Improving Safety and Operations by Limiting Access on Virginia Route 28

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Randy Dittberner, P.E., PTOE
Traffic Engineering Program Manager
Virginia Department of Transportation
Northern Operations Region
14685 Avion Parkway
Chantilly, VA 20151
703-383-2404
Randy.Dittberner@VDOT.Virginia.gov

Abstract

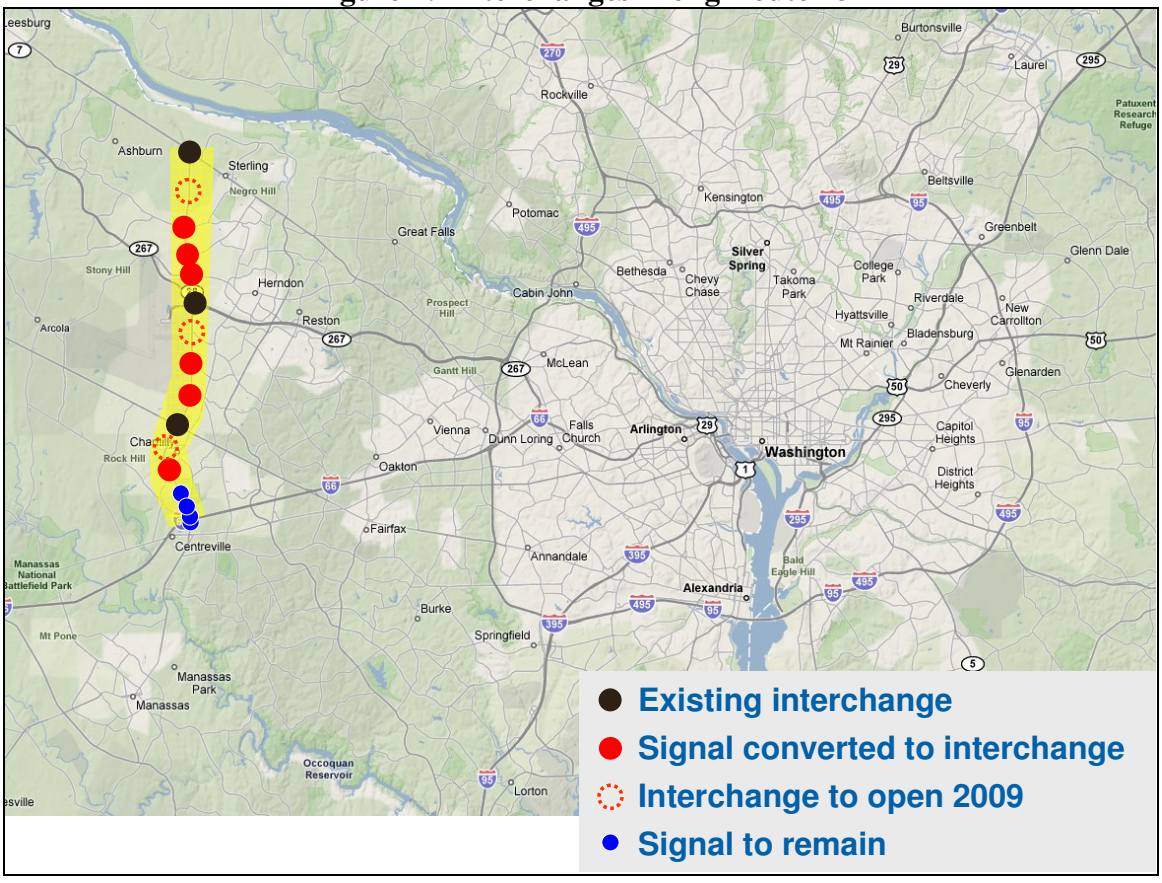
In May 2007, the Virginia Department of Transportation (VDOT) implemented a series of access changes at three intersections on Route 28 in Fairfax County, Virginia. The changes included eliminating several left-turn and cross-street movements from signalized intersections along a very high-volume corridor. The improvements alleviated a chronic bottleneck, shortening peak-hour travel times by about four minutes and improving peak-hour capacity by about 1000 vehicles per hour. Based on the first 11 months after implementation, crashes have declined by about 36 percent, and the crash rate has dropped by 42 percent. Some local trips were lengthened by the access changes, but this disadvantage was more than offset by the tremendous gains in network performance and safety.

