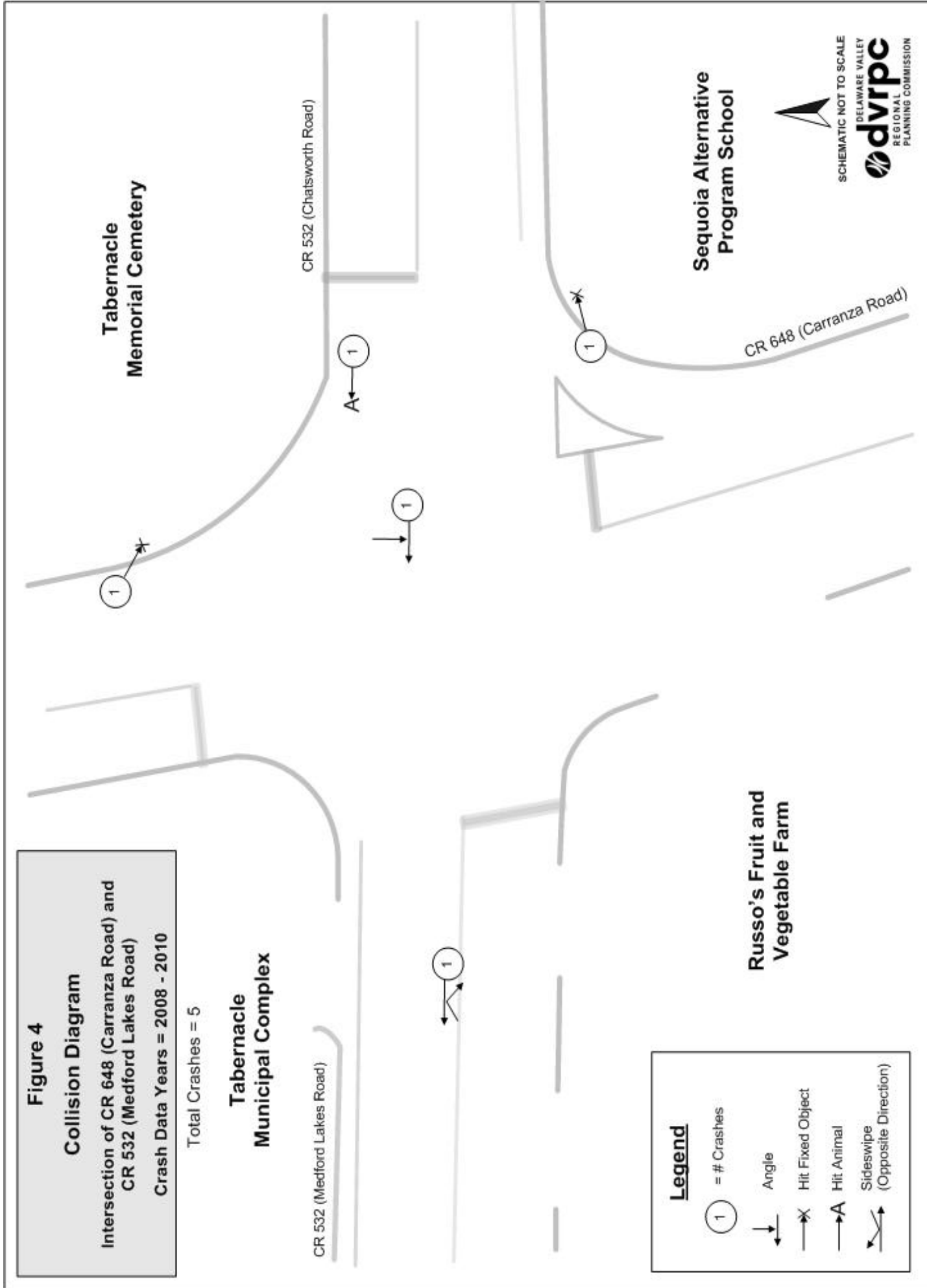
① = # Crashes

↓ Angle

→ X Hit Fixed Object

→ A Hit Animal

↔ Sideswipe
(Opposite Direction)



Issues and Potential Improvements

Building on this analysis, a range of strategies was developed by the stakeholders for this study. The strategies developed fell within the following two categories: safety and operational. Safety strategies consist of improvements that enhance and promote safer conditions for all roadway users traveling in the area. Examples of safety strategies include installing signage and adding or modifying pavement markings. Operational strategies include geometric improvements (e.g., changes in lane designation) at the intersection of CR 648 and CR 532.

