

# CR 541 Corridor Safety Review

## Burlington County, New Jersey



July 2012



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# Executive Summary

This corridor safety review established a three-year baseline of crash history and then compared that baseline to a subsequent three-year data period. The subject corridor, CR 541, is an important transportation artery in Burlington County that connects two heavily traveled major arterials at its ends: NJ 38 to the south, and US 130 to the north. This corridor also provides access to the New Jersey Turnpike and to I-295, carrying residential, commercial, and commuter traffic throughout. Safe and efficient traffic flow on CR 541 is important locally and regionally.

In the first analysis period (2005 to 2007), 759 crashes occurred, and during the second period, (2008 to 2010) the total increased to 792 (4.3 percent increase). Although the three-year total increased, yearly crash totals show a downward trend. Crashes on CR 541 increased between 2005 and 2008, and peaked at 284 in 2008. Since then, crashes have been declining and a low of 246 was recorded in 2010—a 13 percent reduction. This decline is consistent with both regional and national crash trends.

The most interesting finding from this analysis concerns crash severity. No fatal crashes occurred during either of the two analysis periods, and the percentage of injury crashes declined by just over one percent between analysis periods. Going further, injury severity also lessened, which translates into fewer incapacitating and moderate-level injuries. Despite the marginal increase in total crashes on the corridor, it is encouraging that injury crashes and severity both decreased. Non-injury crashes are a more desirable trend than one of more severe crashes, though difficult to address. This was the case with the CR 541 study corridor.

This analysis examines changes and trends from both the corridor-wide perspective and at 13 crash cluster locations along the 6.3-mile study corridor. Of the clusters, crashes decreased or remained the same in eight locations and increased in five. Only four of those five showed increases of greater than 15 percent in both total crashes and injury crashes. These four locations are evaluated more closely in the Cluster Analysis (Chapter 4).

The study involved representatives from local, county, state, and regional organizations, including engineers, planners, police, and local elected officials. The study area municipalities were Mount Holly, Westampton, and Burlington townships, and Burlington City. As DVRPC staff led the study team through an examination of crash details at priority clusters during the second committee meeting, Burlington County representatives presented planned and completed safety improvements that they were working on along the corridor. Although the study team was surprised to learn of these improvements, they were encouraged that the county was taking a proactive approach to safety on the corridor.

One exceptionally comprehensive safety improvement was the installation of pan/tilt/zoom closed-circuit TV cameras at each signalized intersection along CR 541 within the study area. These cameras feed information to the Burlington County Traffic Operations Center. Having access to this level of real-time information allows professionals to confirm incidents, alert Emergency

Medical Service (EMS) providers, and adjust signal timings if needed to deal with recurring traffic congestion or incident, and event-related congestion.

It is noteworthy that the improvements implemented by the county occurred over a multi-year period and that the analysis in this report overlaps that period. This study was not intended to provide a before and after crash comparison, but rather an examination of crash trends over time.

DVRPC recommends that this crash data review be conducted again once three years of new data are available for comparison. Through its annual work program, DVRPC is available to assist the county by providing additional crash analysis and planning support needed in acquiring federal safety dollars in order to continue this important safety work.



# Background

## Corridor Selection Process

The safety evaluation performed on the CR 541 corridor was conducted as part of the annual work program of DVRPC's Office of Transportation Safety and Congestion Management. Using Plan4Safety, the New Jersey Department of Transportation's (NJDOT) crash analysis tool, DVRPC was able to produce a list of all five-mile county route segments in the region that met a minimum crash threshold for years 2005 through 2007. County-specific top 10 lists were distributed to county partners for consideration for DVRPC's Road Safety Audit (RSA) program, or for a corridor safety review. Of the county route segments identified for consideration in Burlington County, this five-mile section of CR 541 had the highest crash total of any in the county, and was also regionally significant being within the 10 highest of DVRPC's four New Jersey counties (note: the study corridor limits were later expanded to 6.3 miles). Burlington County officials chose the corridor review option and selected CR 541 to study.

## Study Advisory Committee Meetings

The Study Advisory Committee (SAC) was comprised of representatives from Burlington City, the Burlington County Engineer's Office, Burlington County Planning Board, Burlington Township, Mount Holly and Westampton police departments and municipal offices, the Cross County Connection Transportation Management Association, and the NJDOT Bureau of Safety Programs. Appendix A contains the list of committee members representing each of these agencies.

Over the course of two SAC meetings, the group discussed crash findings, land use, roadway geometry, sight distance issues, transit, travel patterns, traffic trends, and traffic issues. During the second meeting, the DVRPC team led the SAC through a more detailed examination of five higher priority crash clusters. Various characteristics and trends were discussed, as well as potential improvements.

During the second SAC meeting, Burlington County representatives spoke about recently completed and planned improvements for many of the corridor cluster locations. In addition, DVRPC met with the county engineers subsequent to the second committee meeting to gather details on these improvements for incorporation in this report.

## Report Focus

This report provides crash statistics and analysis for both the corridor as a whole (corridor-wide) and for a set of 13 identified crash concentration areas (clusters). Data for two analysis periods is included: 2005 to 2007 establishes the baseline, and 2008 to 2010 provides the comparison. The two data sets allow for a comparison over time without any overlapping data.

The report narrative focuses only on those clusters where a notable increase in crashes occurred between the two analysis periods. Summary information is provided for the remaining clusters. Wherever possible, identified improvements are listed in their appropriate location and are considered regarding the identified crash problem.

# Setting

## Study Area

The study limits were originally identified as the beginning of the Mount Holly Bypass in the south, to the intersection with US 130 in the north. At the request of the committee during the study kick-off meeting, the southern limit was extended to include the intersection of CR 541 (Mount Holly Bypass) and CR 626 (Rancocas-Mount Holly Road). The resulting 6.3-mile study segment traverses four municipalities: Mount Holly, Westampton, and Burlington townships, and Burlington City (see Figure 1 on page 6).

## Land Use

The corridor study area and roadway frontage have a variety of land use types, including farmland, pockets of commercial and retail, and a small amount of residential development. From the southern end north to the intersection of Woodlane Road, CR 541 serves a suburban-style shopping district comprised of chain retail stores and fast food restaurants, with numerous driveways and unsignalized side-street intersections that lead to housing developments.

Continuing north between Woodlane Road and Hancock Lane, the land use intensity drops sharply as the roadway is flanked by farmland, with a small concentration of retail and professional uses located along Burrs Road. Hancock Lane provides access to the New Jersey Turnpike (NJTPK) via Exit 5 and to another small collection of restaurants and motels gathered close to the interchange serving long-distance travelers. Between Hancock Lane and I-295 Exit 47, the southbound side of the corridor contains farmland. The northbound side is fronted by a large suburban-style shopping complex that contains more chain retail shops and chain restaurants, and is home to the Burlington Center Mall. This one-and-a-half mile stretch is an important shopping destination and contains four signalized intersections.

Just north of I-295 is the on ramp to the Burlington Bypass, a truck route that provides a connection to US 130 that circumvents downtown Burlington City. Continuing north, for approximately one mile between the Burlington Bypass and Ellis Avenue, CR 541 is again fronted on both sides by a mix of suburban-style retail developments, including chain restaurants and big-box retail, with important signalized intersections at Cadillac Road, Sunset Road, and Garnet Drive. This land use pattern transitions gradually to a residential neighborhood. From this point north, the land use is residential, covering 13 neighborhood blocks for a length of just less than one mile.

Figure 1: Study Area



Source: DVRPC, 2012

## Lane Configurations, Speed Limits, and Turning Movements

As the land use changes along the corridor, the roadway configuration and speed limit also vary over the 6.3-mile study corridor length, though the functional class remains urban principal arterial throughout (see Figure 2, page 9). Turn movements along the corridor are handled both at-intersection and via nearside and far-side jug handles, plus a full cloverleaf interchange at I-295. These movements occur predominantly at the 14 signalized intersections, some of which combine both at-intersection turns with jug handles, which are a good way to give priority to through movements. The only exception is the more densely residential section through Burlington City, which contains about 13 blocks of neighborhood cross streets. Here, all turns are at-intersection.

On the Mount Holly Bypass section in the south between Rancocas-Mount Holly Road and High Street, there is a four-lane divided cross-section that has a 50 mile per hour (mph) speed limit. From the intersection of the Bypass and High Street north to the Woodlane Road intersection, the cross-section remains constant, but the speed limit drops to 35 mph. This most likely is to accommodate the turns to and from the suburban-style shopping district found there.

The approximately three-mile stretch between Woodlane Road and Sunset Road represents the longest unbroken section of the 50 mph posted speed limit. Within this section, the lane configuration is almost evenly split between four-lane and six-lane divided cross-sections with Irick Road marking the transition from four-lanes to six-lanes moving north. The only exception is at the I-295 interchange, where the outer lanes of CR 541 become exit-only ramp lanes, making it a four-lane configuration through that short section.

From Sunset Road to Fountain Avenue, CR 541 retains the four-lane cross-section, but is undivided. As in the south, this section is fronted on both sides by a mix of suburban-style retail developments. The speed limit here starts out at 40 mph, then at about halfway through this three-quarter mile stretch, transitions to 35 mph.

The Fountain Avenue intersection marks the transition from four-lane undivided roadway to three-lane undivided. This section, which continues right up to the US 130 intersection, has a one-lane per-direction and two-way-left-turn-lane configuration. The posted speed limit is 40 mph between Fountain Avenue and Mill Road, where it transitions to 35 mph through the remainder of the Burlington City section. The roadway widens back to four-lanes undivided at the intersection approach with US 130 to accommodate movements between these two major roadways.

## Traffic Volumes

Traffic volumes spike predictably in the vicinity of major interchanges (see Figure 3, page 10). Namely, the highest annual average daily traffic volumes were recorded near the I-295 interchange (Exit 47), at over 19,000 northbound and 16,900 southbound in 2009. Volumes drop slightly to approximately 15,000 per direction south of I-295 near the New Jersey Turnpike interchange. At the southern end of the corridor just north of where CR 541 meets CR 691 (High Street), a volume of 12,350 was recorded northbound and a volume of 15,900 was recorded southbound. The last count location is within the Burlington City neighborhood near 7th Street, where the volumes were about equal by direction, at just over 10,000 vehicles each way. This

makes sense, since much of the traffic that would be going to US 130 northbound was most likely removed from the stream via the Burlington Bypass.