Introduction

Residents often ask for transportation changes to be implemented quickly—even overnight—but not much in the industry can happen so fast. However, when residents of Centreville, Virginia, woke up on the morning of May 5, 2007, they found major traffic control changes on Virginia Route 28 that—overnight—vastly improved traffic safety and operations on what had been one of the most congested corridors in Northern Virginia.

Of course, although the changes were implemented overnight, they had been under consideration for much longer—about six years. Virginia Route 28 is undergoing a transformation from an arterial roadway with mostly signalized intersections to an expressway with mostly interchanges. The conversion is the work of a public/private partnership, funded partly by state tax dollars and partly by a tax on local land owners. As more and more traffic signals are removed from Route 28, the corridor becomes a more and more attractive transportation artery, and congestion worsens at the signals that remain. Figure 1 illustrates the new interchanges that have been constructed on Route 28 as part of the public-private partnership.

Figure 1: Interchanges Along Route 28



Four signals at the southern end of Route 28 were not included in the public-private agreement, and no changes had been planned for these intersections. The southernmost two of the four signals provide access between Route 28 and the Interstate 66 interchange ramps. The

northernmost signal serves Ellanor C. Lawrence Park at a T-intersection with low cross-street volume.

The fourth signal, the first one north of I-66, serves Braddock Road to the west and Walney Road to the east. Its proximity to the interstate would severely complicate construction of an interchange, but it was a severe point of congestion along the Route 28 corridor. Despite the major improvements elsewhere on the corridor, Braddock/Walney was slated to remain a bottleneck that would grow increasingly critical with the continued growth of traffic on the mainline. An aerial photo of the network is shown in Figure 2.

Figure 2: Route 28/I-66 interchange and Braddock/Walney Intersection

Traffic demand at the Braddock/Walney intersection with Route 28 far exceeded capacity, and during peak hours, queues commonly propagated for a mile or more on the peak-direction approach to the signal. During the morning peak hour, the queues infiltrated the I-66 interchange and back onto the mainline in both directions. On eastbound I-66, traffic frequently queued on the shoulder of the mainline for thousands of feet approaching the exit for northbound Route 28; some motorists had been ticketed for this behavior despite its pervasiveness. In the afternoon peak hour, queues extended north as far as the Westfields Boulevard interchange, blocking all three lanes of southbound Route 28.

Field travel time runs and CORSIM simulation results showed that the network suffered from congestion-related delays of over 200 seconds per vehicle. Northern Virginia drivers are accustomed to congested intersections that operate at Level of Service F, but this intersection was beyond normal even for this area.

