7.0 Traffic Operations Strategies

Traffic operations improvements are low-cost measures that aim to minimize congestion or improve safety. These projects are focused to relieve specific operational concerns typically in the confines of the existing roadway network, and can be implemented along the I-526 study corridor or the adjacent arterial-street network. This chapter discusses Traffic Operations improvements which have been separated into the following categories: Geometric Improvements, Pavement Marking Improvements, Signing Improvements, ITS Improvements, and Managed Lanes.

7.1 Geometric Improvements

Geometric traffic operation improvements considered for the I-526 study corridor include turn lane improvements, acceleration/deceleration lane improvements, and restriction of movements. The geometric improvements are grouped by interchange and also include consideration of cross-street arterial improvements.

7.1.1 I-526 & US 17/Sam Rittenberg Boulevard Interchange

- **OPS 1 – Remove the South Leg of the I-526 WB Ramp & Sam Rittenberg Boulevard Intersection:** Currently two paths exist for road users to access US 17 northbound towards Charleston from I-526 westbound. The first path allows I-526 westbound traffic to make a left at the intersection of I-526 WB Ramp & US 17 and the second path allows I-526 westbound traffic to make a left at the intersection of US 17 & Sam Rittenberg Boulevard. Removing this section of roadway would result in one less signal along US 17 and would simplify traffic patterns and reduce the potential for driver confusion.
- **OPS 2 – Provide Dual Rights and Dual Lefts for I-526 WB Approaching Sam Rittenberg Boulevard:** With the through movements proposed to be eliminated at this intersection with the first strategy, the four existing approach lanes will need to be converted to dual left-turn lanes and dual right-turn lanes.
- **OPS 3 – Extend the I-526 WB Right-Turn Lane Approaching Sam Rittenberg Boulevard:** The I-526 westbound right-turn approaching Sam Rittenberg Boulevard has storage length of approximately 500 feet. However, the PM peak hour traffic queues regularly extend past this point. The increase in storage length will result in fewer delays for road users accessing eastbound Sam Rittenberg Boulevard.
- **OPS 4 – Construct Triple Rights for Sam Rittenberg Boulevard Approaching US 17:** Existing traffic volumes for southbound Sam Rittenberg Boulevard right-turn traffic at US 17 are 829 and 1,336 vehicles per hour for the AM peak hour and PM peak hour, respectively. These heavy volumes are projected to grow, and the movement would benefit by providing two additional right-turn lanes, as fewer queues would be present at the approach. The right-turn lanes will need to be signalized which will reduce weaving issues along the US 17 southbound departure from the intersection.
- **OPS 5 – Prepare Access Management Plan along US 17:** Several business driveways at the I-526 & US 17 interchange are located within 500 feet of the various interchange ramps, including driveways providing access to a motel and fast-food restaurant located within the storage lane of the entrance ramp to I-526 eastbound from US 17 southbound. During peak periods of the day, this creates weaving issues and contributes to increased congestion in the area. An access management plan will likely relocate existing driveways to Skylark Drive to enhance traffic flow along US 17 as well as define future driveway placements within the area of the interchange.
- **OPS 6 – US 17 & Skylark Drive – Construct the 2nd SB Approach Lane:** Providing two lanes on southbound Skylark Drive would improve traffic along the roadway headed towards I-526. The added capacity would allow right-turners, which would be behind left-turners in the existing road segment, to perform a right-turn on red movement more often.
- **OPS 7 – Sam Rittenberg Boulevard & Skylark Drive – Construct NB Right-Turn Lane:** . An exclusive right-turn lane for northbound Skylark Drive will allow more right-turn on red movements and separate the right-turns from other traffic continuing through and turning left, which is significant in the PM peak hour.

7.1.2 I-526 & Paul Cantrell Boulevard Interchange

- **OPS 8 – Lengthen the I-526 WB Deceleration Lane to the Paul Cantrell Boulevard EB Loop (SW Quadrant):** An approximately 220-foot deceleration lane currently exists. Lengthening this deceleration lane will provide additional length for exiting vehicles, limiting the interaction with through traffic along I-526 westbound during the peak hours.
- **OPS 9 – Lengthen the I-526 WB Deceleration Lane to Paul Cantrell Boulevard WB (NW Quadrant):** An approximately 530-foot deceleration lane currently exists. Lengthening this deceleration lane will provide additional length for exiting vehicles, limiting the interaction with through traffic along I-526 westbound during the peak hours.

- **OPS 10 – Lengthen the I-526 EB Deceleration Lane to the Paul Cantrell Boulevard WB Loop (NE Quadrant):** An approximately 335-foot deceleration lane currently exists. Lengthening this deceleration lane will provide additional length for exiting vehicles, limiting the interaction with through traffic along I-526 westbound during the peak hours.
- **OPS 11 – Lengthen the I-526 EB Acceleration Lane from Paul Cantrell Boulevard (NE Quadrant):** An approximately 430-feet acceleration lane currently exists. Lengthening this acceleration lane will provide additional length for entering vehicles to merge into the through traffic stream, limiting the interaction with through traffic along I-526 westbound during the peak hours.
- **OPS 12 – Paul Cantrell Boulevard & Tobias Gadson Boulevard – Construct the 2nd EB Left-Turn Lane:** The eastbound left-turn volume is 185 and 238 vehicles per hour during the AM peak hour and PM peak hour, respectively. As future growth is expected to push the AM and PM peak-hour traffic volumes over 300 vehicles per hour, dual left-turn lanes will provide added capacity for the movement. A second receiving lane along Tobias Gadson Boulevard would be needed to accommodate this addition.
- **OPS 13 – Paul Cantrell Boulevard & Tobias Gadson Boulevard – Provide Signage for Paul Cantrell EB Right Lane Approach:** The far right lane of the eastbound approach to Tobias Gadson Boulevard has very little advance indication that the lane only allows for right turns and is dropped at the intersection. Several signs should be added to supplement the pavement markings including a RIGHT TURN ONLY sign added overhead on the signal wire at the intersection and an additional RIGHT LANE MUST TURN RIGHT sign farther away from the intersection. This improvement was completed by SCDOT District 6 in 2013.

7.1.3 I-526 & Leeds Avenue Interchange

- **OPS 14 – Provide the 2nd Left-Turn Lanes from Leeds Avenue to I-526 EB and I-526 WB:** The Leeds Avenue interchange experiences heavy turning volumes and very little through traffic during the peak hours. The left-turn volumes from Leeds Avenue to both directions of I-526 exceed 300 vehicles per hour. The dual left-turn lanes would require the 2nd receiving lane for both entrance ramps.
- **OPS 15 – Extend I-526 WB Acceleration Lane from Leeds Avenue:** An approximately 200-foot acceleration lane currently exists. Lengthening this acceleration lane will provide additional length for entering vehicles, limiting the interaction with through traffic along I-526 westbound during the peak hours.
- **OPS 16 – Provide Ramp Metering for the I-526 WB Entrance Ramp from Leeds Avenue:** During the PM peak hour, congestion occurs at the entrance ramp due to a large volume of vehicles entering from Leeds Avenue. By metering the entrance ramp, the capacity of the merge area along I-526 westbound is maximized with the regulated traffic flow from the ramp.

7.1.4 I-526 & Dorchester Road/Paramount Drive Interchange

- **OPS 17 – Remove the North Leg of I-526 EB Ramp & Paramount Drive Intersection:** Currently two paths exist for road users to access Dorchester Road from I-526 eastbound, the I-526 EB Ramp & Dorchester Road intersection and the Dorchester Road & Paramount Drive intersection. Removing this section of roadway would result in one less signal along Dorchester Road and would simplify traffic patterns and reduce the potential for driver confusion.
- **OPS 18 – Provide Near-Side Signal Heads along Paramount Drive at I-526:** There is a sight distance concern for both signals at the I-526 & Paramount Drive intersections. Due to the intersections being spaced closely to the I-526 overpasses, signal visibility may be obscured, therefore, adding near-side signals would help alleviate this problem.
- **OPS 19 – Restrict Right-Turns-On-Red at the Dorchester Road and Paramount Drive intersections with I-526:** Due to potential sight distance concerns at the intersections, restricting right-turns-on-red will help to reduce potential conflicts.