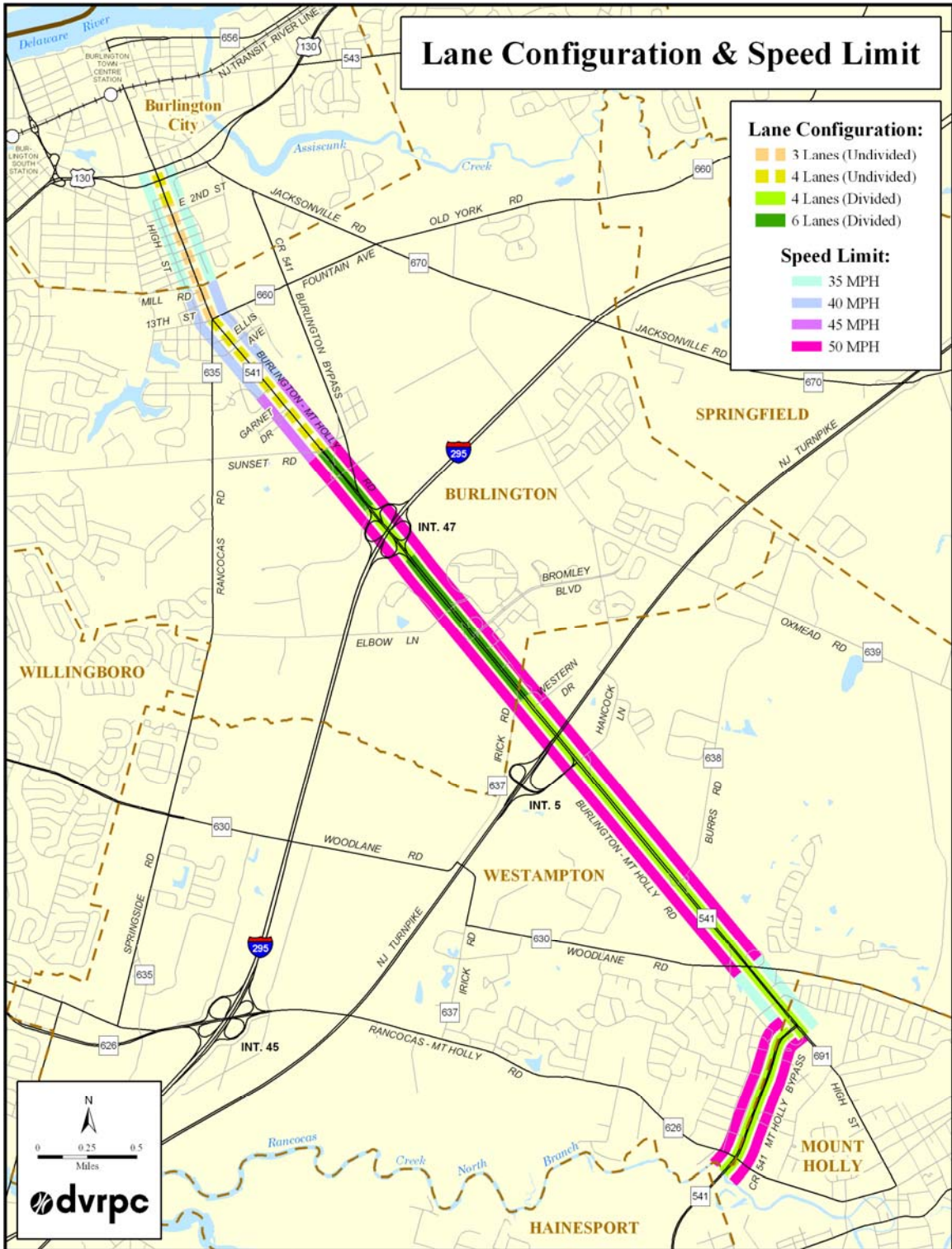
## Transit

The NJ Transit 413 bus route is the only transit service currently serving the entire length of the CR 541 study corridor, though it does not serve the bypass section between High Street and Woodlane Road. The 413 route begins at the Walter Rand Transportation Center in Camden City and traverses Pennsauken, Cherry Hill, Maple Shade, Moorestown, Mount Laurel, Hainesport, Lumberton, Mount Holly, Westampton, and Burlington townships, and Burlington City. This important route provides service to many major destinations along its course including the Cherry Hill and Moorestown malls, East Gate Center, Centerton Square, Burlington County College, Virtua Memorial Hospital, and the River LINE. This service has weekday headways of 30 minutes, starting at 5:34 AM, changing to one-hour headways from 10 AM on until the last full run at 8:11 PM. Limited service is available after 8 PM to 1:10 AM. On weekends there are one-hour headways, starting at 6:21 AM, with the last run at 9:21 PM. Along the CR 541 study corridor there are 14 marked stops and connections with the 409, and the 419 NJ Transit buses, the River LINE, and the BurLink Shuttle.

The BurLink Shuttle service connects people with major destinations not served by NJ Transit bus routes. At one time, the Burlink had a great presence along CR 541, but in 2009, two of those lines were removed from service—the B3 and B6. The B1 traverses a short stretch of CR 541 between CR 691 (High Street) and CR 630 (Woodlane Road), where passengers can transfer to and from the 413 bus route. The BurLink service is provided by the Burlington County Board of Chosen Freeholders.



Figure 2: Lane Configuration & Posted Speed Limit



Source: DVRPC, 2012

Figure 3: Annual Average Daily Traffic Volumes





# Corridor-wide Crash Analysis

## Corridor-wide Statistics: Comparisons and Observations between Analysis Periods, and with Statewide Averages

Presented here are findings from the corridor-wide analysis comparing study corridor data from years 2005 to 2007 with data from years 2008 to 2010. Corridor data from both periods is also compared to statewide averages for county routes. The baseline metric that NJDOT uses to judge a crash problem in context is a comparison to statewide averages for like facility types for various characteristics to identify overrepresentations. When a crash category is above the state average, it may warrant further investigation. Despite declining traffic crash numbers both regionally and nationally since 2008, the CR 541 corridor study area saw a slight increase (4.3 percent) in total crashes, from 759 to 792 between the two analysis periods. Corridor-wide crash trends can be hard to identify in a study area as long as 6.3 miles, where land use and lane configurations vary throughout. Although some corridor-wide trends were identified, smaller roadway sections with localized issues were also found. One corridor-wide trend common to both analysis periods and among the clusters was a predominance of rear-end collisions.

### Severity

Despite a 4.35 percent increase in total crashes between analysis periods, injury crashes decreased, as did injury severity—both encouraging findings—and no fatal crashes were recorded during either analysis period. The percentage of injury crashes declined slightly, from 30.2 percent to 28.9 percent. As stated previously, balancing total crash numbers with severity data helps to qualify the problem, especially given that a property damage only (PDO) crash requires only \$500 of property damage to be determined a reportable crash. This drop in injury crashes between analysis periods is positive; despite the fact that the study corridor's 2008 to 2010 injury crash average is just slightly higher (1.3 percent) than the statewide average of 27.86 percent. Thus, it can be concluded that crash severity is lessening on the study corridor.

Table 1 compares three of the four categories of nonfatal injury severity used in the New Jersey crash database: incapacitated, moderate injury, and complaint of pain (no crashes were listed in the “unknown” severity category in the study corridor). Of the injury crashes from the initial analysis period, 320 people were hurt and over 78 percent of the victims reported complaint of pain as their most severe injury, 17.5 percent suffered moderate injuries, and 3.75 percent were incapacitated (12 people).

Despite more people being injured (351) during years 2008 to 2010, the injuries were less severe. Approximately 87 percent reported complaint of pain, 10.54 percent suffered moderate injuries, and 1.71 percent were incapacitated (six people). The combination of zero fatalities, a predominance of low-severity injuries, and an overrepresentation of rear-end collisions are likely the result of frequent low-speed crashes. Though one main goal is to reduce the total number of crashes, a reduction in crash severity is also a high priority and has occurred on the CR 541 corridor over time. This is an encouraging trend.

Table 1: CR 541 Corridor-wide Summary - Injury Severity Comparison

	2005-2007		2008-2010	
	People Injured	Percent of People Injured	People Injured	Percent of People Injured
Incapacitated	12	3.75%	6	1.71%
Moderate Injury	56	17.50%	37	10.54%
Complaint of Pain	252	78.75%	308	87.75%
	320		351	

Source: DVRPC, 2012

### Collision Type

The predominant collision type was rear-end crashes in both analysis periods, though increasing in the second analysis period from 50.5 percent to 54.4 percent (see Table 2). Both rates were significantly higher than the current state average of 32 percent for county routes. This is somewhat predictable given the divided roadway configuration present in over half of the study area length, which reduces the possibility for opposite or angular direction collision types. This overrepresentation was discussed during the study team meetings, and the group suggested the relatively wide signal spacing due to land development density along the corridor may increase the probability of approaching a traffic queue at a red light unexpectedly—a situation which leads to rear-end crashes. This has been found in other similar situations.

Same-direction sideswipe crashes decreased between analysis periods by about one percent (13.3 percent down to 12.4 percent), though they were still slightly higher than the statewide average of 11.7 percent. These crashes are the second greatest in concentration after rear-end crashes, though not as significant as the former. Sideswipe crashes tend to be more common in multilane cross-section road types as can be found along the majority of CR 541, where passing and unrestricted lane changing is commonplace, as is speeding. Also of note was the reduction in right-angle crashes, from 13.3 percent to 10.6 percent (statewide average is 18.7 percent), though no obvious explanation is available. Minor fluctuations were found in most of the remaining 14 crash collision types, though none greater than 0.7 percent.

Table 2: CR 541 Corridor-wide Summary - Collision Type

2005-2007 17.50 – 23.84 Total Crashes: 759			2008-2010 17.50 – 23.84 Total Crashes: 792		2010 Statewide Statistics for County Routes Total Crashes: 76,302	
Collision Type	Total	%	Total	%	Total	%
Rear End (Same Direction)	383	50.5%	431	54.4%	24758	32.5%
Side Swipe (Same Direction)	101	13.3%	98	12.4%	8927	11.7%
Right Angle	101	13.3%	84	10.6%	14320	18.8%
Opposite Direction	5	0.7%	3	0.4%	2528	3.3%
Struck Parked Vehicle	6	0.8%	11	1.4%	4255	5.6%
Left Turn / U Turn	41	5.4%	48	6.1%	3550	4.7%
Backing	6	0.8%	3	0.4%	1740	2.3%
Encroachment	1	0.1%	1	0.1%	266	0.4%
Overtuned	2	0.3%	5	0.6%	522	0.7%
Fixed Object	74	9.7%	74	9.3%	8648	11.3%
Animal	21	2.8%	21	2.7%	3606	4.7%
Pedestrian	4	0.5%	7	0.9%	1454	1.9%
Pedalcyclist	4	0.5%	2	0.3%	743	1.0%
Non-fixed Object	4	0.5%	3	0.4%	363	0.5%
Railcar - Vehicle	0	0.0%	0	0.0%	6	0.0%
Unknown	0	0.0%	0	0.0%	38	0.1%
Other	6	0.8%	1	0.1%	578	0.8%
total	759	100.0%	792	100.0%	76302	100.0%

Source: DVRPC, 2012

### Pedestrians and Bicyclists

Unfortunately, the number of pedestrian crashes along the corridor increased from four in the 2005 to 2007 analysis to seven during the 2008 to 2010 period, but thankfully, no pedestrians were killed. Though the percentage (0.9) is still lower than the statewide average for similar roads (1.91), this is worth further consideration. This increase in pedestrian crashes follows the recent state trend of increasing pedestrian crashes. The cause for this rise in statewide numbers is not fully understood, though many speculate that walking, biking, and transit usage tend to increase during an economic downturn, which also increases crash exposure. Fortunately, bicycle crashes declined between analysis periods, from four to two (0.5 to 0.3 percent)—also below the statewide average of 0.9 percent.

## Roadway Surface Condition

Regarding roadway surface condition, a slight shift occurred between dry conditions and both the wet and snowy conditions (see Table 3). Wet road surface crashes increased from 18.8 percent in 2005 to 2007 to 21.8 percent in 2008 to 2010, which is about 20 percent higher than the statewide average of 15.9 percent. Additionally, there were eight snowy road surface condition crashes in the 2005-2007 period, and 22 during the latter analysis period (2.8 percent), though still below the state average of 3.2 percent. These categories reflect variations in local weather conditions from year to year.