Table 4 and the following sections describe the main issues and the corresponding strategies for alleviating these safety and operational concerns.

Table 4: CR 648 and CR 532 Issues and Potential Strategies

Issues	Potential Strategies
<ul style="list-style-type: none"> ■ 1. Motorists regularly fail to stop at the intersection. ■ 2. Motorists regularly speed through the intersection. ■ 3. The stop bar on the southbound CR 648 approach is located too far back from the intersection. ■ 4. The stop bar on the westbound CR 532 approach is located too far back from the intersection. ■ 5. The southbound CR 648 approach is wide enough for two separate approach lanes; however, it is currently striped as a single lane for all traffic movements. ■ 6. There are heavy westbound right-turning movements during the morning peak period. ■ 7. The passing zone on CR 648 is located too close to the intersection (located approximately 150 feet north of the stop bar from intersection). ■ 8. There are multiple driveway openings at Russo’s Fruit and Vegetable Farm along CR 532, which may cause driver confusion. 	<ul style="list-style-type: none"> ■ 1A. Consider installing a roundabout. ■ 1B. Install advance “stop ahead” warning signs. ■ 1C. Consider installing a flashing beacon. ■ 2. Consider installing a roundabout. ■ 3. Move the stop bar closer to the intersection. ■ 4. Move the stop bar closer to the intersection. ■ 5. Restripe the lane configuration for one exclusive right-turn lane and one shared through and left-turn lane. ■ 6. Add a dedicated right-turn lane at the westbound approach. ■ 7. Extend the “no passing” zone by adding double lines. ■ 8. Consider consolidating the driveways.

Source: DVRPC, 2011

Operational Strategies

Two operational strategies were developed and discussed for this intersection. The first operational strategy was refined so it could be simulated using Synchro software. A summary

and table are provided for each scenario tested. The results are for comparison to the existing LOS conditions documented in Chapter 3.

Scenario #1 – Add a Dedicated Right-Turn Lane to Southbound CR 648 and Westbound CR 532 Approaches

Characteristics

- ◆ Restripe the westbound CR 532 approach of the intersection to accommodate an exclusive right-turn lane.
- ◆ Restripe the southbound CR 648 approach of the intersection to accommodate an exclusive right-turn lane.
- ◆ The through and left-turning traffic on the southbound CR 648 and westbound CR 532 approaches will have a separate lane for dedicated movements.

Advantage

- ◆ This option reduces delay on the westbound approach, especially during the morning peak period.
- ◆ This option slightly reduces delay on the southbound approach.
- ◆ The southbound CR 648 approach is wide enough for two separate approach lanes. According to the county engineer, there is sufficient pavement between the curb and centerline to provide two 10 foot lanes and one 4 foot shoulder.

Disadvantage

- ◆ In order to accommodate the westbound CR 532 right-turn lane, right-of-way (ROW) would have to be acquired. ROW can not be acquired from the Tabernacle Memorial Cemetery, which is located north of the approach; however it could be purchased from the Sequoia Alternative Program School property, located south of the approach.
- ◆ If ROW is acquired from the Sequoia Alternative Program School property, the through lane on the eastside of the intersection will not line up properly with the through lane on the other side of the intersection. See [Figure 5](#).

LOS Analysis

Under this scenario, the overall LOS and vehicle delay in the morning and afternoon peak period is nearly identical to results from existing conditions. Compared with the existing conditions, in the morning the westbound approach experiences a five-second reduction in delay. The delay along most of the remaining approaches during both peak periods remains the same. The eastbound approach experiences a slight increase in delay during both peak periods. These results are shown in [Table 5](#) below.

Table 5: LOS Analysis – Scenario 1

Direction	Existing Condition				Scenario 1			
	AM		PM		AM		PM	
	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
Northbound CR 648	11	B	8	A	12	B	9	A
Southbound CR 648	12	B	12	B	11	B	10	B
Eastbound CR 532	14	B	12	B	17	C	13	B
Westbound CR 532	17	C	14	B	12	B	11	B
Total Intersection	14	B	12	B	13	B	11	B

Source: DVRPC, 2011

Scenario #2 – Construct a Roundabout

Characteristic

- ◆ Construct a single-lane roundabout.

Advantages

- ◆ Roundabouts reduce the chance and severity of crashes.
- ◆ Roundabouts force slower vehicle speeds.
- ◆ Roundabouts are more environmentally friendly (reduce pollution).
- ◆ Roundabouts are cheaper to maintain than a traffic signal.
- ◆ Drivers traveling through a roundabout experience less delay.