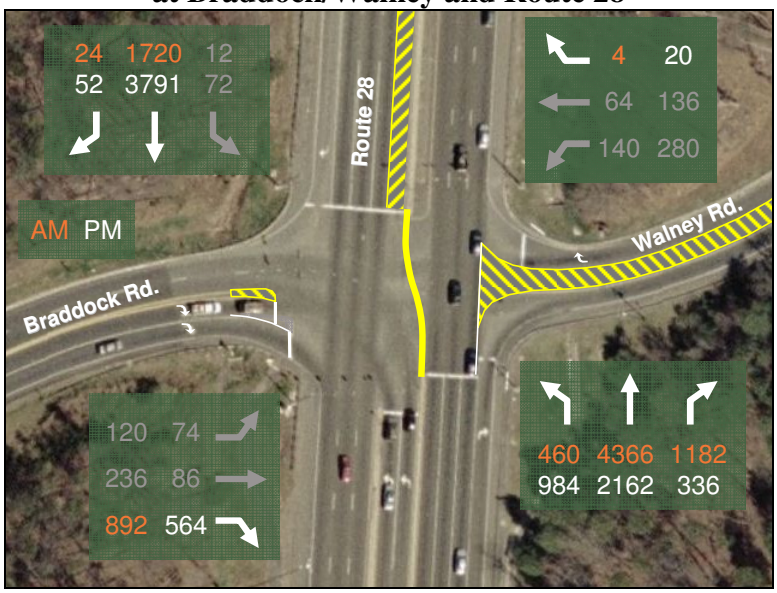
Meanwhile, the Braddock/Walney intersection suffered from one of the worst crash records of any intersection in the State of Virginia, with an average of 48 crashes per year.

Proposed Improvements

Rather than allow Braddock/Walney to cannibalize the effectiveness of the other improvements on the Route 28 corridor, the Virginia Department of Transportation (VDOT) worked to devise a change at the intersection to improve traffic flow short of fully closing the side street access and removing the signal.

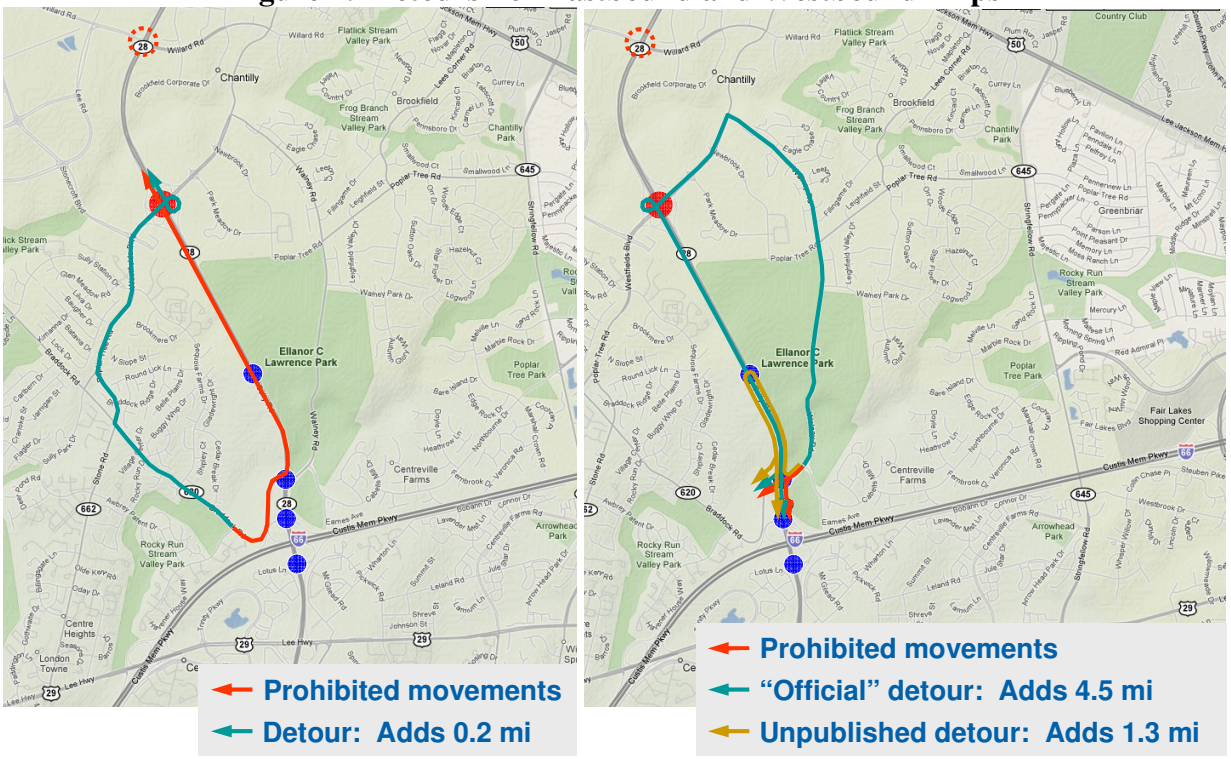
Instead, three of the four left-turn movements and the side-street through movements were restricted, allowing all other movements to remain. The restrictions allowed the former 8-phase signal to operate with two phases, so more green time could be allocated to congested Route 28. The proposed improvements, along with the traffic volumes at the intersection at the time, are presented in Figure 3.