Table 3: CR 541 Corridor-wide Summary - Road Surface Condition

2005-2007 17.50 – 23.84 Total Crashes: 759			2008-2010 17.50 – 23.84 Total Crashes: 792		2010 Statewide Statistics for County Routes Total Crashes: 76,302	
Surface Condition	Total	%	Total	%	Total	%
Dry	596	78.5%	588	74.2%	60068	78.7%
Wet	143	18.8%	173	21.8%	12159	15.9%
Snowy	8	1.1%	22	2.8%	2447	3.2%
Icy	8	1.1%	8	1.0%	1005	1.3%
Other	4	0.5%	1	0.0%	623	0.8%
total	759	100.0%	792	100.0%	76302	100.0%

Source: DVRPC, 2012

## At-intersection vs. Between Intersection

The percentage of at-intersection crashes declined from 33.7 percent in the 2005 to 2007 analysis period to 24.9 percent during 2008 to 2010 (see Table 4). This is important, as it may be the result of the county's signal upgrade project that increased the standard signal heads to 12-inch-sized heads for better visibility, along the entire corridor study area. This project was underway during the second analysis period.

The between-intersection crashes were at 66.1 percent during the 2005 to 2007 analysis period, and then climbed to 75.1 percent in the second analysis period. Both of these percentages exceed the state average of 60.9 percent.

The NJDOT's Bureau of Safety Programs uses strict criteria for intersection crashes, which are defined as having occurred within the intersection stop bars. This allows the state to address common pre-crash trends using proven countermeasures specifically designed to reduce intersection crashes. Crashes that occur at intersection approaches, but still outside the intersection box, are considered intersection-related crashes.

Table 4: CR 541 Corridor-wide Summary - Intersection

2005-2007 17.50 – 23.84 Total Crashes: 759			2008-2010 17.50 – 23.84 Total Crashes: 792		2010 Statewide Statistics for County Routes Total Crashes: 76,302	
Intersection	Total	%	Total	%	Total	%
At Intersection	256	33.7%	197	24.9%	29773	39.02%
Not at Intersection	502	66.1%	595	75.1%	46493	60.93%
At or Near Railroad Crossing	1	0.1%	0	0.0%	36	0.05%
total	759	100.0%	792	100.0%	76302	100.0%

Source: DVRPC, 2012

### Light Condition

As shown in Table 5, over 70 percent of the crashes occurred during daylight condition in both analysis periods, which is fairly typical and consistent with statewide averages. Nighttime crashes slightly exceeded statewide percentages during the 2005 to 2007 period, but during the 2008 to 2010 period, the percentage was reduced to 20.6 percent, just more than three percentage points below the statewide number.

Table 5: CR 541 Corridor-wide Summary - Light Condition

2005-2007 17.50 – 23.84 Total Crashes: 759			2008-2010 17.50 – 23.84 Total Crashes: 792		2010 Statewide Statistics for County Routes Total Crashes: 76,302	
Light Condition	Total	%	Total	%	Total	%
Day	546	71.9%	605	76.4%	54512	71.4%
Dusk	19	2.5%	17	2.2%	1997	2.6%
Night	188	24.8%	163	20.6%	18624	24.4%
Dawn	6	0.8%	5	0.6%	845	1.1%
Other/Unknown	0	0.0%	2	0.1%	324	0.4%
total	759	100.0%	791	100.0%	76302	100.0%

Source: DVRPC, 2012

## Other Corridor-wide Crash Trends

- ▶ Examining the entire six-year analysis period as a whole, crashes along the corridor increased between 2005 and 2008, when they peaked at 284 in 2008. Since then crashes have been declining, and a low of 246 was recorded in 2010.
- ▶ The highest number of crashes was recorded each December in both analysis periods. This may be a result of increased traffic along CR 541 due to holiday shoppers.
- ▶ Noticeable variations were identified in the crashes per weekday totals. In both analysis periods, the fewest crashes were recorded on Sundays and the most on Fridays. The committee reported that the peak-hour periods (which coincide with A.M. and P.M. rush hours) seem to be extended on Fridays, which could be a factor as to why so many crashes are occurring on that particular day. A closer look at the time-of-day distribution across all days shows that approximately 57 percent of the crashes occurred during the noon to 6 PM period, with 4 PM having the highest hourly total during the 2005 to 2007 period, and 5 PM during the latter analysis period. These findings support the committee's assertions.
- ▶ Ambient lighting conditions are present along most of the corridor (US 130 to the NJTPK) and there are noticeably darker conditions from the NJTPK to the southern corridor limit. The corridor-wide analysis showed that the percentage of crashes that occurred during daylight was higher than the statewide average during both analysis periods. Also, crashes declined in the dusk, night, and dawn categories between the two analysis periods. This may be an indication of lighting, striping, or retroreflectivity upgrades along the corridor.
- ▶ Driver inattention, the second highest contributing circumstance, noted in 25 percent of the crashes, captures a range of commonly cited behaviors, including eating and cell phone use. This is often the second most common contributing circumstance behind "none," as found in other crash analysis projects conducted by DVRPC. "None" is typically assigned when a driver is stopped at a red signal and is rear-ended, or when the driver did nothing to contribute to the crash. These percentages were roughly the same between analysis periods.

# Cluster Analysis

## Cluster Determination

The Study Advisory Committee was originally presented with 14 crash concentrations, or clusters, for further investigation. These clusters were identified using a cluster finder database tool, employing the following criteria: one-tenth mile roadway segments where a minimum of 24 crashes occurred during the three-year study period. During the first committee meeting, the group asked for cluster limit changes to better reflect localized conditions. In most situations, these changes broadened the concentration limits, which decentralized the focal points, and increased the crash totals. Despite the changes, 11 of the final 13 clusters either center on, or include an intersection (see Figure 4 on page 20). This is not surprising; intersections are typically crash attractors, as red signals and turning movements interrupt traffic flow.

The I-295 interchange area cluster was not identified through the database analysis but was added to the list following the first meeting. Although this location only showed 17 crashes during the initial analysis period, it was included because highway interchange areas typically present hazards for pedestrians and bicyclists, a concern expressed by committee.

Through the study process the committee identified nine of the clusters as high priority: 1, 3, 5, 7, 8, 9, 10, 11, and 12. Of those nine, four were discussed in detail during the second study committee meeting: 3, 7, 9, and 10. Cluster 13 was also examined in the second meeting due to its unique character as compared to the rest of the corridor. Figure 4 shows all clusters in the study area, and lists the crash totals from both analysis periods for comparison. Those clusters that had crash increases between study periods are shown in red, and those that decreased are shown in green. Table 6 on page 19 provides a comparison of analysis periods for each cluster location. The clusters where the most significant increases in total crashes occurred are discussed in more detail starting on page 21.

## Cluster Review

The following narrative discusses changes in crash clusters between periods, including a comparison to corridor-wide crashes and a more detailed focus on the four clusters where crashes increased by more than 15 percent between analysis periods: clusters 2, 6, 9, and 10.

## Cluster Crashes as Compared to Corridor Total: General Observations

When combined, the final list of 13 identified clusters included 693 crashes, representing 91 percent of the corridor's 759 crashes recorded during the 2005 to 2007 analysis period. During the recent period, the cluster percentage decreased to 86 percent despite an increase in total crashes across the corridor. Injury crashes within the clusters decreased slightly from 211 to 201, about one-half percent. Pedestrian crashes increased from four to five within the clusters between periods, while corridor-wide pedestrian crashes increased from four to seven.

## Cluster Changes Over Time

General Cluster Findings:

- ▶ Total crashes increased in five clusters, decreased in seven, and remained the same in one;
- ▶ Injury crashes increased in eight clusters and decreased in five clusters;
- ▶ In three clusters where total crashes decreased, the injury percentage increased;
- ▶ In one cluster, the total crashes increased and the injury percentage decreased.

Highlights of Crash Cluster Increases:

Four of the five crash cluster increases were between 19 percent and 40 percent.

- ▶ The largest total crash increase was at Cluster 10 (Sunset Road intersection), which increased by 28 crashes, from 69 to 97 between analysis periods (this cluster also had the highest percentage increase of 40.6 percent).
- ▶ The smallest increase (five percent) was in Cluster 12 at the Fountain Avenue intersection, where total crashes increased from 39 to 41 between periods.

Highlights of Crash Cluster Decreases:

Two clusters decreased by under two percent and the remaining five clusters had decreases of between 12 and 64 percent.

- ▶ A 64 percent decrease was recorded at the I-295 interchange (Cluster 8), where crashes dropped from 17 during the 2005 to 2007 period to six during the 2008 to 2010 period;
- ▶ The largest total crash reduction was at Cluster 5 (NJTPK interchange at Hancock Drive), which saw a decline of 22 crashes (43 percent), from 51 to 29 between analysis periods;
- ▶ Cluster 13 (12<sup>th</sup> Street to Fountain Avenue) experienced the second highest total crash reduction of 21 fewer crashes between analysis periods, from 132 ('05-'07) to 111 ('08-'10);
- ▶ Cluster 3 (intersection at CR 630 Woodlane Road) experienced a less than two percent drop in total crashes, though the injury percentage declined by over 60 percent.

The injury crash percentage of the cluster crash total declined slightly between analysis periods, from 30.4 percent (2005 to 2007) to 29.6 percent (2008 to 2010).