7.1.5 I-526 & International Boulevard Interchange

- **OPS 20 – Extend the I-526 EB Acceleration Lane from the Loop Ramp through the I-526 WB Ramp Intersection:** An approximately 200-feet acceleration lane currently exists. By lengthening this acceleration lane through the intersection, additional length for entering vehicles to merge into the through traffic stream will be provided and additional capacity will be provided for International Boulevard traffic.
- **OPS 21 – Provide the 2nd Left-Turn Lane from International Boulevard to I-526 WB:** The left-turn from International Boulevard to the I-526 westbound entrance ramp exceeds 400 vehicles per hour during the PM peak hour. By providing dual left-turns, the movement will be better able to handle expected future growth. A second receiving lane along I-526 westbound would be needed to accommodate the additional left-turn lane.
- **OPS 22 – International Boulevard & South Aviation Avenue – Construct the 2nd EB Left Turn Lane:** Existing volumes for the International Boulevard eastbound left-turn at South Aviation Avenue are 91 and 209 vehicles per hour for the AM peak hour and PM peak hour, respectively. Future growth

is expected to increase the PM peak-hour volume to 507 vehicles per hour, and the dual-left turn lanes will be required.

- **OPS 23 – International Boulevard & Centre Pointe Drive – Construct the 3rd EB Left Turn Lane:** The dual left-turn lanes for the International Boulevard eastbound approach to Centre Pointe Drive currently serve 337 and 612 vehicles per hour for the AM peak hour and PM peak hour, respectively. Future growth is expected to increase the traffic volumes, which will require more capacity for this left-turn movement. A third receiving lane along Centre Pointe Drive would be needed to accommodate the additional left-turn lane.
- **OPS 24 – International Boulevard & Centre Pointe Drive – Construct the 2nd SB Right-Turn Lane:** The right-turn lane for the Centre Pointe Drive southbound approach to International Boulevard currently serves 228 and 846 vehicles per hour for the AM peak hour and PM peak hour, respectively. Future growth is expected to increase the traffic volumes, which will require more capacity for this right-turn movement.
- **OPS 25 – International Boulevard & Tanger Outlet Boulevard – Construct Exclusive WB Right-Turn Lane:** The right-turn lane for the International Boulevard westbound approach to Tanger Outlet Boulevard currently serves 145 and 481 vehicles per hour for the AM peak hour and PM peak hour, respectively. The current configuration requires right-turn vehicles to wait behind through traffic at a red signal indication. An exclusive right-turn lane will provide additional capacity and allow for right-turn-on-red movements to be completed more often.
- **OPS 26 – Montague Avenue & International Boulevard – Construct the 2nd SB Right-Turn Lane:** Existing volumes for the Montague Avenue southbound right-turn approach to International Boulevard are 343 and 657 vehicles per hour for the AM peak hour and PM peak hour, respectively. Future growth is expected to increase the traffic volumes, which will require more capacity for this right-turn movement.

7.1.6 I-26 & I-526 Interchange

- **OPS 27 – End the Outside I-526 EB to I-26 WB Ramp Lane 500 Feet Prior to Current Merge Area:** The I-526 eastbound exit Ramp to I-26 westbound consists of two lanes that merge together prior to the merge with I-26 westbound and I-526 westbound approximately 500 feet downstream. This merge configuration generally creates significant friction in the PM peak hour. By reducing I-526 eastbound ramp traffic to one lane earlier, the two merge areas will be separated for I-526 eastbound traffic, promoting improved flow and weaving condition at the merge of I-526 eastbound with I-26 westbound and I-526 westbound.

7.1.7 I-526 & Rivers Avenue Interchange

- **OPS 28 – Extend the Rivers Avenue Acceleration Lanes from the I-526 EB & WB Loop Ramps:** There are approximately 200-foot acceleration lanes along Rivers Avenue for both loop ramps exiting I-526. By lengthening the acceleration lanes, additional length for entering vehicles to merge into the through traffic stream will be provided, resulting in smoother traffic flows.

7.2 Pavement Marking Improvements

Pavement markings deliver guidance and convey information to road users. When pavement markings are used consistently for similar road patterns, guidance and information become clearer to road users as opposed to inconsistent pavement marking patterns. The following section includes improvements related to pavement marking throughout the corridor.

7.2.1 I-526 at the Ashley River Bridges (OPS 29)

The current bridges on I-526 over the Ashley River measure 39.5 feet gutter to gutter in width. An additional through lane may be provided in both directions by widening the bridges or by restriping the existing bridge structures. The widening of the bridges could cost in excess of $40 million and would have impacts to waters and wetlands of the Ashley River. An alternative measure is to restripe the existing bridge structures to accommodate three lanes with reduced shoulders in both directions. The recommended cross section would be:

- 2-foot inside shoulder,
- 12-foot travel lane,
- 11-foot travel lane,
- 12-foot travel lane, and
- 2.5-foot outside shoulder.

A review of crash data along the existing two-lane I-526 bridges over the Ashley River shows a relatively low history of crashes on the bridge. Crashes along I-526 approaching the bridges generally occur in the vicinity of adjacent interchange ramps. Providing the three lanes by restriping the bridge would require extra monitoring to ensure that any incident on the bridge would receive an immediate response. Providing complete camera coverage and extending the motorist assistance program for the entire length of I-526 would provide this added assurance. The cost to restripe the bridges to three lanes would be approximately $55,000 and the cost of the cameras (three recommended at this location) would be approximately $90,000. Placement of additional cameras should be coordinated with the existing traffic cameras along I-526.

7.2.2 I-526 from Rivers Avenue to the Don Holt Bridge (OPS 30)

The current roadway width of I-526 is 44 feet throughout most of I-526 east of Rivers Avenue. Much of I-526 is carried on elevated bridge structures as I-526 moves toward the crossing of the Cooper River via the Don Holt Bridge. An additional through lane in both directions will require widening of the existing bridges between I-26 and Clements Ferry Road or by restriping the existing bridge structures. The widening of the bridge structures would cost in excess of $60 million and would impact wetlands along the route. An alternative measure is to re-stripe the existing bridges to accommodate three lanes in both directions with reduced shoulders. The recommended cross-section would be:

- 2-foot inside shoulder,
- 11-foot travel lane,
- 11-foot travel lane,
- 11-foot travel lane and
- 9-foot outside shoulder.

Additionally, there is an approximately 1000-foot section between I-26 and Rivers Avenue that would need to be widened to accommodate the widening of I-526 by restriping east of Rivers Avenue.

An additional third lane in each direction would reduce the volume of traffic in the outside lanes where merge and weaving actions are most prevalent. This reduction in traffic should provide a safer route with fewer accidents associated with the interchange ramps. It should be noted that I-526 westbound between Clements Ferry Road and the Don Holt Bridge currently accommodates three lanes on the elevated bridge structure.

Providing three lanes by restriping the bridge would require extra monitoring to assure that any incident would receive an immediate response. Providing complete camera coverage and extending the motorist assistance program for the entire length of I-526 would provide this added assurance. In 2006, SCDOT estimated the cost of roadway widening and re-striping from I-26 to Clements Ferry Road to be $4.3 million. In addition to this cost, additional incident responder patrols and camera coverage would be needed since the lack of shoulders will make response times critical. Placement of additional cameras should be coordinated with the existing traffic cameras along I-526.

7.2.3 Interstate Route Shields (OPS 31)

A pavement marking strategy that has been utilized is the marking of the Interstate exiting lanes with the route shield for the roadway that the lane accesses. For instance, along I-26 eastbound, the lanes that exit to I-526 could include painted route shields on the pavement with TO I-526. These markings could also be utilized along the I-526 lanes that exit to I-26. By using route shield pavement markings, drivers are further informed that the lane in which they are traveling is an exit lane, which either serves as an indication to change lanes or confirmation that they are in the correct lane.