Figure 3: Proposed Improvements and Peak-Hour Traffic Volumes at Braddock/Walney and Route 28



The tradeoff of the changes was a loss of access for local traffic. Some local trips were diverted to new routes that were several miles longer, as shown in Figure 4. Some residents were concerned that new cut-through traffic patterns could develop. Local elected officials were hesitant to support the changes because their constituents bore the brunt of the plan's disadvantages, and the long-distance commuters who stood to benefit lived in other jurisdictions.

Figure 4: Detours For Eastbound and Westbound Trips



VDOT conducted a series of public meetings to introduce the plan to local residents and gauge the level of community support. As expected, many residents opposed the plan entirely, but there was a surprising level of support as well, likely because of the extreme frustration with congestion on Route 28. Some residents were skeptical that the changes would effectively improve Route 28, and they recommended working with the signals at the I-66 interchange as well. They said that if they were expected to increase their trip lengths, they wanted to ensure that Route 28 was as streamlined as possible, so at least their longer trips could be faster.

With the approval of the Federal Highway Administration, VDOT modified the plan to include the signals at the I-66 interchange. The close proximity of U.S. Route 29 offered a convenient alternative route that allowed for the closure of two very low-volume ramps. A Fairfax County community facility was also impacted, as its access was proposed to be limited to right-in, right-out only. The proposed changes to the two intersections are shown in Figures 5 and 6, and the access changes are presented in Figure 7.