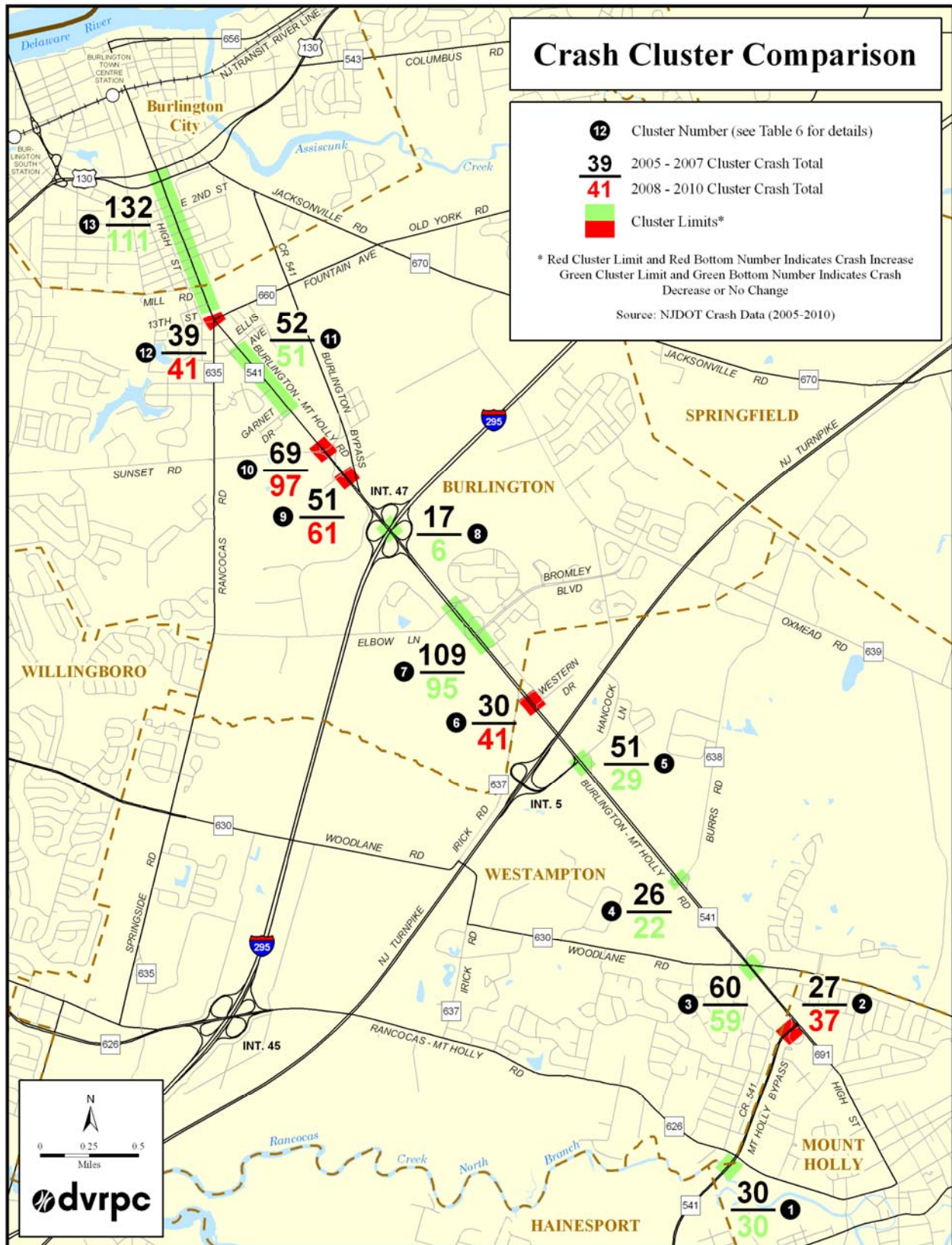
Table 6: Crash Cluster Comparison

Cluster Number	MP Start	MP End	Cluster Length (mi)	Nearby Cross Street(s)	Total Crashes		Total Change Btwn Periods	Percent Change Btwn Periods	Total Injury Change Btwn Periods	Injury Crash Percentage	
					'05-'07	'08-'10				'05-'07	'08-'10
1	17.5	17.6	0.1	Rancocas-Mt. Holly Rd	30	30	0	0.0%	-2	36.7%	30.0%
2	18.26	18.36	0.1	CR 691 Mt. Holly-Burlington Rd	27	37	10	37.0%	4	19.0%	24.0%
3	18.69	18.79	0.1	CR 630 Woodlane Rd	60	59	-1	-1.7%	-17	46.7%	18.6%
4	19.29	19.35	0.06	CR 638 Burrs Rd	26	22	-4	-15.4%	1	19.2%	27.3%
5	20.04	20.14	0.1	NJTPK Interchange & Hancock Ln	51	29	-22	-43.1%	-12	35.3%	20.7%
6	20.44	20.54	0.1	Western Dr & Irick Rd	30	41	11	36.7%	3	40.0%	36.6%
7	20.81	21.16	0.32	Bromley & Elbow	109	95	-14	-12.8%	-7	33.0%	30.5%
8	21.58	21.68	0.1	I-295	17	6	-11	-64.7%	-2	23.5%	33.3%
9	21.93	22.01	0.08	Cadillac Rd	51	61	10	19.6%	6	29.4%	34.4%
10	22.11	22.21	0.1	Sunset Rd	69	97	28	40.6%	10	20.3%	24.7%
11	22.41	22.85	0.44	Garnet Dr to Dresser Ave	52	51	-1	-1.9%	4	34.6%	43.1%
12	22.99	23.05	0.06	Fountain Ave	39	41	2	5.1%	2	23.1%	26.8%
13	23.07	23.84	0.77	12th St to US 130 (study area limit)	132	111	-21	-15.9%	0	27.3%	32.4%

Red indicates an increase, green indicates a decrease, and black indicates no change.

Source: DVRPC, 2012

Figure 4: Crash Cluster Comparison

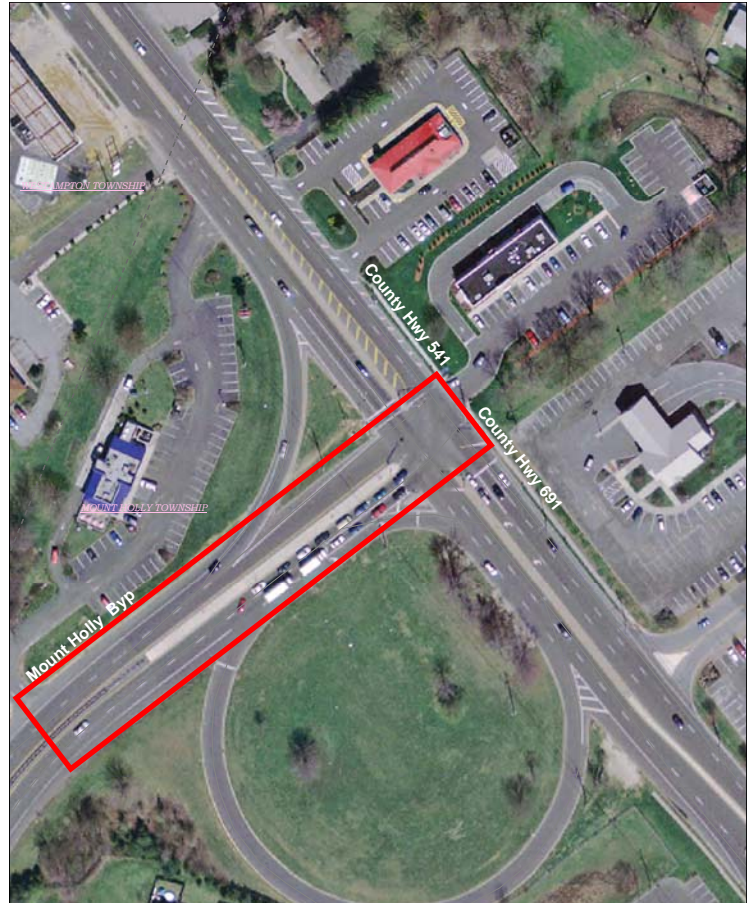


## Cluster #2: Intersection with CR 691 Mt. Holly-Burlington Road

Milepost 18.26 – 18.36: 1/10<sup>th</sup> mile cluster including the intersection  
27 crashes ('05-'07), 37 crashes ('08-'10)

- ▶ 37 percent **increase** in total crashes; and
- ▶ Injury crashes **increased** by five percentage points.

Cluster #2 is a one-tenth-mile-long section located along CR 541 in the vicinity of the CR 691 and Mount Holly-Burlington Road intersection (mile post 18.35), comprised predominantly of the roadway section where the bypass meets the local road. Twenty-seven (27) total crashes were recorded in this cluster during the 2005 to 2007 period, and 37 during 2008 to 2010. At this location, CR 541 is four lanes wide, plus turn lanes and jug handle lanes. Left turns and U-turns from CR 541 southbound are facilitated by a far-side jug handle, and right turns to the bypass are made via a slip ramp. All northbound turns are made at the intersection.



Red box indicates cluster limits

Source: DVRPC

Within this one-tenth mile cluster, the crashes were concentrated mostly at milepost 18.35 during both analysis periods (33 percent in the first and 43 percent in the second), which is at the intersection midpoint. Crashes by direction of travel were evenly split between north and southbound directions in 2005 to 2007, though the split changed to 54 percent northbound and 43 percent southbound during 2008 to 2010. Regarding collision type, there was a shift in proportions between analysis periods. Rear-end and hit-fixed-object crashes each accounted for 33 percent during 2005 to 2007. In the recent analysis period, both of these types were predominant, but rear-end accounted for 46 percent and hit-fixed-object increased also, but only to 38 percent. Both of these collision type percentages are above statewide averages for county route signalized intersections, at 28.15 percent for rear-end crashes and 4.74 percent for hit-fixed-object crashes.



Injury crashes increased from five to nine during the second analysis period, though still below the statewide average for signalized intersections. Also, one pedestrian crash was recorded in the latter analysis and no pedestrian crashes occurred in the initial analysis.

No significant differences were recorded regarding light condition, though changes were seen in surface-condition-related crashes. In the latter analysis period, wet surface condition crashes increased to 41 percent, up from 30 percent, and snowy condition crashes increased from four to five percent in the 2008 to 2010 period. More crash cluster details can be found in Appendix B.

### Cluster #6: Intersections with Western Drive and Irick Road

Milepost 20.44 – 20.54: 1/10<sup>th</sup> mile cluster including the Irick Road intersection  
30 crashes ('05-'07), 41 crashes ('08-'10)

- ▶ 36.7 percent **increase** in total crashes; and
- ▶ Injury crashes **decreased** by 3.4 percentage points.

Cluster #6 is located along CR 541 between mileposts 20.44 and 20.54, near the signalized intersection at Irick Road (milepost 20.52). At this location, CR 541 is two lanes per direction and turn movements are accommodated by a combination of near, and far-side jug handles. Thirty crashes were recorded in this cluster during the initial analysis period (2005 to 2007), and 41 in the later period.

In the initial analysis period, the crashes were more evenly distributed throughout the cluster, but in the latter period, 53 percent of the crashes occurred at milepost 20.52, where Irick Road meets CR 541. Crashes were heavier

northbound (53 percent) than southbound (37) during the initial period, but were more evenly split during the latter period (54 percent northbound and 44 percent southbound).



Red box indicates cluster limits

Source: DVRPC

Severity distribution remained very similar between analysis periods, though a small shift occurred in the latter period where fewer injury crashes were recorded, though still slightly above the statewide average. The collision type distribution changed between periods: in the first period, rear-end crashes were predominant at 53 percent, and in the latter period, rear-end remained the top collision type, but only at 37 percent. Right-angle and sideswipe crashes increased from 10 percent each to 27 and 20 percent, respectively. Both the right-angle and sideswipe percentages exceeded statewide averages. Regarding light condition, crashes at night dropped from 30 percent to 20 percent between analysis periods. In the initial period, 80 percent of the crashes occurred on dry surface conditions. That number dropped to 68 percent, while 24 percent of the crashes occurred on wet surface conditions and another seven percent on snowy roads; both exceed state averages for those categories. See Appendix B for more details.