7.2.4 Acceleration Lane Markings (OPS 32)

Some of the more common pavement markings related to freeways involve the marking of merge areas from entrance ramps, exit ramps, and lane drops. Pavement marking in these areas currently is inconsistent around the I-526 study corridor and possibly confusing to road users unfamiliar with the area.

For acceleration lanes and lane drops, mini-skip markings supplemented with 45 degree arrows provide better guidance to road users than simply ending regular skip lines and displaying a decreasing two-lane wide, non-marked pavement. Acceleration lanes along the freeway, such as the acceleration lane for I-526 westbound from International Boulevard, and along arterials that exit from the freeway, such as the acceleration lane for Paul Cantrell Boulevard eastbound from I-526 eastbound (which was completed by SCDOT District 6 in 2013), could greatly reduce the chance of driver confusion by applying this measure.

7.3 Signing Improvements

Improvements to the signing along I-526 will improve traffic operations by providing motorists with clearer information allowing them to better anticipate upcoming exits and enter the correct lane in advance of the interchanges, reducing the large number of merging and diverging conflicts observed at the interchanges along the corridor. Because of the large number of visitors to the Charleston area, especially those arriving at the airport located along the corridor, clear signage is especially important.

The study team has identified several improvements to existing signs as well as additional signs that could be installed to provide better motorist information. Improvements to signs along I-526 and on the crossing routes are summarized in Table 7-1 through Table 7-8 for each of the I-526 interchange areas, including a schematic of each recommended signing change.

Table 7-1: Signing Improvements – US 17/Sam Rittenberg Boulevard Interchange (OPS 33)

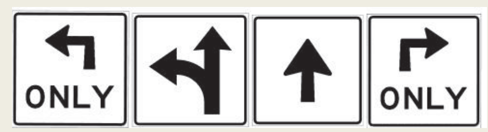
#			Description	Sign Detail
1	Location	US 17 NB	Revise overhead sign on US 17 Northbound to add "Exit Only"	
	Priority	High		
	Cost	$2,500		
2	Location	US 17 NB	Revise overhead bridge mounted sign on US 17 Northbound to add "Exit Only Sign	
	Priority	High		
	Cost	$6,000		
3	Location	I-526 WB	Add span wire structure to provide lane assignments approaching SC 7 and US 17	
	Priority	High		
	Cost	$10,000		
4	Location	I-526 WB	Add ground mounted sign for Savannah	
	Priority	Medium		
	Cost	$12,000		
5	Location	I-526 WB	Erect new oversize 35 mph speed limit signs on both sides of I-526 Westbound	
	Priority	Medium		
	Cost	$500		
6	Location	I-526 WB	Erect new Speed Zone Ahead signs on both sides of I-526 Westbound	
	Priority	Medium		
	Cost	$500		

Table 7-2: Signing Improvements – Paul Cantrell Boulevard Interchange (OPS 34)

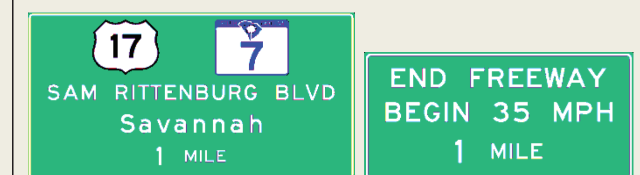
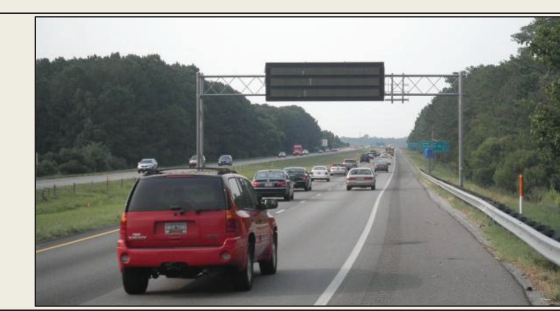
#			Description	Sign Detail
7	Location	I-526 WB	Convert advance sign at Ashley River Road to an overhead cantilever structure	
	Priority	Medium		
	Cost	$73,000		
8	Location	I-526 WB	Erect new cantilever structure to advise that I-526 ends	
	Priority	High		
	Cost	$88,000		
9	Location	Paul Cantrell NB	Erect new cantilever structure on Paul Cantrell Northbound	
	Priority	Medium		
	Cost	$73,000		
10	Location	Paul Cantrell SB	Erect new cantilever structure on Paul Cantrell Southbound	
	Priority	Medium		
	Cost	$88,000		
11	Location	I-526 EB & WB	Convert existing I-526 EB DMS sign structure to full sign bridge. Erect new DMS signs for I-526 WB.	
	Priority	High		
	Cost	$300,000		
12	Location	I-526 WB	Convert ground mounted advance sign for Paul Cantrell/Glenn McConnell on I-526 Westbound to an overhead cantilever structure	(No Change in Sign Information Recommended)
	Priority	High		
	Cost	$73,000		

Table 7-3: Signing Improvements – Leeds Avenue Interchange (OPS 35)

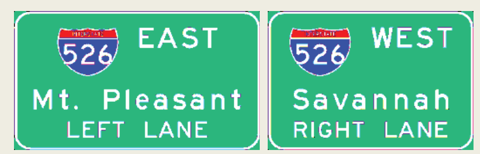
#			Description	Sign Detail
13	Location	I-526 EB	Convert ground mounted advance sign for Leeds Avenue on I-526 Eastbound to an overhead cantilever structure	(No Change in Sign Information Recommended)
	Priority	Medium		
	Cost	$73,000		
14	Location	I-526 EB	Convert the exit direction sign for Leeds Avenue on I-526 Eastbound to an overhead cantilever Structure. Move the advance sign for Paramount Drive/Dorchester Road from the bridge to this structure.	
	Priority	High		
	Cost	$88,000		
15	Location	Leeds SB	Erect a cantilever structure on Leeds Avenue Southbound in advance of the interchange providing lane assignments.	
	Priority	Medium		
	Cost	$88,000		
16	Location	Leeds NB	Erect a cantilever structure on Leeds Avenue Northbound before the curve providing lane assignments	
	Priority	Medium		
	Cost	$88,000		
17	Location	Leeds NB & SB	Erect two span wire structures on the Leeds Avenue bridge providing I-526 directional information	
	Priority	High		
	Cost	$20,000		
18	Location	I-526 WB	Erect new overhead cantilever structure on I-526 Westbound indicating an exit only for Leeds Avenue	
	Priority	High		
	Cost	$73,000		
19	Location	I-526 WB	Erect a new overhead cantilever structure on I-526 Westbound indicating an exit only for Leeds Avenue	
	Priority	High		
	Cost	$73,000		

Table 7-4: Signing Improvements – Dorchester Road/Paramount Drive Interchange (OPS 36)

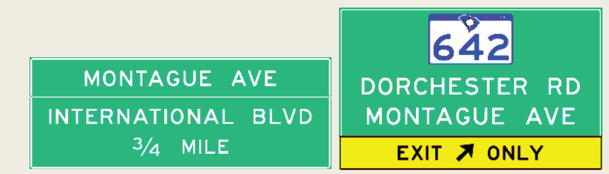
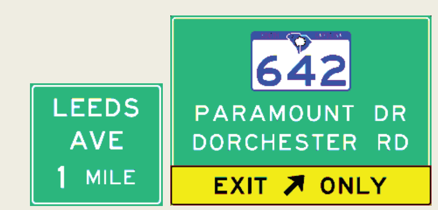
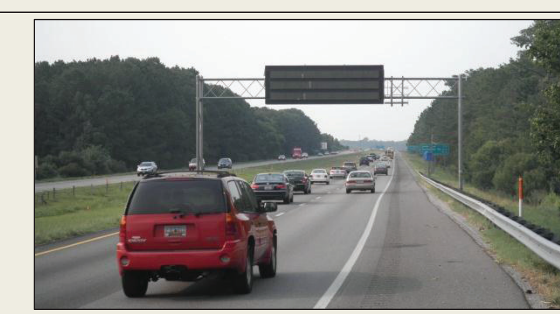
#			Description	Sign Detail
20	Location	I-526 EB	Erect new overhead cantilever structure on I-526 Eastbound for the exit only for Paramount Drive/Dorchester Road	
	Priority	High		
	Cost	$73,000		
21	Location	I-526 EB	Erect new overhead cantilever structure on I-526 Eastbound for the exit direction for Paramount Drive/Dorchester Road. Move the advance sign for Montague Avenue to this structure.	
	Priority	High		
	Cost	$88,000		
22	Location	Dorchester NB	Erect new overhead cantilever structure on Dorchester Road Northbound to provide lane assignments	
	Priority	Medium		
	Cost	$88,000		
23	Location	Dorchester SB	Erect a new overhead cantilever on Dorchester Road Southbound to provide lane assignments	
	Priority	Medium		
	Cost	$88,000		
24	Location	I-526 WB	Erect a new overhead cantilever structure on I-526 Westbound for Paramount Drive/Dorchester Road and move the advance sign for Leeds Avenue from the bridge to this structure	
	Priority	High		
	Cost	$88,000		
25	Location	I-526 WB	Erect new DMS signs for I-526 WB.	
	Priority	High		
	Cost	$300,000		