Figure 5: Proposed Changes to I-66 North Ramp Signal at Route 28

Figure 6: Proposed Changes to I-66 South Ramp Signal at Route 28

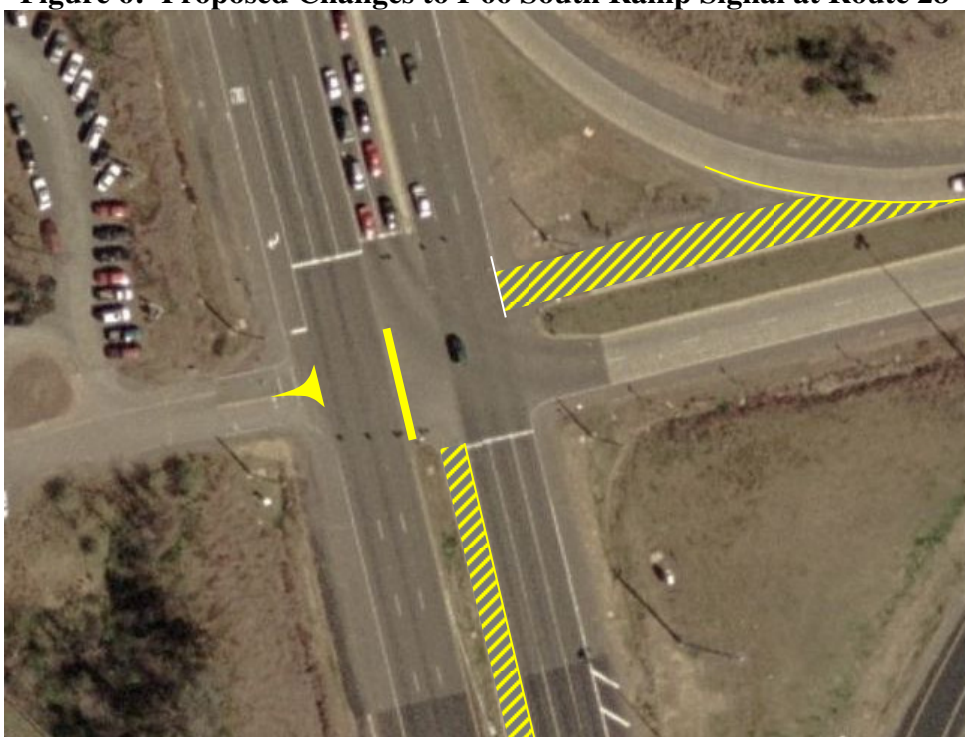


Figure 7: Alternative Routes for I-66 Eastbound and Westbound Ramp Traffic

Some strong local opposition was not enough to overcome regional support; both County and State elected officials expressed support for the project, allowing implementation to progress overnight on May 4-5, 2007.

Implementation

Initial implementation focused on modifying the three traffic signals, obliterating and re-installing pavement markings, and making final adjustments to signs. The median and ramp closures were accomplished using temporary traffic control devices, such as barricades and, in some cases, temporary concrete barrier. (Many signs were changed in advance of implementation to limit the overnight workload.) In the following weeks, crews returned to replace the temporary median closures with raised concrete medians.

Media coverage helped to alert motorists to the changes, but the biggest concern immediately after implementation was the increased number of U-turns in unexpected places. Some of these U-turns were already prohibited, but new U-turn prohibitions were added at a few locations after implementation. One of these was along Braddock Road west of Route 28, where U-turning traffic was not able to get out of the stream of through traffic, causing operational and safety concerns.

The northbound U-turn at the Ellanor Lawrence Park signal was much more heavily used after implementation, but not so much that problems developed. Rarely were more than three or four vehicles observed in a single queue, and this volume was easily accommodated by the 500-foot-

long left-turn bay. U-turning traffic interrupted southbound traffic more frequently than in the past, but the volume was low enough that the park signal still provided more southbound green time than the Braddock/Walney signal. Some residents asked that this U-turn be prohibited, but staff declined to do so because of its benefits to local circulation. (Figure 4 shows how much it reduces the detour distance for Walney traffic.)

A few motorists called VDOT to express concerns about the changes after implementation, but surprisingly, several others called with compliments, amazed at the sudden loosening in a renowned traffic chokepoint.

Results

Effects of the changes were immediate and pronounced. A comprehensive set of before-and-after data collection quantified the impacts on peak-period travel times, as shown in Figures 8 and 9. The figures show travel times between Route 29 and Westfields Boulevard, a distance of approximately 2 miles. Northbound during the morning, a sharp travel time peak occurred before implementation between 7:30 and 9:00 a.m., when travel times commonly extended between 6 and 8 minutes. After implementation, average travel time was less than 3 minutes, a savings of about 4 minutes per vehicle during the peak period. Travel time reliability improved significantly as well, eliminating much of the area's former travel time uncertainty.