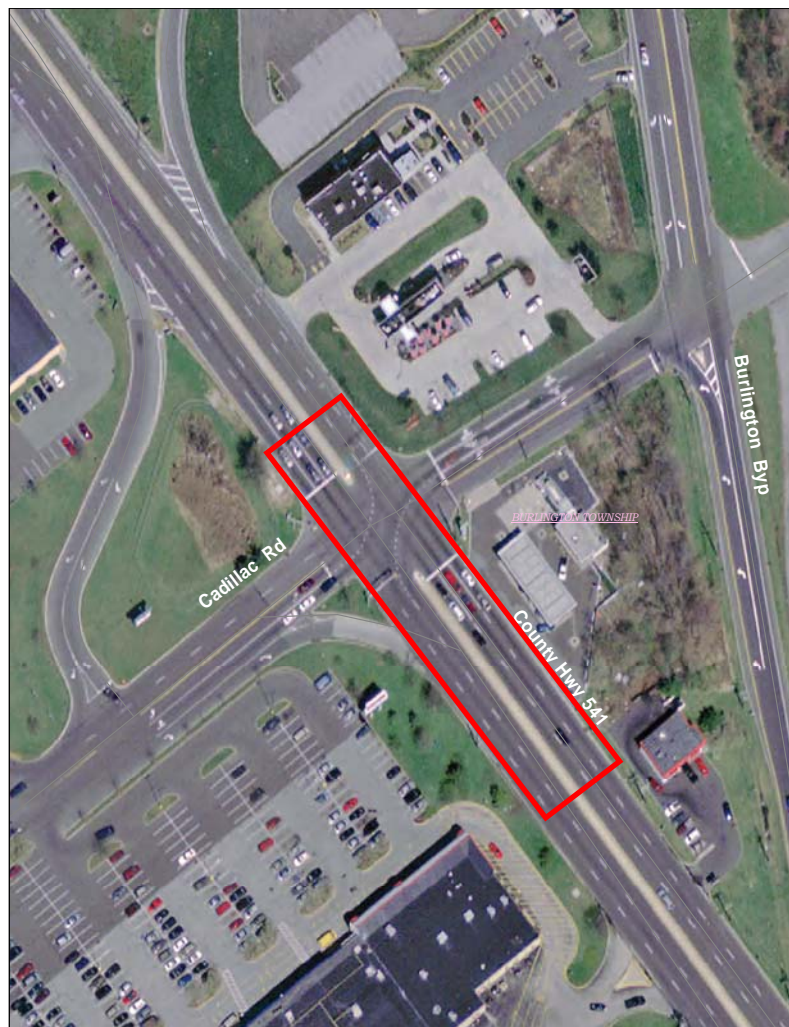
### Cluster #9: Intersection with Cadillac Road

Milepost 21.93 – 22.01: 0.08 mile section centered on the Cadillac Road intersection  
 51 crashes ('05-'07), 61 crashes ('08-'10)

- ▶ 19.6 percent **increase** in total crashes; and
- ▶ Injury crashes **increased** by five percentage points.

Cluster #9 is located along CR 541 between mileposts 21.93 and 22.01, near the Cadillac Road intersection (milepost 21.97).

At this location, CR 541 is six lanes wide. Left-turns from CR 541 are accommodated via nearside jug handles from both directions. Left-turns from Cadillac Road onto CR 541 are made via dedicated left-turn lanes from each approach. In addition to serving as part of the northbound CR 541 jug handle, Cadillac Road is also an important connector between southbound bypass traffic and CR 541, carrying all northbound traffic to the commercial



Red box indicates cluster limits

Source: DVRPC

destinations located west of the intersection.

Although the percentage of injury crashes increased somewhat between the analysis periods, neither exceeded the statewide average of 34.44 percent, though the 2008 to 2010 injury crashes were at 34 percent. Wet surface condition crashes were above the statewide average of 15.9 percent in both analysis period, and up from 20 to 21 percent between periods.

Regarding milepost distribution, in the initial analysis, 61 percent of the crashes were coded to milepost 21.97 (at the intersection). In the latter period, only 43 percent of the crashes were recorded there. This number, combined with the adjacent mile postings to the south (23 percent) and to the north (15 percent) of the intersection, accounted for 80 percent of the crashes.

Directional split proportions are nearly the same between analysis periods. In the 2005 to 2007 period, northbound crashes accounted for 43 percent, and southbound, 37 percent. This was switched in 2008 to 2010, when southbound recorded 46 percent and northbound 38 percent of the crashes. Common to both periods were westbound crashes, which accounted for over 13 percent. This may be related to the heavy flow of traffic from the Burlington Bypass, which enters CR 541 from Cadillac Road.

Collision type distribution is heavy on rear-end, sideswipe, and hit-fixed-object crashes in both analysis periods, though shifts occurred between periods. Rear-end crashes were predominant in both periods, though the percentage increased from 33 to 51 percent during 2008 to 2010. Sideswipe crashes decreased from 25 to 21 percent, and hit-fixed-object collisions decreased from 12 to 8 percent. Most important is that each of these collision type percentages exceeded the statewide averages, with rear-end and sideswipe crashes being almost double the state numbers.

### Cluster #10: Intersection with Sunset Road

Milepost 22.11 – 22.21: 1/10 mile section centered on Sunset Road intersection

69 crashes ('05-'07), 97 crashes ('08-'10)

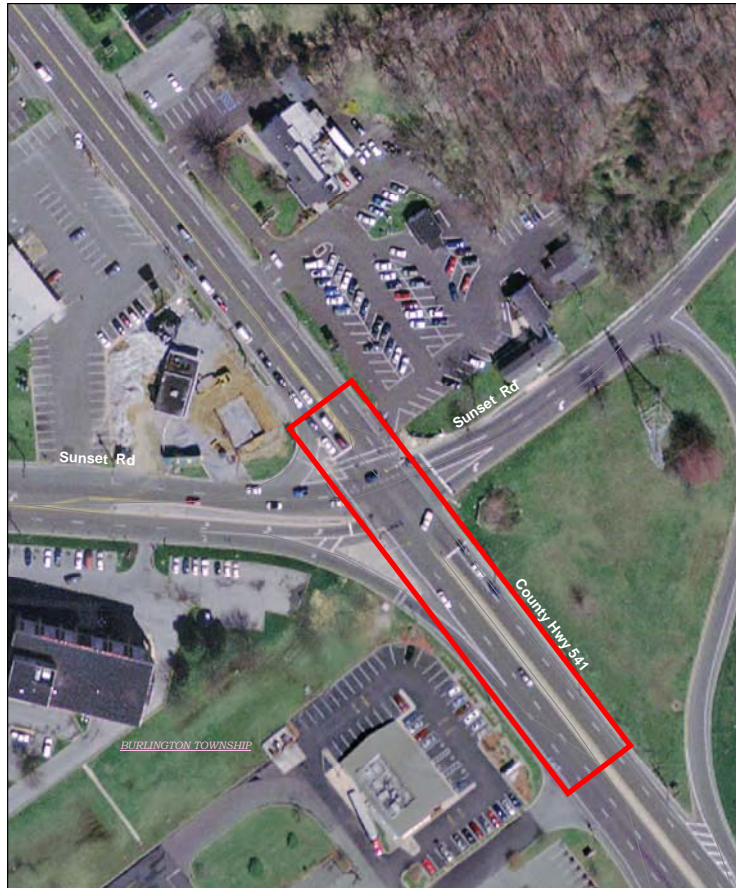
- ▶ 40.6 percent **increase** in total crashes; and
- ▶ Injury crashes **increased** by 4.4 percentage points.

Cluster #10 is located along CR 541 between mileposts 22.11 and 22.21, in the vicinity of Sunset Road, a signalized intersection located at milepost 22.15.

At this location, CR 541 is two lanes in each direction and turns are made via a combination of movements. Sunset Road is one-way westbound carrying southbound bypass traffic to CR 541, as well as traffic from the Northgate Village housing complex. Northbound CR 541 traffic must utilize a nearside jug handle for left turns to Sunset Road. Southbound right turns are made via a slip lane at the intersection.



Within this one-tenth mile cluster, 30 percent of the crashes were concentrated at milepost 22.15, which is at the Sunset Road intersection. During the latter analysis, the concentration shifted south to milepost 22.12, where 33 percent of the 97 crashes were recorded, while just over 16 percent of the crashes were recorded at milepost 22.15. Examining crashes by direction of travel reveals that northbound crashes were more frequent in the first analysis, but southbound were more prevalent in the recent analysis. Crashes were more common eastbound than westbound in both analysis periods, and the split was even greater during 2008 to 2010, when 12 percent of the crashes were eastbound and only one percent was westbound.



Red box indicates cluster limits

Source: DVRPC

Collision type distribution shows rear-end crashes as by far the most common crash type, with sideswipe and hit-fixed-object crashes nearly equal, though much less than the rear-end crashes. Between analysis periods, rear-end crashes grew from 51 percent of the total in 2005 to 2007 to 70 percent in 2008 to 2010, while hit-fixed-object and sideswipe crash percentages remained between four and seven percent between analysis periods. It is clear from the comparison that rear-end crashes account for the majority of the 40.6 percent increase in total crashes. In both periods, rear-end crashes exceeded the statewide average of 28.2 percent. Hit-fixed-object crashes slightly exceeded the statewide percentage of 4.74 percent in both analysis periods.

Injury crashes increased from 20 to 25 percent between analysis periods, though they were still below the statewide average of 34.4 percent for signalized intersections. In addition, one bicyclist crash was recorded during the 2005 to 2007 period, but no bicyclist or pedestrian crashes were recorded in the latter analysis.

Nighttime crashes decreased in the latter analysis period to 15 percent, down from 22 percent during the 2005 to 2007 period. Wet surface condition crashes increased to 22 percent, up from 17 percent; both percentages were higher than the statewide average of 15.92 percent. See Appendix B for additional details.





# Safety Improvements

## Safety Considerations

Some crash problems can be mitigated through corridor-wide strategies, while others may require a localized treatment. As discussed previously, the baseline metric used by NJDOT to measure a crash problem is a comparison to statewide averages for like facility types, considering various characteristics in search of overrepresentations. When a crash category is above the state average it may warrant further investigation. Examples include concentrations by collision type, surface condition, and those occurring at night. Also important, though not measured here, are education, enforcement, and policy initiatives for concentrations among certain age groups, or those where a seatbelt was not used as well as where alcohol was a contributing factor, to name a few.

The goal in addressing a crash problem is to reduce crash frequency and severity, typically focusing first on fatal and incapacitating injuries. In the case of the CR 541 study area, no fatal crashes occurred in either analysis period, and both the injury crash percentage and the incapacitating and moderate injury crash percentages decreased between analysis periods. The fact that the number and severity of injury crashes decreased is significant, despite the slight increase in total crashes.

Over the course of the combined analysis periods, Burlington County made many improvements along CR 541 within the study area. It is a positive sign that those improvements coincide with the reduction in injury crashes, despite the modest increase in total crashes. It is advisable to conduct a yearly monitoring of data to track changes in crash frequency and severity over time, and to gauge the effectiveness of improvements.

## Improvements

The following planned or recently completed improvements were contributed by the Burlington County Engineer's Office. Many of those listed below have primary safety benefits, while others have secondary benefits.

- ▶ All signals on CR 541 have been upgraded with 12-inch red lenses, and most signals already have 12-inch yellow and green lenses. **This is a recommended strategy for addressing rear-end and angle crashes.**

This important improvement makes signal indications visible from a greater distance, giving drivers added sight distance when approaching intersections. This is particularly helpful in

situations where signals are widely spaced, as in less densely developed locations, a characteristic found intermittently along CR 541.

- ▶ Burlington County has retained a consultant for a signal contract that covers CR 541 from CR 691 to US 130 to optimize each signal and set up traffic-responsive parameters. This new technology changes signal timing based on real-time traffic conditions gathered from the existing in-road detectors. This upgrade replaces the existing fixed-time signal timing. CR 541 is divided into three closed-loop systems: US 130 to I-295, I-295 to CR 691, and CR 691 to NJ 38.