Table 7-5: Signing Improvements – International Boulevard/Montague Avenue Interchange (OPS 37)

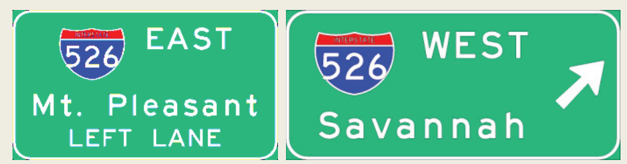
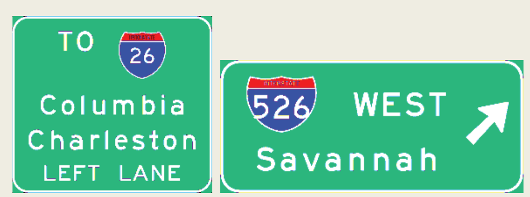
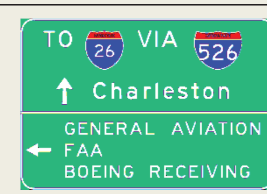
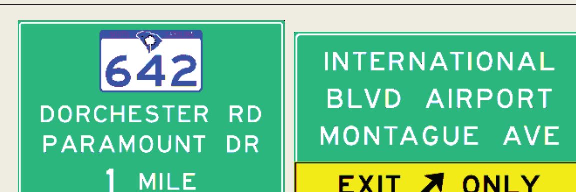
#			Description	Sign Detail
26	Location	I-526 EB	Modify the existing exit direction sign for Montague Avenue on I-526 Eastbound to add exit only	
	Priority	High		
	Cost	$6,000		
27	Location	Montague SB	Erect a new overhead cantilever structure on Montague Avenue Southbound to provide lane assignments	
	Priority	Medium		
	Cost	$88,000		
28	Location	Montague NB	Erect a new overhead cantilever structure on Montague Avenue Northbound to provide lane assignments	
	Priority	Medium		
	Cost	$88,000		
29	Location	International NB	Erect a new overhead cantilever structure on International Boulevard Northbound to provide lane assignments	
	Priority	High		
	Cost	$88,000		
30	Location	International SB	Erect a new overhead cantilever structure on International Boulevard southbound to provide lane assignments and additional guidance for Charleston	
	Priority	High		
	Cost	$88,000		
31	Location	International SB	Replace existing ground mounted sign with a standard green and white sign	
	Priority	Low		
	Cost	$10,000		
32	Location	I-526 WB	Modify existing cantilever structure to add advance sign for Dorchester Road/Paramount Drive	
	Priority	High		
	Cost	$88,000		

Table 7-6: Signing Improvements – I-26 & I-526 Interchange (OPS 38)

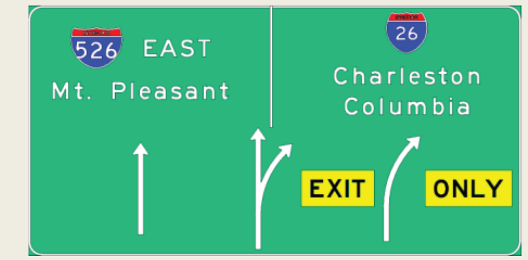
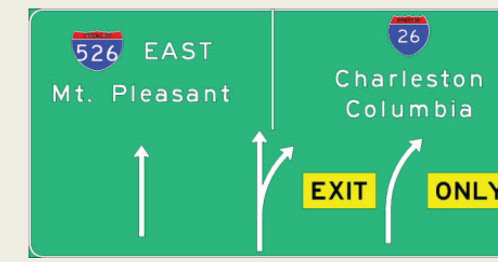
#			Description	Sign Detail
33	Location	I-526 EB	Install new "Arrow per Lane" signs on I-526 Eastbound in advance of I-26	
	Priority	High		
	Cost	$100,000		
34	Location	I-526 EB	Install new "Arrow per Lane" signs on I-526 Eastbound approaching I-26 near ramp gore	
	Priority	High		
	Cost	$100,000		
35	Location	I-526 WB	Install new overhead cantilever sign on I-526 Westbound providing exit only information for International Boulevard	
	Priority	Medium		
	Cost	$73,000		

Table 7-7: Signing Improvements – Rivers Avenue Interchange (OPS 39)

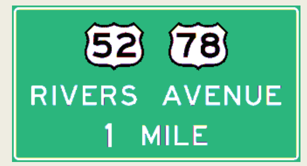
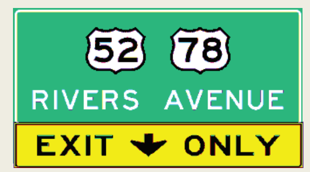
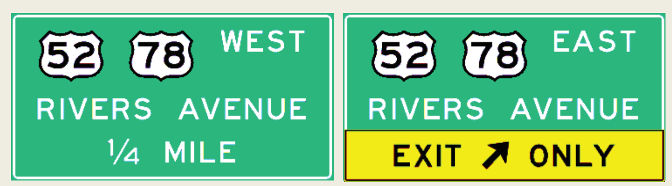
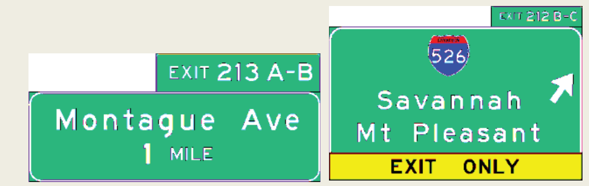
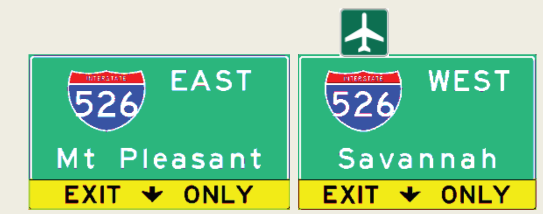
#			Description	Sign Detail
36	Location	I-526 EB	Install new overhead cantilever advance sign for US 52/78 on I-526 Eastbound	
	Priority	High		
	Cost	$73,000		
37	Location	I-526 EB	Install new overhead cantilever sign on I-526 Eastbound providing exit only information for US 52/78 east	
	Priority	High		
	Cost	$73,000		
38	Location	I-526 EB	Modify existing overhead sign to add exit only	
	Priority	High		
	Cost	$6,000		
39	Location	Rivers NB	Install new overhead cantilever sign on Rivers Avenue Northbound providing lane assignment information	
	Priority	Medium		
	Cost	$88,000		
40	Location	Rivers SB	Install new overhead cantilever sign on Rivers Avenue Southbound providing lane assignment information	
	Priority	Medium		
	Cost	$88,000		

Table 7-8: Signing Improvements – I-26 West of I-526 (OPS 40)

#			Description	Sign Detail
41	Location	I-26 EB	Modify existing overhead sign on I-26 Eastbound to add exit only	
	Priority	High		
	Cost	$6,000		
42	Location	I-26 EB	Install new overhead sign on I-26 Eastbound to give lane assignments for Mt. Pleasant and Savannah	
	Priority	High		
	Cost	$100,000		

7.4 Intelligent Transportation Systems Improvements

There are many potential uses for Intelligent Transportation Systems (ITS) technologies throughout the I-526 corridor. These technologies include signal timings, traffic cameras, incident response, and active traffic management.