Figure 8: Northbound Travel Time Before and After Results

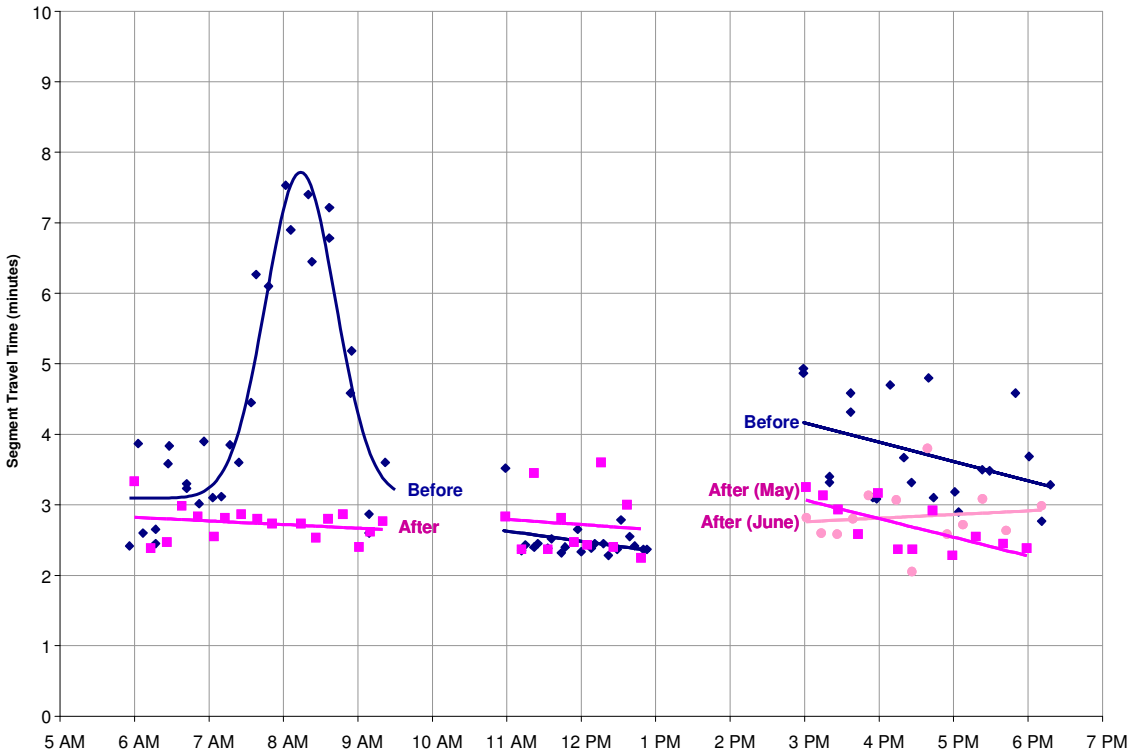
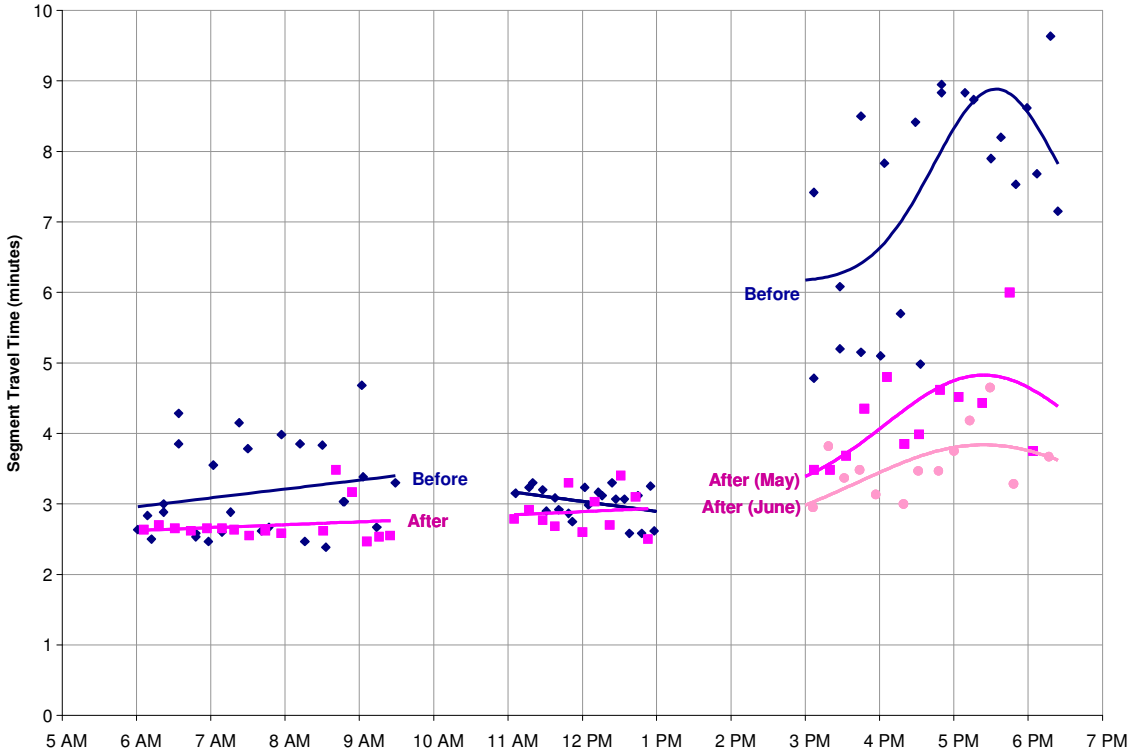