Signal optimization is a process whereby the traffic signal is timed to move vehicles through the intersection as efficiently as possible. A closed-loop system coordinates adjacent traffic signals to move traffic in a platoon-like fashion to better facilitate movements through a string of signals. When combined, these improvements improve traffic flow by making it steadier and more predictable, which is safer. As of spring 2012, the design work was completed and implementation is scheduled for later in 2012. **This is a recommended strategy for addressing rear-end crashes.**

- ▶ Seven pan/tilt/zoom (PTZ) traffic cameras have been installed along CR 541 within the study corridor limits. The video feed is used for incident and congestion identification and verification and is monitored by the Burlington County Traffic Operations Center (TOC) during AM and PM peak commute times. The local 911 center also has access to this video feed for locating and verifying crashes and gauging severity. Camera installation was completed and operational in the summer of 2011.

A crash scene can produce additional crashes as motorists react to the event and attempt to circumvent the scene. Video camera surveillance helps to verify crashes to improve emergency service response times, which promotes crash survivability and reduces the likelihood of secondary crashes. **This is a recommended strategy for improving emergency response times.**

- ▶ Variable Message Signs (VMS) were installed along CR 541 southbound between the Cadillac Road intersection and the I-295 interchange, and northbound between the Burrs Road intersection and the Hancock Road-NJTPK interchange. This project was completed in summer 2011. The VMS are used to deliver incident and detour information regarding NJTPK and I-295 to motorists on CR 541 connecting to these routes. Information regarding incidents on CR 541 may also be listed if deemed significant. **Intelligent Transportation System (ITS) equipment such as VMS provide secondary safety benefits by helping to address congestion through informing the driving public. This helps reduce the possibility of secondary crashes.**

- ▶ Left-turn lane extensions are being installed at two locations: 1) along CR 541 northbound at CR 626 westbound, and 2) along CR 541 northbound at Elbow Lane westbound. At each of these locations, the left-turn stacking capacity was inadequate, resulting in the queue extending into the through traffic lane. The improvements at Elbow Lane were combined with a new pedestrian crossing of CR 541 complete with striping and pedestrian countdown signal heads. This project was under construction as of spring 2012, with completion expected by summer 2012.

Providing adequate storage space for turning vehicles aids traffic flow. **Lengthening left-turn storage lanes is a recommended strategy for reducing both rear-end and sideswipe crashes because it helps prevent turning traffic from obstructing through**

**traffic. Pedestrian improvements are a corridor-wide recommendation due to the lack of pedestrian facilities throughout much of the study area.**

- ▶ In response to current traffic demands, the left-turn receiving lane on Hancock Lane was widened and restriped to two lanes to better accommodate the dual-left-turn lane feeding it from CR 541 southbound. The project was completed in 2011. Additional improvements are also planned, including new sidewalks, crosswalk striping, and pedestrian countdown signal heads. **Implementing pedestrian amenities is a recommended strategy for improving pedestrian safety and encouraging pedestrian activity.**
- ▶ Pedestrian countdown signal heads and crosswalks were added to the Bromley Boulevard intersection and to the Home Depot access road for crossing the side streets and CR 541. This improvement was completed in 2011. **Implementing pedestrian amenities is a recommended strategy for improving pedestrian safety, especially at shopping destinations, where pedestrian traffic is higher.**
- ▶ At the intersection of Fountain Avenue and CR 541, there is a history of crashes involving southbound vehicles unsuccessfully navigating through the intersection along CR 541 due to the skewed intersection alignment. The county installed skip-line pavement markings, or “elephant tracks,” through the intersection to better guide motorists. County representatives reported a noticeable reduction in crashes. The project was completed in 2009. **New and/or improved striping and roadway markings are recommended low-cost strategies for improving visibility and delineating the travel way.**
- ▶ The county has long-term plans to make further improvements to the area of Cadillac Road and Sunset Road, with the goal of improving access to Liberty Square. Ideally, drivers would be able to better circulate within the shopping area, which in turn would reduce redundant trips along CR 541. This project will include new signage and geometric improvements. These changes will result in additional capacity without physically adding capacity by removing short trips between adjacent destinations from CR 541 and allowing them to occur internally. This project was in design as of spring 2012, and full implementation is projected for 2014. **This is a recommended strategy for every trip-generating location within the study area because it reduces unnecessary trips along CR 541.**
- ▶ Sidewalk improvements were completed on CR 541 near the intersection with US 130 as part of a larger NJDOT Safe Routes to School project. That project also included improvements to nearby routes. The Safe Routes to School program identifies physical deficiencies of school routes that impede safe walking and street crossing, as well as qualitative items like pedestrian comfort level. **Participation in a Safe Routes to School program is a recommended strategy for identifying deficiencies and improving the safety of the pedestrian environment.** Note: It is Burlington County policy that all intersections accommodate pedestrians with marked crossings and pedestrian count-down signal heads.
- ▶ The county installed a GPS-based Emergency Vehicle Pre-emption system, which includes every signal on the corridor. This project was completed in 2011. Signal preemption provides a green signal for an emergency responder (fire department, emergency medical services, etc.) as he or she approaches the traffic light. The benefits are reduced response time, a decreased likelihood of additional crashes resulting from responders advancing through a red signal, and quicker delivery of the victims to the hospital. This program was funded by NJDOT using federal funds through the Federal Local Aid Safety program (and other state funding sources) and includes hardware for one to three vehicles per responding agency, depending on the number of vehicles in service. This funding approach provides an

incentive for local departments to outfit remaining fleet vehicles using local funds. This system will eventually be available for transit preemption also. **This is a recommended strategy for addressing EMS response times and improving EMS safety, as well as increasing crash survivability.**

## Corridor-wide Considerations

Study team members suggested that the CR 541 corridor be recommended to the state for consideration in the Safe Corridor program. To date, this program has only been used on state routes. Also, at the time of the team's recommendation, the Safe Corridor program was on an indefinite hiatus. This recommendation can be revisited when the program is reinstated.

Any crash characteristics that were overrepresented as compared to statewide averages should be monitored in search of continuing trends. If trends persist during a subsequent three-year crash review, then this may not be an anomaly and should be investigated in detail depending on the percent change in total crashes and the related crash severity.

Federal Highway Administration's (FHWA's) Nine Proven Countermeasures – 2012

In early 2012, the FHWA released a list of nine safety countermeasures that have proven benefits. These improvements are eligible for federal safety funding if supported by an appropriate data-driven analysis. The FHWA's Highway Safety Manual has an analysis tool that can be used to evaluate candidate locations to determine the appropriate countermeasure and associated benefit/cost analysis. These tools are recommended when seeking federal safety funds.

The following narrative provides a brief overview taken from the FHWA's website (<http://safety.fhwa.dot.gov/provencountermeasures/>) of those proven countermeasures that are applicable to the study corridor.

### ► Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

Medians in urban and suburban areas can either be open (pavement markings only) or they can be channelized (raised medians or islands) to separate various road users. Pedestrian crossing islands (or refuge areas) are raised islands placed in the median. These devices should be considered in curbed sections of multilane roadways in urban and suburban areas, particularly in areas where there are mixtures of pedestrian and vehicle traffic (more than 12,000 Average Daily Traffic (ADT)) and intermediate or high travel speeds. The FHWA fact sheet sites the following among the list of benefits:

- ◆ may reduce pedestrian crashes by 46 percent and motor vehicle crashes by up to 39 percent; and
- ◆ may decrease delays (by greater than 30 percent) for motorists.

There were 11 pedestrian crashes along the CR 541 corridor study area over the combined six-year analysis period. **This countermeasure may be appropriate at locations of high pedestrian density (e.g., shopping centers) and at bus stop locations.**

▶ Corridor Access Management

Access management is a set of techniques that state and local governments can use to control access to highways, major arterials, and other roadways. The benefits of access management include improved movement of traffic, reduced crashes, and fewer vehicle conflicts, while preserving capacity and providing for pedestrian and bicyclist needs. The FHWA recommends that access management be considered as part of any federally funded highway project that involves new construction or reconstruction. **The county has already begun using access management techniques at the shopping centers in the vicinity of Cadillac and Sunset roads. At that location, they improved circulation within and between adjacent uses to minimize use of CR 541 as a connector between destinations. Having a corridor access management plan in place can influence driveway spacing and connectivity as vacant land becomes developed.**

▶ Backplates and Retroreflective Borders

When added to a traffic signal, backplates improve the visibility of the illuminated face of the signal by introducing a controlled contrast background. The effect is increased by framing the backplate with a retroreflective border, making the signal more visible and conspicuous in both daytime and nighttime conditions, which is intended to reduce unintentional red-light running crashes and the effects of sun glare. **This low-cost improvement is recommended for the CR 541 corridor due to the widely spaced signal placement along select sections of the corridor.**

▶ Pedestrian Hybrid Beacon

The pedestrian hybrid beacon (also known as the High intensity Activated crossWalk (or HAWK)) is a pedestrian-activated warning device located on the roadside or on mast arms over midblock pedestrian crossings. The beacon head is “dark” until the button is pushed, then flashes in steady yellow intervals and displays a steady red indication to drivers and a “WALK” indication to pedestrians. **This countermeasure is recommended for any location along CR 541 where a midblock pedestrian crossing may be considered in the future.**



## Conclusion

Crashes on CR 541 have been declining since 2008, as have the injury percentage and the severity of the injury crashes. In addition, no person died in a crash on the corridor during the years 2005 through 2010. Although the crash-per-mile number seems significant, it is tempered by moderate to low severity. Non-injury crashes are a more desirable trend than one of more severe crashes, though they can be difficult to address.

This effort revealed an interesting finding regarding the approach of using total crashes as the ranking criteria, specifically for New Jersey, since the minimum threshold for a crash to be considered reportable is \$500 worth of damage (the database consists solely of reportable crashes). By applying a crash severity weighting, an otherwise alarming number of total crashes can be reviewed with a more balanced metric for comparing corridors.

DVRPC recommends that this crash data review be conducted again once three years of new data are available for comparison. Upon request, DVRPC will provide assistance with crash analysis and help with the federal safety funding process facilitated by NJDOT's Local Aid Office.

It is recommended that future safety efforts along CR 541 consider the following priorities

- ▶ investigate improvement opportunities at the four Clusters—2, 6, 9, and 10—where total crashes increased between analysis periods, targeting predominant crash trends, and;
- ▶ improve pedestrian access and crossings, especially at retail nodes and bus stops.