7.4.1 Signal Retiming

Signal coordination benefits traffic flow on arterials by providing platooning within the coordinated system. This creates less congestion on the arterials as well as exiting and entering traffic from I-526. Most cross-street arterials along I-526 are currently coordinated in some form, either time-based or fiber-connected. According to the SCDOT *Traffic Signal Design Guidelines*, signal retiming should be considered at least every three years for coordinated corridors. Table 7-9 lists the cross-street arterials along I-526 and their current coordination status. Traffic signal retiming and coordination is recommended for corridors that haven't been retimed in the past two years.

Table 7-9: Arterial Present Coordination Most Recent Timing Implementation

Traffic Operations Strategy Number	Arterial	Present Coordination	Most Recent Timing Implementation
OPS 41	US 17/Sam Rittenberg Boulevard	Fiber Optic	2008
OPS 42	Paul Cantrell Boulevard	Copper	2008
OPS 43	Leeds Avenue	Time-Based	-
OPS 44	Dorchester Road	None	-
OPS 45	Montague Avenue	None	-
-	International Boulevard	Fiber Optic	2012
-	Rivers Avenue	Fiber Optic (Planned)	2011

7.4.2 Traffic Cameras (OPS 46)

While much of I-526 is covered by traffic cameras providing a view of much of the corridor to the existing SCDOT Traffic Management Center (TMC), the cameras do not cover the entire length of the corridor. The addition of traffic cameras in areas not currently covered, including full coverage of the Ashley River bridge and east of Rivers Avenue with the associated restriping to three travel lanes in both directions, will provide operators at the TMC with a full view of the corridor allowing incidents to be more easily identified and the operators to provide more information to emergency responders regarding the exact location and nature of the incident.

Traffic cameras have also been used by SCDOT to collect traffic data along certain routes. While SCDOT currently has several count stations located along the corridor that consist of inductive loop detectors, traffic cameras can also be used to collect traffic volumes and speeds on an hourly, daily, monthly or annual basis. The addition of traffic cameras at certain locations, as well as the use of existing cameras for data collection will provide more sources of traffic volume and speed data to supplement existing data sources.

7.4.3 Incident Management (OPS 47)

Many traffic crashes are actually secondary crashes resulting from braking and lane changes in response to primary incidents. By better responding to the primary incident, secondary incidents could be reduced improving traffic operations and safety for all motorists. Traffic cameras can provide more information to TMC operators and emergency responders as to the location and nature of incidents.

Additional incident management strategies could also benefit traffic operations and safety along the I-526 corridor. Increasing the coverage area and hours for SCDOT's existing incident management service would allow for better response times to incidents and provide motorist assistance along the corridor at all times, not just peak hours.

7.4.4 Accident Investigation Areas (OPS 48)

During AM and PM peak hours along the interstate, crashes are fairly common causes of congestion. While more severe collisions cause heavy backups due to lane closures, even minor fender-benders can cause congestion problems with "rubbernecking". Long after the vehicles have been moved to the shoulder, the closeness of the accident-involved vehicles and law enforcement officials to the adjacent roadway tend to slow passing traffic as they look at the incident. In addition, the vehicles and law enforcement officials on the shoulder are potentially at-risk for secondary crashes due to the narrowness of some roadside shoulders.

Accident investigation areas address these issues by removing the vehicles involved in the crash from the lanes of the freeway by providing an area away from the roadway to enhance the safety of the vehicles involved in the incident, the assisting law-enforcement officials, and the passing traffic. These areas can also be shielded by vegetation to further reduce the gaper's delays resulting from passing traffic. It is recommended that one (1) accident investigation area be considered along I-526.

7.4.5 Active Traffic Management (OPS 49)

Active traffic management (ATM) is a form of intelligent transportation systems (ITS) that helps to combat delay on highways by applying methods such as variable speed limits, ramp metering, and hard-shoulder running. By monitoring the roadway environment through fixed and pan/tilt/zoom cameras and capturing traffic volume data through in-pavement vehicle detection loops, an ATM system helps the roadway better adapt to congestion, incidents, and/or adverse weather conditions by adjusting speed limits along the roadway or identifying an incident and allowing traffic to merge out of that particular lane. This traffic management technique could be useful in future infrastructure expansions for the I-526 study corridor, specifically across the Ashley River and between the Rivers Avenue interchange and the Clements Ferry Road Interchange.

7.4.5.1 Background

Several ATM systems have recently been implemented in the United States, including for I-90 and SR 520 in Seattle, Washington and for I-35W and I-94 in Minneapolis, Minnesota. There are several defining components to an ATM freeway. In a typical ATM setup, there are multiple overhead structures or gantries positioned roughly a ½ mile from one another through the ATM zone, which is important as there should always be a gantry visible to a driver throughout the ATM zone. Each gantry will have several different Dynamic Message Signs (DMS). Lane Control Signs (LCS) will be positioned above each travel lane that will display several different symbols or messages. There may also be Variable Message Signs (VMS) signs that are positioned on the sides of the roadway or overhead to the right of an LCS sign to provide messages to passing vehicles

There are also in-pavement vehicle detection loops in each lane spaced throughout the corridor to monitor traffic volumes carried and average vehicle speeds. Fixed and pan/tilt/zoom cameras are utilized to monitor and detect congestion and incidents along the roadway from the TMC. The cameras are also used to confirm any manual modifications to the ATM system. Also in some ATM systems, cameras are used to enforce speed limits, which is important for the successful implementation of variable speed limits.

The LCS signs would typically display regulatory speed limits or lane control messages depending on the situation. In most cases, the speed limits for all lanes would be constant at one gantry to harmonize speeds along the freeway. In some ATM systems, such as WSDOT's ATM systems in Seattle, the speed limit is displayed as a regulatory speed limit sign. In some ATM examples in Europe, the speed limit numbers are simply shown on the LCS signs and for other ATM systems the LCS signs feature a circle around the speed. If heavy congestion is present downstream, the LCS signs would display lower speed limits gradually down the corridor to decrease the effects of a shockwave, which is an abrupt change in speed due to the incidents that could lead to other incidents. If an incident occurs downstream, the LCS signs further upstream would change from speed limits to lane control messages. If the particular incident occurred in any specific lane(s) downstream, a pattern of lane control messages would be displayed at the gantries before the incident to tell vehicle users to merge out of the lane(s).

Some ATM systems may have other features or differ slightly from what is described above. Some systems have Emergency Refuge Areas (ERAs) equipped with phones and cameras. This supplements hard-shoulder running, which allows drivers to drive on the specified shoulder during times of congestion. Others show the normal regulatory speeds on DMS signs mounted on the sides of the gantries and the LCS signs go dark when a freeway is operating at normal speeds.

An ATM system would generally be controlled from the existing SCDOT TMC, with workstations to access the system, the ATM control software, and emergency response dispatch operations.

7.4.5.2 I-526 ATM Need

The areas of I-526 across the Ashley River and between the interchanges of Rivers Avenue and Clements Ferry Road have been identified for potential ATM implementation due to several factors affecting the roadway. I-526 over the Don Holt Bridge is a continual site for incidents and crashes, due in part to the speed differential caused by the vertical curve of the bridge and the weaving created by the addition of the truck lane on the bridge approach inclines.

As previously noted, these sections of I-526 are all elevated bridge structures which would be costly to widen. The potential to restripe these sections would provide additional capacity, and would require additional monitoring to quickly mitigate incidents due to the smaller shoulder sections. A fully-monitored roadway where drivers can be notified immediately of an incident and make lane changes based on the LCS signs provided would help alleviate some congestion that would normally be associated with an incident.