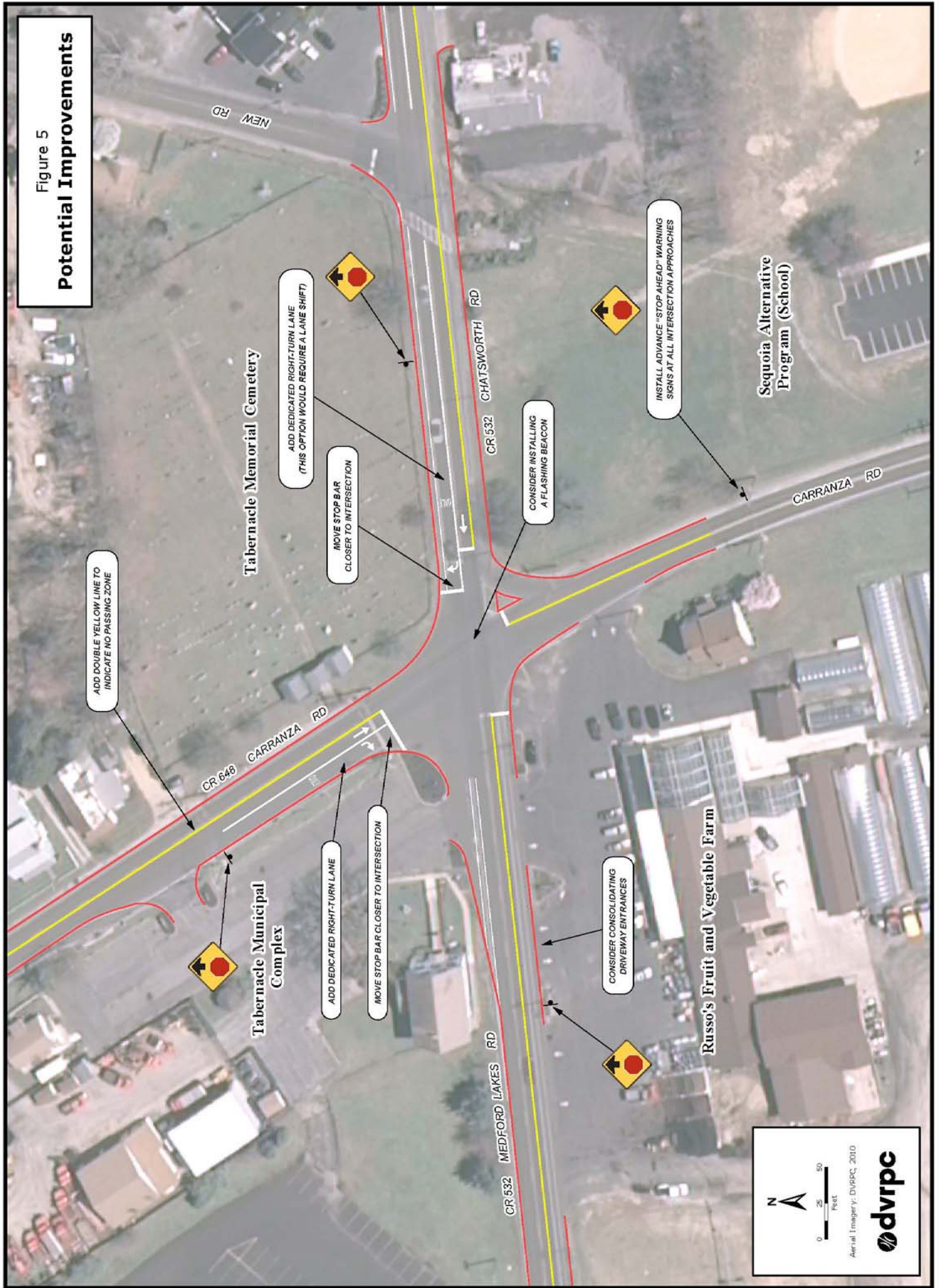
Disadvantages

- ◆ Given the skew layout of the intersection, there are limited options of where to place the roundabout. In order accommodate a roundabout at this location; ROW would need to be acquired from the Tabernacle Municipal Complex and Russo’s Fruit and Vegetable Farm. See [Figure 6](#).
- ◆ Officials from Tabernacle Township do not support the construction of a roundabout at the study intersection.