APPENDIX A





# Study Team

Name	Agency
Frank S. Morris	Alaimo Group representing City of Burlington
Marty Livingston	Burlington County Engineer's Office
Carol Thomas	Burlington County Engineer's Office
Anthony M. DiMaggio	Burlington County Engineer's Office
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Jeff Taylor	Burlington Township Police Department
Sgt. Kevin Shoppas	Burlington Township Police Department
James Sullivan	Burlington Township Police Department
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Regina Moore	Delaware Valley Regional Planning Commission
Kathleen Hoffman	Mount Holly Township
Chief Steve Martin	Mount Holly Township Police Department
Sophia Azam	New Jersey Department of Transportation Bureau of Safety Programs
Yosy Cosme	New Jersey Department of Transportation Bureau of Safety Programs
Lt. Sean McGough	Westampton Township Police Department



APPENDIX B





# Cluster Comparison Tables





<b>Cluster # 1 CR 541 at Rancocas-Mt. Holly Rd MP 17.50 - 17.60</b>					<b>Statewide Statistics for Signalized County Route Intersections*</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	21	70%	16	53%	3183	28.15%
Same-Dir Sideswipe	1	3%	1	3%	1265	11.19%
Right Angle	2	7%	4	13%	3214	28.42%
Opposite Direction		0%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	3	10%	6	20%	1667	14.74%
Backing		0%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned		0%		0%	18	0.16%
Fixed Object	2	7%	2	7%	536	4.74%
Animal	1	3%		0%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist		0%		0%	175	1.55%
Non-fixed Object		0%	1	3%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	9	30%	16	53%	11309	100.00%
Not at Intersection	21	70%	14	47%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	27	90%	22	73%	7989	70.64%
Dusk		0%		0%	299	2.64%
Night	3	10%	8	27%	2874	25.41%
Dawn		0%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	11	37%	9	30%	3895	34.44%
Property	19	63%	21	70%	7401	65.45%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	24	80%	20	67%	9093	80.40%
Wet	6	20%	7	23%	1800	15.92%
Snowy		0%	1	3%	271	2.40%
Icy		0%	2	7%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 2 CR 541 at CR 691 Mt. Holly-Burlington Rd MP 18.26 - 18.36</b>					<b>Statewide Statistics for Signalized County Route Intersections*</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	9	33%	17	46%	3183	28.15%
Same-Dir Sideswipe	4	15%	4	11%	1265	11.19%
Right Angle	1	4%		0%	3214	28.42%
Opposite Direction		0%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	2	7%	1	3%	1667	14.74%
Backing	1	4%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned	1	4%		0%	18	0.16%
Fixed Object	9	33%	14	38%	536	4.74%
Animal		0%		0%	19	0.17%
Pedestrian		0%	1	3%	381	3.37%
Pedalcyclist		0%		0%	175	1.55%
Non-fixed Object		0%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>27</b>	<b>100%</b>	<b>37</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	10	37%	8	22%	11309	100.00%
Not at Intersection	17	63%	29	78%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>27</b>	<b>100%</b>	<b>37</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	17	63%	24	65%	7989	70.64%
Dusk	1	4%		0%	299	2.64%
Night	9	33%	11	30%	2874	25.41%
Dawn		0%	1	3%	113	1.00%
Other/Unknown		0%	1	3%	34	0.31%
<b>total</b>	<b>27</b>	<b>100%</b>	<b>37</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality	0	0%	0	0%	13	0.11%
Injury	5	19%	9	24%	3895	34.44%
Property	22	81%	28	76%	7401	65.45%
<b>total</b>	<b>27</b>	<b>100%</b>	<b>37</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	18	67%	20	54%	9093	80.40%
Wet	8	30%	15	41%	1800	15.92%
Snowy	1	4%	2	5%	271	2.40%
Icy		0%		0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>27</b>	<b>100%</b>	<b>37</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 3 CR 541 at CR 630 Woodlane Rd MP 18.69 - 18.79</b>					<b>Statewide Statistics for Signalized County Route Intersections 2010</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	44	73%	43	73%	3183	28.15%
Same-Dir Sideswipe	5	8%	3	5%	1265	11.19%
Right Angle	2	3%	5	8%	3214	28.42%
Opposite Direction		0%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	2	3%	4	7%	1667	14.74%
Backing	1	2%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned		0%		0%	18	0.16%
Fixed Object	4	7%	2	3%	536	4.74%
Animal	1	2%		0%	19	0.17%
Pedestrian	1	2%	1	2%	381	3.37%
Pedalcyclist		0%	1	2%	175	1.55%
Non-fixed Object		0%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>60</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	13	22%	15	25%	11309	100.00%
Not at Intersection	47	78%	44	75%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>60</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	44	73%	48	81%	7989	70.64%
Dusk	2	3%		0%	299	2.64%
Night	13	22%	11	19%	2874	25.41%
Dawn	1	2%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>60</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	28	47%	11	19%	3895	34.44%
Property	32	53%	48	81%	7401	65.45%
<b>total</b>	<b>60</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	55	92%	46	78%	9093	80.40%
Wet	4	7%	13	22%	1800	15.92%
Snowy		0%		0%	271	2.40%
Icy	1	2%		0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>60</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 4 CR 541 at CR 638 Burrs Rd MP 19.29 - 19.35</b>					<b>Statewide Statistics for Signalized County Route Intersections*</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	10	38%	14	64%	3183	28.15%
Same-Dir Sideswipe	4	15%	2	9%	1265	11.19%
Right Angle	3	12%	3	14%	3214	28.42%
Opposite Direction	1	4%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	2	8%	2	9%	1667	14.74%
Backing		0%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned		0%		0%	18	0.16%
Fixed Object	1	4%		0%	536	4.74%
Animal	3	12%	1	5%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist	1	4%		0%	175	1.55%
Non-fixed Object	1	4%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>26</b>	<b>100%</b>	<b>22</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	10	38%	5	23%	11309	100.00%
Not at Intersection	16	62%	17	77%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>26</b>	<b>100%</b>	<b>22</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	16	62%	19	86%	7989	70.64%
Dusk	1	4%		0%	299	2.64%
Night	9	35%	3	14%	2874	25.41%
Dawn		0%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>26</b>	<b>100%</b>	<b>22</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	5	19%	6	27%	3895	34.44%
Property	21	81%	16	73%	7401	65.45%
<b>total</b>	<b>26</b>	<b>100%</b>	<b>22</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	21	81%	16	73%	9093	80.40%
Wet	5	19%	5	23%	1800	15.92%
Snowy		0%		0%	271	2.40%
Icy		0%	1	5%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>26</b>	<b>100%</b>	<b>22</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 5 CR 541 at NJTPK Interchange &amp; Hancock Ln MP 20.04 - 20.14</b>					<b>Statewide Statistics for Signalized County Route Intersections*</b>	
Category	2005-2007		2008-2010		2010	
	Total	%	Total	%	Total	%
Rear End	34	67%	16	55%	3183	28.15%
Same-Dir Sideswipe	5	10%	3	10%	1265	11.19%
Right Angle	8	16%	3	10%	3214	28.42%
Opposite Direction		0%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn		0%	3	10%	1667	14.74%
Backing	1	2%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overtuned		0%		0%	18	0.16%
Fixed Object	2	4%	1	3%	536	4.74%
Animal	1	2%	3	10%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist		0%		0%	175	1.55%
Non-fixed Object		0%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>29</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	11	22%	6	21%	11309	100.00%
Not at Intersection	40	78%	23	79%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>29</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	36	71%	19	66%	7989	70.64%
Dusk	2	4%		0%	299	2.64%
Night	12	24%	10	34%	2874	25.41%
Dawn	1	2%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>29</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	18	35%	6	21%	3895	34.44%
Property	33	65%	23	79%	7401	65.45%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>29</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	41	80%	23	79%	9093	80.40%
Wet	9	18%	4	14%	1800	15.92%
Snowy		0%	1	3%	271	2.40%
Icy	1	2%	1	3%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>		<b>100%</b>	<b>29</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 6 CR 541 at Western Drive and Irick Road MP 20.44 – 20.54</b>					<b>Statewide Statistics for Signalized County Route Intersections 2010</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	16	53%	15	37%	3183	28.15%
Same-Dir Sideswipe	3	10%	8	20%	1265	11.19%
Right Angle	3	10%	11	27%	3214	28.42%
Opposite Direction		0%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	4	13%	4	10%	1667	14.74%
Backing		0%	1	2%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned		0%		0%	18	0.16%
Fixed Object	3	10%	2	5%	536	4.74%
Animal		0%		0%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist		0%		0%	175	1.55%
Non-fixed Object		0%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other	1	3%		0%	31	0.25%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	13	43%	17	41%	11309	100.00%
Not at Intersection	17	57%	24	59%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	17	57%	32	78%	7989	70.64%
Dusk	2	7%		0%	299	2.64%
Night	9	30%	8	20%	2874	25.41%
Dawn	2	7%	1	2%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%	0	0%	13	0.11%
Injury	12	40%	15	37%	3895	34.44%
Property	18	60%	26	63%	7401	65.45%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	24	80%	28	68%	9093	80.40%
Wet	4	13%	10	24%	1800	15.92%
Snowy	1	3%	3	7%	271	2.40%
Icy	1	3%		0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>30</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 7 CR 541 Bromley &amp; Elbow MP 20. 81 - 21.16</b>					<b>Statewide Statistics for Signalized County Route Intersections*</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	59	54%	58	61%	3183	28.15%
Same-Dir Sideswipe	14	13%	17	18%	1265	11.19%
Right Angle	19	17%	4	4%	3214	28.42%
Opposite Direction	1	1%		0%	519	4.59%
Struck Parked Vehicle		0%	1	1%	69	0.61%
Left Turn/U Turn	9	8%	10	11%	1667	14.74%
Backing	1	1%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overtuned	1	1%	1	1%	18	0.16%
Fixed Object	1	1%	3	3%	536	4.74%
Animal	1	1%	1	1%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist	1	1%		0%	175	1.55%
Non-fixed Object	2	2%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>109</b>	<b>100%</b>	<b>95</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	50	46%	26	27%	11309	100.00%
Not at Intersection	59	54%	69	73%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>109</b>		<b>95</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	79	72%	69	73%	7989	70.64%
Dusk	1	1%	6	6%	299	2.64%
Night	29	27%	20	21%	2874	25.41%
Dawn		0%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>109</b>		<b>95</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	36	33%	29	31%	3895	34.44%
Property	73	67%	66	69%	7401	65.45%
<b>total</b>	<b>109</b>		<b>95</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	82	75%	72	76%	9093	80.40%
Wet	22	20%	18	19%	1800	15.92%
Snowy	2	2%	4	4%	271	2.40%
Icy	2	2%	1	1%	87	0.77%
Other	1	1%		0%	58	0.51%
<b>total</b>	<b>109</b>	<b>100%</b>	<b>95</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 8 CR 541 at I-295 MP 21.58 - 21.68</b>					<b>Statewide Statistics for Signalized County Route Intersections 2010</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	3	18%	2	33%	3183	28.15%
Same-Dir Sideswipe	5	29%	1	17%	1265	11.19%
Right Angle		0%		0%	3214	28.42%
Opposite Direction	1	6%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn		0%		0%	1667	14.74%
Backing		0%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned		0%		0%	18	0.16%
Fixed Object	5	29%	2	33%	536	4.74%
Animal	2	12%	1	17%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist		0%		0%	175	1.55%
Non-fixed Object		0%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other	1	6%		0%	31	0.25%
<b>total</b>	<b>17</b>	<b>100%</b>	<b>6</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	5	29%		0%	11309	100.00%
Not at Intersection	12	71%	6	100%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>17</b>	<b>100%</b>	<b>6</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	13	76%	4	67%	7989	70.64%
Dusk	1	6%		0%	299	2.64%
Night	3	18%	2	33%	2874	25.41%
Dawn		0%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>17</b>	<b>100%</b>	<b>6</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	4	24%	2	33%	3895	34.44%
Property	13	76%	4	67%	7401	65.45%
<b>total</b>	<b>17</b>	<b>100%</b>	<b>6</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	11	65%	3	50%	9093	80.40%
Wet	4	24%	3	50%	1800	15.92%
Snowy	1	6%		0%	271	2.40%
Icy	1	6%		0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>17</b>	<b>100%</b>	<b>6</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary