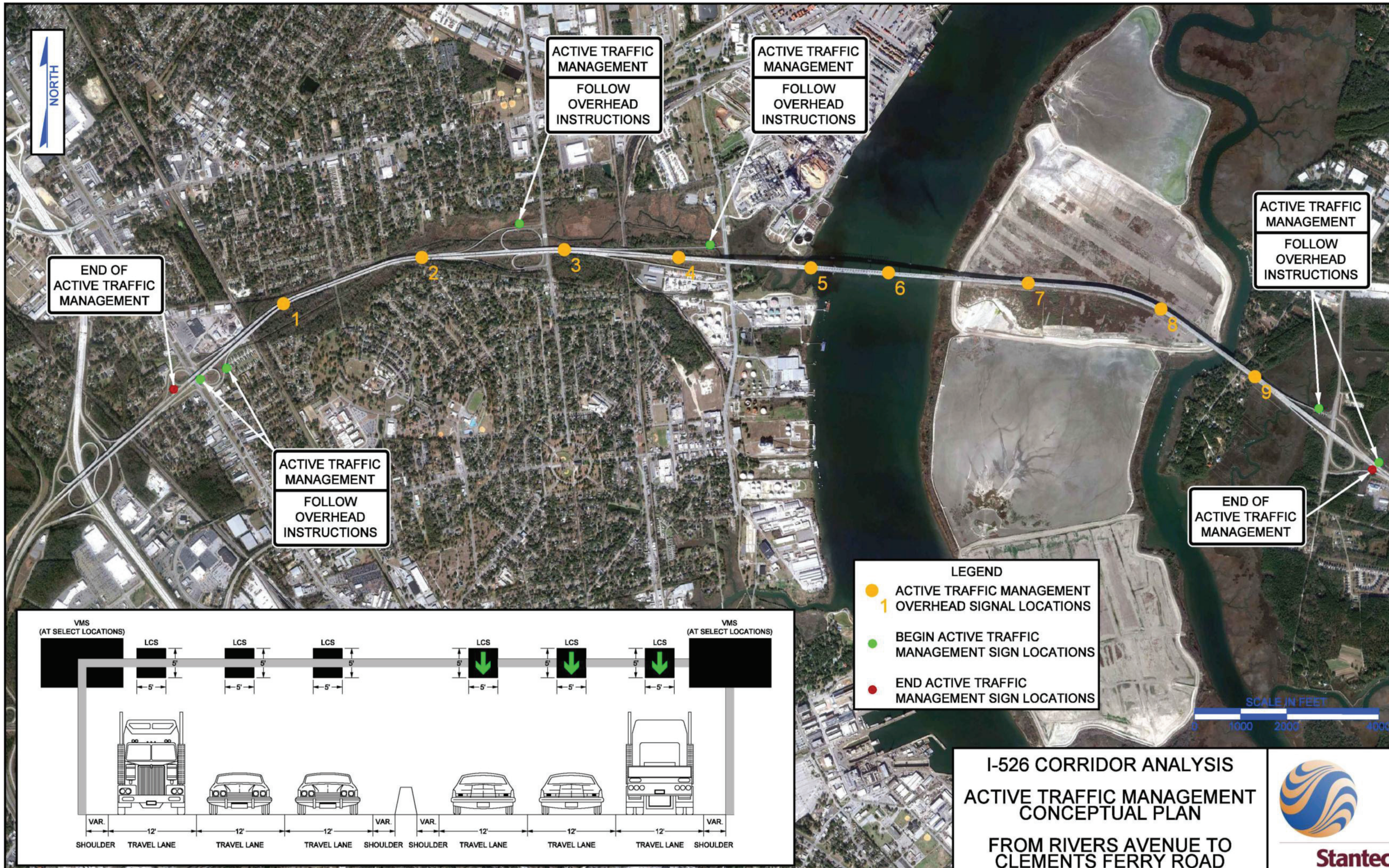
In addition, speed harmonization could greatly improve traffic flows along the I-526 corridor. Speed differentials between passenger vehicles and heavy vehicles are commonplace along the elevated sections of I-526 due to the vertical curves of the entrance ramps, exit ramps, and the approaches to the Don Holt Bridge. A constant visual of the speed permitted and perhaps speed enforcement would help provide smoother traffic patterns.

7.4.5.3 I-526 ATM Application

When entering the ATM zone, I-526 drivers would be notified via post-mounted signs that read ACTIVE TRAFFIC MANAGEMENT | FOLLOW OVERHEAD INSTRUCTIONS. These signs would be placed at both entry points along I-526 and all entrance ramps in the vicinity of the ATM zone. There would also be exit signs after the ATM zone on I-526 that read END OF ACTIVE TRAFFIC MANAGEMENT.

For the proposed section of I-526 between Rivers Avenue and Clements Ferry Road, nine gantries would be installed at approximately ½-mile distances in the ATM zone, which would span the entire width of the I-526 bridge structures. Each of these gantries would consist of six LCS signs, three facing both directions of traffic. The LCS signs would be five feet by five feet, which matches the height of a regulatory speed limit sign for a freeway. At select locations, a VMS sign would be located in the top right corner of the gantry facing traffic. Cameras would be installed where needed to monitor the entire ATM zone and in-pavement vehicle detection loops would be placed near each gantry in each lane. Exhibit 7-1 illustrates a potential ATM plan for I-526 east of Rivers Avenue.

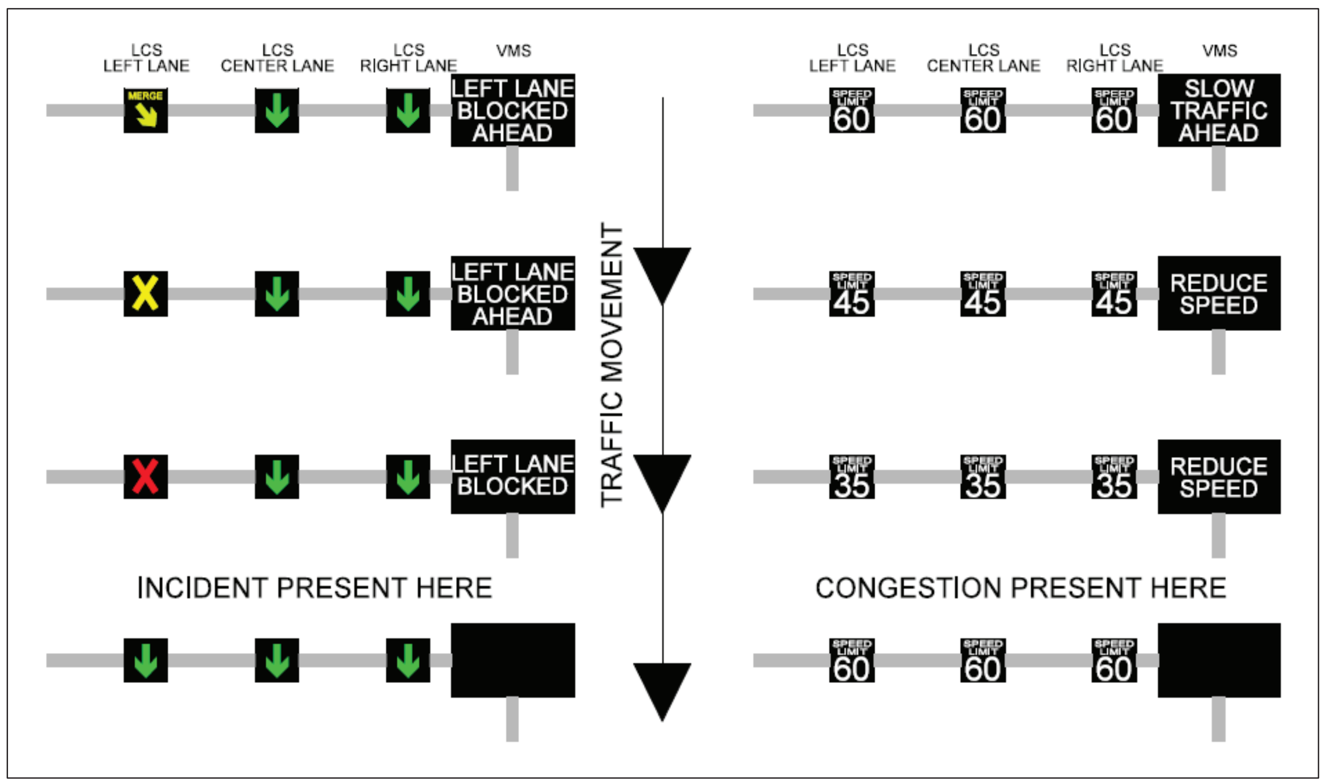
Exhibit 7-1: I-526 Active Traffic Management Plan



7.4.5.4 I-526 ATM Operations

During congestion downstream, the LCS signs would begin to lower the speed limits to slow traffic down smoothly to prepare for the congestion. During an incident the LCS signs would change to lane control signs to move cars out of the incident-involved lanes and the VMS signs in the top-right corner would display messages such as INCIDENT AHEAD or LEFT LANE CLOSED. Exhibit 7-2 illustrates an example of how the progression of LCS indications could work in in both of these situations.