Conclusions from Scenarios

The intersection of CR 648 and CR 532 currently operates at desirable levels. Both of the scenarios considered provide some benefit in improving the traffic and making the intersection safer. Scenario 2 would likely have the greatest impact and a significant cost; however, without the support from the municipality, this option is not worth considering.

Figure 5
Potential Improvements





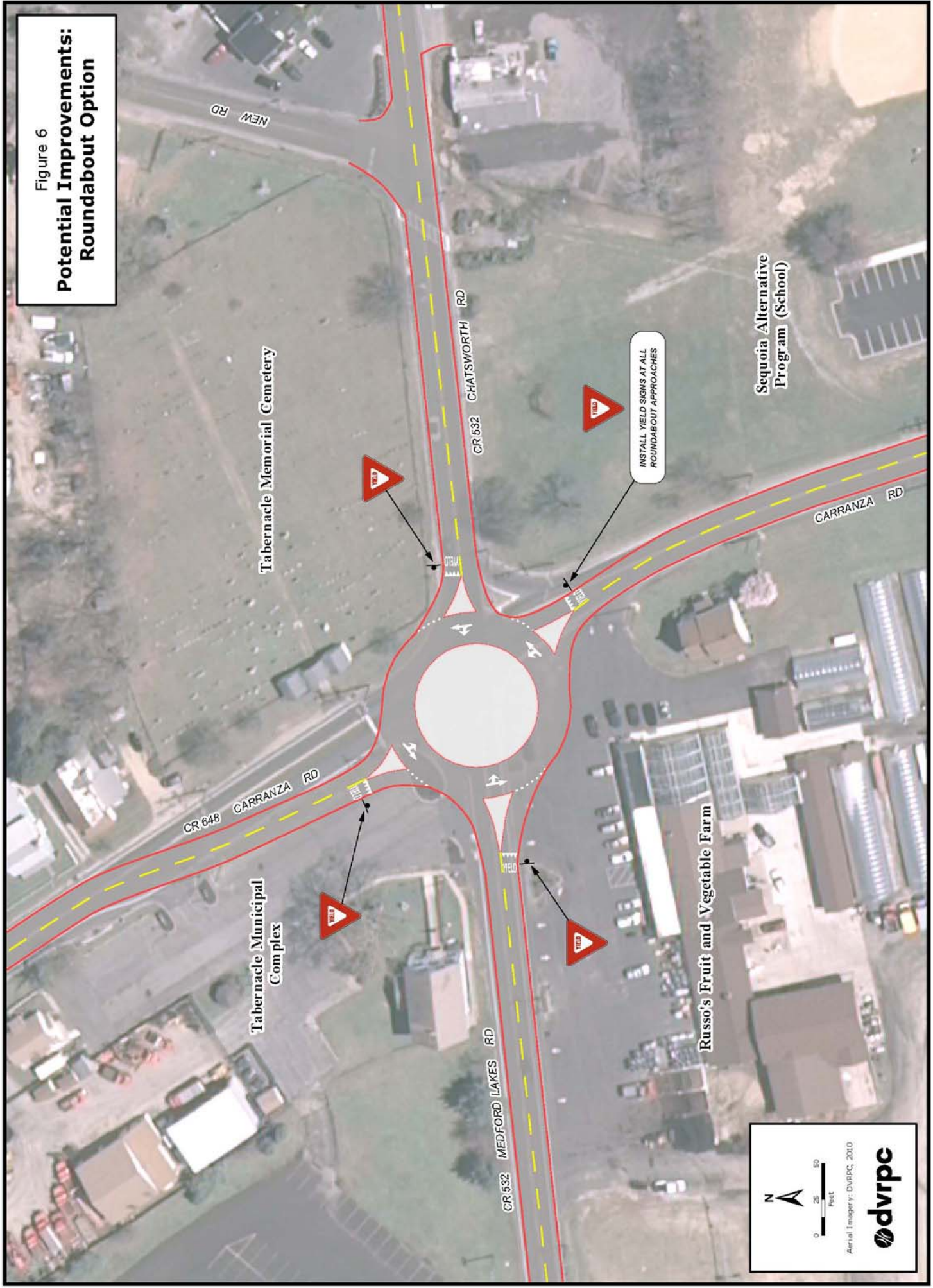

 0 25 50
 FEET
 Aerial Imagery: DVPCC, 2010



Figure 6

Potential Improvements: Roundabout Option



0 25 50 Feet

Aerial Imagery: DVRPC, 2010



Recommendations

At the follow-up meeting held on June 23, 2011, representatives from the Burlington County Engineering Department, Tabernacle Township, and DVRPC worked together and developed a set of recommendations. The agreed-upon recommendations should provide safety and operational benefits for the intersection of CR 648 and CR 532.