<b>Cluster # 9 CR 541 Intersection with Cadillac Road MP 20.44 – 20.54</b>					<b>Statewide Statistics for Signalized County Route Intersections</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	17	33%	31	51%	3183	28.15%
Same-Dir Sideswipe	13	25%	13	21%	1265	11.19%
Right Angle	12	24%	7	11%	3214	28.42%
Opposite Direction		0%	0	0%	519	4.59%
Struck Parked Vehicle	1	2%	0	0%	69	0.61%
Left Turn/U Turn	1	2%	3	5%	1667	14.74%
Backing		0%	1	2%	141	1.25%
Encroachment		0%	0	0%	71	0.63%
Overtuned		0%	0	0%	18	0.16%
Fixed Object	6	12%	5	8%	536	4.74%
Animal		0%	1	2%	19	0.17%
Pedestrian	1	2%	0	0%	381	3.37%
Pedalcyclist		0%	0	0%	175	1.55%
Non-fixed Object		0%	0	0%	16	0.14%
Railcar - Vehicle		0%	0	0%	1	0.01%
Unknown		0%	0	0%	3	0.03%
Other		0%	0	0%	31	0.25%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>61</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	24	47%	20	33%	11309	100.00%
Not at Intersection	27	53%	41	67%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>61</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	34	67%	47	77%	7989	70.64%
Dusk	1	2%	1	2%	299	2.64%
Night	15	29%	13	21%	2874	25.41%
Dawn	1	2%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>61</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%	0	0%	13	0.11%
Injury	15	29%	21	34%	3895	34.44%
Property	36	71%	40	66%	7401	65.45%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>61</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	40	78%	45	74%	9093	80.40%
Wet	10	20%	13	21%	1800	15.92%
Snowy	1	2%	3	5%	271	2.40%
Icy		0%	0	0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>51</b>	<b>100%</b>	<b>61</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 10 CR 541 Intersection with Sunset Road MP 22.11 – 22.21</b>					<b>Statewide Statistics for Signalized County Route Intersections 2010</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	35	51%	68	70%	3183	28.15%
Same-Dir Sideswipe	5	7%	4	4%	1265	11.19%
Right Angle	21	30%	18	19%	3214	28.42%
Opposite Direction		0%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	2	3%	2	2%	1667	14.74%
Backing		0%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overturned		0%		0%	18	0.16%
Fixed Object	4	6%	5	5%	536	4.74%
Animal		0%	0	0%	19	0.17%
Pedestrian		0%	0	0%	381	3.37%
Pedalcyclist	1	1%	0	0%	175	1.55%
Non-fixed Object	1	1%	0	0%	16	0.14%
Railcar - Vehicle		0%	0	0%	1	0.01%
Unknown		0%	0	0%	3	0.03%
Other		0%	0	0%	31	0.25%
<b>total</b>	<b>69</b>	<b>100%</b>	<b>97</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	11	16%	8	8%	11309	100.00%
Not at Intersection	57	83%	89	92%	0	0.00%
At or Near Railroad Crossing	1	1%		0%	0	0.00%
<b>total</b>	<b>69</b>	<b>100%</b>	<b>97</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	52	75%	77	79%	7989	70.64%
Dusk	2	3%	4	4%	299	2.64%
Night	15	22%	15	15%	2874	25.41%
Dawn	0	0%	1	1%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>69</b>	<b>100%</b>	<b>97</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%	0	0%	13	0.11%
Injury	14	20%	24	25%	3895	34.44%
Property	55	80%	73	75%	7401	65.45%
<b>total</b>	<b>69</b>	<b>100%</b>	<b>97</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	57	83%	75	77%	9093	80.40%
Wet	12	17%	21	22%	1800	15.92%
Snowy	0	0%	1	1%	271	2.40%
Icy		0%	0	0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>69</b>	<b>100%</b>	<b>97</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 11 CR 541 Garnet Dr to Dresser Ave MP 22.41 - 22.85</b>					<b>Statewide Statistics for Signalized County Route Intersections*</b>	
Category	2005 - 2007		2008 - 2010		2010	
	Total	%	Total	%	Total	%
Rear End	27	52%	26	51%	3183	28.15%
Same-Dir Sideswipe	7	13%	2	4%	1265	11.19%
Right Angle	9	17%	12	24%	3214	28.42%
Opposite Direction	2	4%		0%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	2	4%	5	10%	1667	14.74%
Backing	1	2%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overtuned		0%	1	2%	18	0.16%
Fixed Object	3	6%	2	4%	536	4.74%
Animal		0%		0%	19	0.17%
Pedestrian		0%	1	2%	381	3.37%
Pedalcyclist		0%	1	2%	175	1.55%
Non-fixed Object		0%	1	2%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other	1	2%		0%	31	0.25%
<b>total</b>	<b>52</b>	<b>100%</b>	<b>51</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	11	21%	22	43%	11309	100.00%
Not at Intersection	41	79%	29	57%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>52</b>	<b>100%</b>	<b>51</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	36	69%	43	84%	7989	70.64%
Dusk	4	8%	1	2%	299	2.64%
Night	12	23%	7	14%	2874	25.41%
Dawn		0%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>52</b>	<b>100%</b>	<b>51</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	18	35%	22	43%	3895	34.44%
Property	34	65%	29	57%	7401	65.45%
<b>total</b>	<b>52</b>	<b>100%</b>	<b>51</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	38	73%	41	80%	9093	80.40%
Wet	13	25%	10	20%	1800	15.92%
Snowy		0%		0%	271	2.40%
Icy		0%		0%	87	0.77%
Other	1	2%		0%	58	0.51%
<b>total</b>	<b>52</b>	<b>100%</b>	<b>51</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

<b>Cluster # 12 CR 541 Fountain Ave MP 22.99 - 23.05</b>					<b>Statewide Statistics for Signalized County Route Intersections 2010</b>	
Category	2005 - 2007		2008 - 2012		2010	
	Total	%	Total	%	Total	%
Rear End	6	15%	22	54%	3183	28.15%
Same-Dir Sideswipe	6	15%	3	7%	1265	11.19%
Right Angle	3	8%	2	5%	3214	28.42%
Opposite Direction		0%	2	5%	519	4.59%
Struck Parked Vehicle		0%		0%	69	0.61%
Left Turn/U Turn	8	21%	2	5%	1667	14.74%
Backing		0%		0%	141	1.25%
Encroachment		0%		0%	71	0.63%
Overtuned		0%	1	2%	18	0.16%
Fixed Object	16	41%	9	22%	536	4.74%
Animal		0%		0%	19	0.17%
Pedestrian		0%		0%	381	3.37%
Pedalcyclist		0%		0%	175	1.55%
Non-fixed Object		0%		0%	16	0.14%
Railcar - Vehicle		0%		0%	1	0.01%
Unknown		0%		0%	3	0.03%
Other		0%		0%	31	0.25%
<b>total</b>	<b>39</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
At Intersection	24	62%	16	39%	11309	100.00%
Not at Intersection	15	38%	25	61%	0	0.00%
At or Near Railroad Crossing		0%		0%	0	0.00%
<b>total</b>	<b>39</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Day	23	59%	32	78%	7989	70.64%
Dusk	1	3%		0%	299	2.64%
Night	14	36%	9	22%	2874	25.41%
Dawn	1	3%		0%	113	1.00%
Other/Unknown		0%		0%	34	0.31%
<b>total</b>	<b>39</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Fatality		0%		0%	13	0.11%
Injury	9	23%	11	27%	3895	34.44%
Property	30	77%	30	73%	7401	65.45%
<b>total</b>	<b>39</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>
Dry	27	69%	34	83%	9093	80.40%
Wet	12	31%	7	17%	1800	15.92%
Snowy		0%		0%	271	2.40%
Icy		0%		0%	87	0.77%
Other		0%		0%	58	0.51%
<b>total</b>	<b>39</b>	<b>100%</b>	<b>41</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary

Cluster # 13 CR 541 Near 12th St to US 130 MP 23.07 - 23.84					Statewide Statistics for Signalized County Route Intersections		
Category	2005 - 2007		2008 - 2010		2010		
	Total	%	Total	%	Total	%	
Rear End	82	62%	63	57%	3183	28.15%	
Same-Dir Sideswipe	14	11%	15	14%	1265	11.19%	
Right Angle	16	12%	12	11%	3214	28.42%	
Opposite Direction		0%	1	1%	519	4.59%	
Struck Parked Vehicle	5	4%	9	8%	69	0.61%	
Left Turn/U Turn	5	4%	5	5%	1667	14.74%	
Backing		0%		0%	141	1.25%	
Encroachment	1	1%	1	1%	71	0.63%	
Overturned		0%		0%	18	0.16%	
Fixed Object	5	4%	2	2%	536	4.74%	
Animal		0%		0%	19	0.17%	
Pedestrian	2	2%	2	2%	381	3.37%	
Pedalcyclist		0%		0%	175	1.55%	
Non-fixed Object		0%		0%	16	0.14%	
Railcar - Vehicle		0%		0%	1	0.01%	
Unknown		0%		0%	3	0.03%	
Other	2	2%	1	1%	31	0.25%	
<b>total</b>	<b>132</b>	<b>100%</b>	<b>111</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>	
At Intersection	57	43%	35	32%	11309	100.00%	
Not at Intersection	75	57%	76	68%	0	0.00%	
At or Near Railroad Crossing		0%		0%	0	0.00%	
<b>total</b>	<b>132</b>	<b>100%</b>	<b>111</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>	
Day	113	86%	92	83%	7989	70.64%	
Dusk	1	1%	2	2%	299	2.64%	
Night	18	14%	15	14%	2874	25.41%	
Dawn		0%	1	1%	113	1.00%	
Other/Unknown		0%		0%	34	0.31%	
<b>total</b>	<b>132</b>	<b>100%</b>	<b>110</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>	
Fatality		0%		0%	13	0.11%	
Injury	36	27%	36	32%	3895	34.44%	
Property	96	73%	75	68%	7401	65.45%	
<b>total</b>	<b>132</b>	<b>100%</b>	<b>111</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>	
Dry	110	83%	88	79%	9093	80.40%	
Wet	20	15%	20	18%	1800	15.92%	
Snowy	1	1%	2	2%	271	2.40%	
Icy	1	1%		0%	87	0.77%	
Other		0%		0%	58	0.51%	
<b>total</b>	<b>132</b>	<b>100%</b>	<b>110</b>	<b>100%</b>	<b>11309</b>	<b>100.00%</b>	

\*New Jersey Department of Transportation Bureau of Safety Programs Crash Summary





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**Abstract** This report details the safety review process of a 6.3-mile segment of CR 541 in Burlington County, New Jersey, undertaken by the Delaware Valley Regional Planning Commission. The review examines corridor-wide crash findings and cluster location findings from two analysis periods: 2005-2007, and 2008-2010. Data from the two periods is examined for changes over time, and compared to statewide averages for like facilities in New Jersey. An important finding is that although total crashes increased slightly between periods, the percentage of injury crashes decreased, as well as the severity of those injury crashes. This report also presents a synopsis of recent roadway improvements undertaken by Burlington County, some of which have safety benefits.

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