Exhibit 7-2: Potential LCS Indication Progressions



It is expected that the ATM control room could be an extension of the existing SCDOT District 6 TMC located at 6335 Fain Street in North Charleston. The control room should be equipped with workstations (approximately $1,500 each) to access the system and monitors to observe existing traffic conditions. The operations center should also be connected with local emergency response dispatch operations, including first-responders and local motorist emergency services such as SHEP in South Carolina. The monitoring should also be connected with the local 511 and text alert systems.

The ATM Management control software to monitor and operate the system varies based upon the desired operating system, which can be open-source or proprietary. Open-source software can be less expensive, provide significant cost benefits, and be of higher design, but it is less flexible and customizable to an individual agency, and may take more time to implement than a proprietary software package.

The Advanced Highway Maintenance & Construction Research Laboratory (AHMCT) at the University of California, Davis conducted a comparison of costs/benefits Caltrans' existing proprietary ATM software with the implementation of the IRIS open-source software in Caltrans District 10. The IRIS open-source software was first utilized by the Minnesota DOT, and is now also utilized in California, Wisconsin, and Wyoming. Software acquisition costs vary between $375,000 and $850,000 and annual maintenance costs vary between $150,000 and $500,000 for the two systems. The results of the AHMCT costs/benefits comparison indicated that Caltrans would save 72% in costs over a five-year period with the IRIS open-source software, and that it maximizes innovation in the Active Traffic Management system.

The costs of ATM systems vary as much as the different implementations of ATM systems. For this particular implementation the cost of each gantry including the six LCS signs, two VMS signs, and the structure are estimated at $300,000 each. The hardware and software that is required as an expansion of the TMC is estimated at $500,000. Without taking into account cameras or restriping related to the ATM, the total cost of the ATM system is estimated to be $3,200,000.

7.5 Managed Lanes (OPS 50)

The following analysis evaluates the feasibility of implementing managed lanes in the I-526 corridor. Managed lanes are increasingly being considered by metropolitan planning organizations as a way to improve regional mobility. Managed lanes are commonly thought of as a freeway within a freeway, and the most recent applications include the use of "HOT Lanes", or High-Occupancy Toll lanes. The HOT lane concept blends the principles of High Occupancy Vehicle lanes (HOV) with tolling, by permitting HOVs to use the lanes without charge and all other vehicles to pay a toll to avoid congestion. Tolls would be a source of funding for part or all of the construction of the new capacity, and would be a source of recurring revenue that would be used to pay for operations and maintenance. The utilization and financial feasibility of a HOV or HOT lane in the I-526 corridor was analyzed and results presented in this section.

7.5.1 Project Definition

It was assumed the proposed managed lanes would be added in the median of I-526 between Paul Cantrell Boulevard and Rivers Avenue and open for operations by January 1, 2020. This section of I-526 generally consists of two full general purpose lanes per direction plus an auxiliary lane between interchanges and would have the greatest need for managed lanes from a traffic demand and capacity perspective. Paul Cantrell Boulevard is a major source of traffic in the existing corridor, and was therefore considered as the western terminus. Rivers Avenue was chosen as the eastern terminus because this arterial provides access to a large amount of retail and commercial activity and therefore travel demand.

The HOV or HOT lanes would extend for 4.35 miles from Paul Cantrell Boulevard to Rivers Avenue, with a single 12-foot wide lane in each direction. An intermediate access point would be created with a 0.25 mile mixing area located within the International Boulevard Interchange, allowing HOV or HOT lane vehicles to exit the eastbound lanes to access I-26, or allow vehicles to enter the westbound lanes from I-26. Vehicles traveling to or from the west would have access to or from Paul Cantrell Boulevard, while vehicles traveling to or from the eastern terminus would be able to access to or from Rivers Avenue. Solid double white lines would separate the HOV or HOT lanes from the adjacent general purpose lanes. Exhibit 7-3 illustrates the limits of the project and its access points.

In conjunction with HOV or HOT lane improvements, it is assumed that all existing and committed transportation projects in the BCDCOG travel demand model would be constructed. To provide for a conservative analysis, it is also assumed that the proposed completion of I-526 south to Johns Island and then east to James Island, terminating at Folly Road was in place.

HOV/HOT lane restrictions would apply 24 hours a day and seven days a week. The lanes would be restricted to passenger cars (no trailers), public transit buses, and emergency vehicles. Trucks would be prohibited from using the HOV or HOT lanes. All vehicles, with the exception of emergency vehicles, would be required to mount a transponder. Passenger cars with two or more occupants (HOV-2+) would be permitted to use the HOV lanes, and allowed to ride without charge in the HOT lanes. Single occupant vehicles (SOV) would gain access to the HOT lanes by paying a toll. Tolls would vary by hour and day of week, and would increase as demand increased. Tolls would start at a minimum rate of 13.2 cents per mile, or 57.5 cents for a full length trip, and increase as demand increases.

Exhibit 7-3: Managed Lanes Project Extents

7.5.2 Traffic Forecasts and Methodology

To fully understand the utility of either a HOV or HOT lane, three scenarios were evaluated in this study; a No-Build, Build HOV lanes, and Build HOT lanes scenario. The No Build scenario establishes a baseline upon which the HOV and HOT alternatives can be compared. This baseline assumes neither HOV nor HOT lanes would be built in the I-526 corridor but all existing and committed projects, along with the proposed completion of I-526 to Folly Road.

Traffic forecasts for the No Build, Build HOV, and Build HOT lanes scenarios pivot off the BCDCOG travel demand model that were released in April 2012. The BCDCOG model forecasts 2015 and 2035 traffic assuming that only existing and committed projects (EC scenario) are constructed. However, all scenarios analyzed assume the inclusion of the extension of the I-526 general purpose lanes so base forecasts were increased by approximately 2.5 percent to compensate for the expectation that the extension would increase traffic in the study area. Opening year 2020 traffic is obtained by interpolation between 2015 and 2035 results. Year 2049 traffic is estimated by growing year 2035 volumes at a rate of 0.35 percent per year which is equal to the rate of growth predicted by the model from 2010 to 2035.

HOV lane scenario traffic estimates were made using the BCDCOG volumes as inputs and existing information on the hourly distribution of traffic, and historical data on HOV shares in the area. The HOV lane scenario estimates are further incorporated into the forecast of total HOT lane traffic.

HOT Lane scenario traffic and revenue were forecast using the same input volumes, hourly traffic profiles, and incorporate the above referenced HOV traffic estimates, and finally Stantec's HOT lanes market share model to forecast likely toll traffic demand for the HOT lanes, toll rates, and resulting revenue.

7.5.3 No Build Results

BCDCOG traffic forecasts show that by 2015, traffic will grow from 2010 levels by four to 10 percent depending on the location. From 2015 to 2035, traffic along the I-526 corridor would grow by about five to 13 percent. These forecasts assume only existing and committed projects. Volumes used for analysis were increased by 2.5 percent to reflect traffic pulled into the corridor from the completion of I-526 to Folly Road. Exhibits 7-4 and 7-5 provide a corridor view of traffic conditions under this No Build condition, and demonstrate that during AM and PM peak hours and travel directions, I-526 would operate below capacity.