The short-term recommendations are listed in [Table 6](#). **The highlighted text in the table reflects the recommended improvements that the Burlington County Engineering Department has implemented.**

Table 6: Short-term Recommended Improvements

Issues	Recommended Improvements
<ul style="list-style-type: none"> ■ 1. Motorists fail to stop at the intersection. ■ 2. The stop bar on the southbound CR 648 approach is located too far back from the intersection. ■ 3. The southbound CR 648 approach is wide enough for two separate turn lanes; however, it is currently striped as a single lane for all traffic movements. ■ 4. The passing zone on CR 648 is located too close to the intersection (located approximately 150 feet north of the stop bar from intersection). 	<ul style="list-style-type: none"> ■ 1. Install advance “stop ahead” warning signs. ■ 2. Move the stop bar on the southbound CR 648 approach closer to the intersection. <i>The county has implemented this improvement.</i> ■ 3. Restripe the lane configuration for one exclusive right-turn lane and one shared through and left-turn lane. <i>The county has implemented this improvement.</i> ■ 4. Add double lines to indicate “no passing” zone. <i>The county has implemented this improvement.</i>

Source: DVRPC, 2011

Two long-term improvements were identified. The first long-term improvement is contingent upon the second recommendation being implemented. The long-term recommendations are listed in [Table 7](#).

Table 7: Long-term Recommended Improvements

Issues	Recommended Improvements
<ul style="list-style-type: none"> ■ 1. The stop bar on the westbound CR 532 approach is located too far back from the intersection. ■ 2. There are heavy westbound right-turning movements during the morning peak period. 	<ul style="list-style-type: none"> ■ 1. <i>The county will consider relocating the stop bar after determining whether to proceed with adding a right-turn lane.</i> ■ 2. <i>The county will consider adding a dedicated right-turn lane at the westbound approach.</i>

Source: DVRPC, 2011

APPENDIX A



Study Advisory Committee Members

Table A-1: Study Advisory Committee Members

Name	Organization	Title
Kim Brown	Tabernacle Township	Mayor
Doug Cramer	Tabernacle Township	Administrator
Marty Livingston	Burlington County Engineering Department	Traffic Engineer
Jesse Buerk	DVRPC	Transportation Planner
Regina Moore	DVRPC	Transportation Engineer

Source: DVRPC, 2011

Publication Title: Congestion and Crash Site Analysis Program –
Tabernacle Township, Burlington County

Publication Number: 10014

Date Published: October 2011

Geographic Area Covered: Tabernacle Township, Burlington County

Key Words: Carranza Road, Medford Lakes Road, CR 532, CR 648, high risk rural road, HRRR, level of service, LOS, intersection, safety, crashes, roadway, improvements, turning movements, peak hour, strategies

Abstract: This document represents the findings and recommendations for the Congestion and Crash Site Analysis Program study conducted in Burlington County in Fiscal Year 2011. This Program represents an effort to improve the mobility and safety on roadways in the DVRPC region. The goal of the program is to identify cost-effective improvement strategies that will reduce congestion and crashes and improve mobility and safety for all road users.

Working with a data-driven process and the Burlington County Engineering Department, the intersection of CR 648 (Carranza Road) and CR 532 (Medford Lakes Road/Chatsworth Road) was chosen for analysis. In-depth crash and level of service analyses were performed to quantify and gain an understanding of the issues. With input from the advisory committee, improvement strategies were identified to address the issues. As appropriate, proposed improvement strategies were tested for level of effectiveness and recommended for improving safety at the intersection. Some of the recommendations were immediately implemented by the county.

Staff Contact:

Regina Moore
Transportation Engineer
☎ (215) 238-2862
✉ rmoore@dvrpc.org

Delaware Valley Regional Planning Commission
190 N. Independence Mall West, 8th Floor
Philadelphia PA 19106
Phone: (215) 592-1800
Fax: (215) 592-9125
Internet: www.dvrpc.org



DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION

**190 N INDEPENDENCE MALL WEST
8TH FLOOR
PHILADELPHIA, PA 19106-1520
215.592.1800
WWW.DVRPC.ORG**