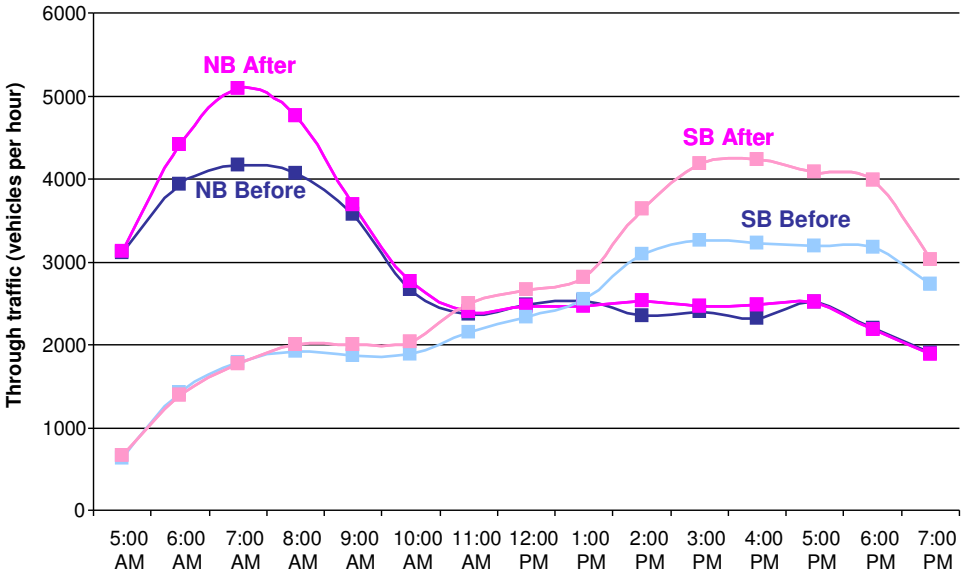
Figure 9: Southbound Travel Time Before and After Results



Southbound in the afternoon, congestion was even more pronounced than in the morning before implementation, with travel times commonly exceeding 8 minutes in a longer peak between 4:30 and 6:30 p.m. Some queuing still occurs after implementation, but average travel times have dropped to between 4 and 5 minutes—also a savings of about 4 minutes per vehicle. The heavy northbound left-turn movement from Route 28 to Braddock Road conflicts with southbound traffic on Route 28, likely a cause of the latent southbound queues after implementation.

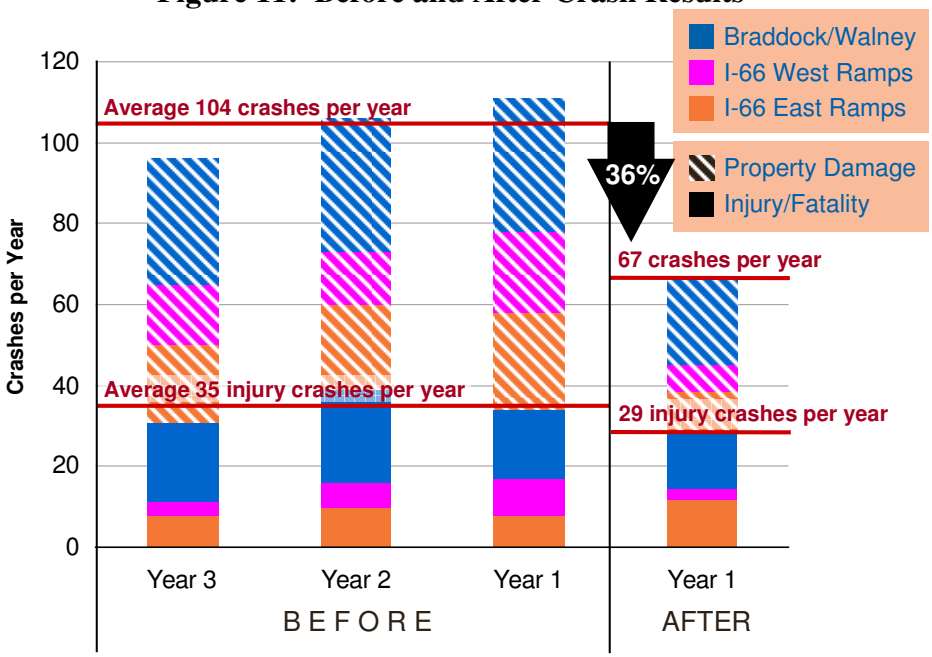
The Braddock/Walney intersection is equipped with loop detectors in every lane capable of counting traffic. Data was retrieved from this system both before and after the changes were made to observe changes to the amount of traffic using Route 28. Figure 10 shows the northbound and southbound throughput along Route 28 in the before and after conditions. Throughput for peak-direction traffic increased by about 1,000 vehicles per hour during both morning and afternoon peaks.

Figure 10: Before and After Throughput Results



About 11 months of crash data is available since implementation, not enough for a conclusive analysis of safety effects, but the trends from the early data are encouraging, as noted in Figure 11. The three modified intersections had a combined average of 104 crashes per year in the three years prior to implementation, with about half of those at Braddock/Walney. Based on the data available, 67 crashes are expected in the first year after implementation, a drop of 36 percent. The drop in injury crashes was less pronounced at 17 percent, but it is possible that the higher speeds now possible along the corridor have led to an increasing tendency for more severe crashes.

Figure 11: Before and After Crash Results



The combined effect of the increased traffic volumes and reduced crashes suggests that the crash rate in the area has dropped by about 42 percent.

A key concern prior to implementation was possible increased cut-through traffic. Before-and-after studies in one adjacent neighborhood showed that those concerns were not realized. Daily traffic volume on Sequoia Farms Drive, the subject of many cut-through traffic concerns, changed only about 1 percent after implementation, with slight increases and decreases occurring during different parts of the day to reflect the new circulation patterns. Cut-through traffic using Walney Road, although not quantified, has dropped precipitously because of the loss of direct access to I-66. Residents on the east side of Route 28 report much less traffic using their neighborhood streets during peak periods. In general, the increase in traffic volume on Route 28 suggests that many cut-through motorists have been attracted back to Route 28 by the improved traffic conditions.

Remarks

The severe access changes in the area were possible because of a unique combination of characteristics, including the heavy and increasing volume on Route 28, the documented congestion and safety problems, lack of surrounding development, and geometric characteristics. The success of the changes has encouraged VDOT to seek other areas where similar principles could be applied. Although a few locations have been identified, none have yet been able to approach the benefits observed by the Braddock/Walney area.

Acknowledgement

The author expresses appreciation to Sunil Taori, project manager, and the many other VDOT staff whose diligent efforts allowed the project to move forward.