It should be noted that the segment from Paul Cantrell Blvd to Leeds Avenue, which crosses the Ashley River, has the least amount of unused capacity available and therefore may be considered as the segment of highest demand relative to capacity. Analyses of HOV and HOT lane traffic will focus on volumes in this segment. Further analysis of this segment demonstrates that the I-526 freeway without the HOV or HOT lanes would operate below capacity through the 2015 through 2049 analysis period. Table 7-10 shows that projected eastbound peak hour traffic during the AM peak hour would be at 89% of capacity by year 2035 and grow to 94% of capacity by the last analysis year 2049. During the PM peak hour, westbound traffic would reach 83% of capacity by year 2035, and grow to 87% of capacity by 2049.

Exhibit 7-4: I-526 Eastbound AM Peak Hour Traffic, 2010, 2015, 2035

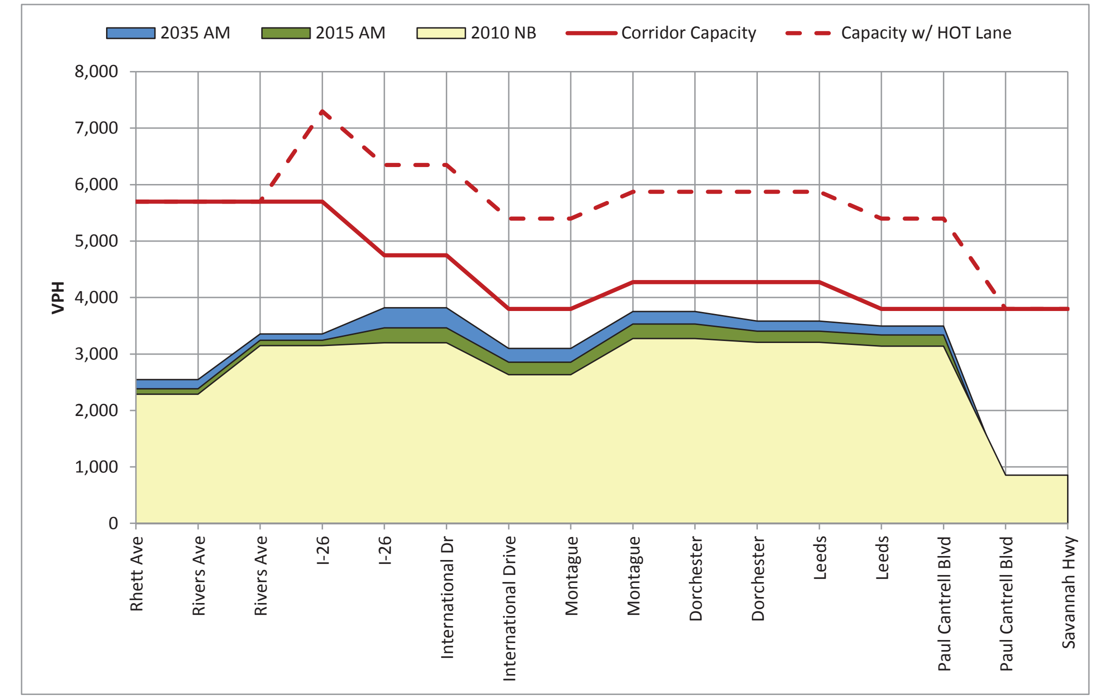


Exhibit 7-5: I-526 Westbound PM Peak Hour Traffic, 2010, 2015, 2035

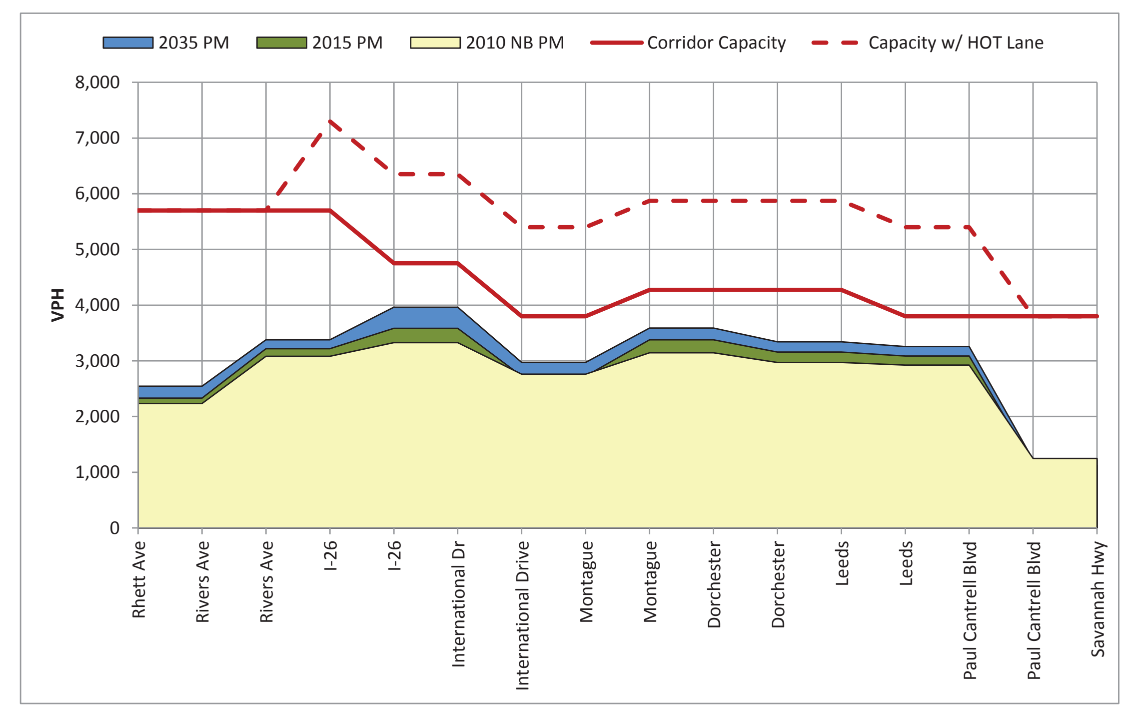


Table 7-10: I-526 No Build Scenario, Peak Hour Traffic, 2010, 2015, 2035, 2049

YEAR	EASTBOUND AM	% OF CAPACITY*	WESTBOUND PM	% OF CAPACITY*
2010	3,139	78%	2,924	73%
2015	3,387	85%	3,138	78%
2035	3,551	89%	3,305	83%
2049	3,741	94%	3,488	87%

*GP Lane capacity assumed to be 4,000 vehicles per hour (2 lanes).

7.5.4 HOV Lanes Results

Adding HOV lanes to the corridor between Paul Cantrell Blvd and Rivers Avenue would expand capacity by approximately 33 to 50 percent, but the utilization of the HOV lanes is expected to be well below capacity through the entire 30 year forecast period. Table 7-11 compares weekday peak hour HOV traffic expected in the HOV lane. Forecasts of HOV lane demand assume the same level of daily corridor traffic as forecast in the No Build scenario, an increase in the share of HOV vehicles to account for the added incentive to carpool given a HOV lane, and that approximately 50 percent of HOV vehicles in the corridor would use the HOV lanes (higher share for periods and directions with high demand, lower for low demand).

Generally HOV lanes have the greatest utilization in areas where the adjacent general purpose lanes experience demand at or over capacity and where the land use is conducive to carpooling. Survey data in the area collected previously by SCDOT demonstrate that approximately seven percent of area freeway traffic could be considered as HOV traffic, and therefore permitted to use the proposed HOV lanes. By comparison, carpooling shares in areas where HOV lanes are observed to have high demand such as Los Angeles and Northern Virginia show 10 to 20 percent of all freeway vehicles are high occupancy vehicles.

Table 7-11: I-526 Build HOV Scenario, Peak Hour Traffic, 2015, 2035, 2049

YEAR	STATISTIC	EASTBOUND AM	% OF CAPACITY*	WESTBOUND PM	% OF CAPACITY*
2015	HOV Volume	208	13%	220	14%
	GP Volume	3,179	79%	2,918	73%
2035	HOV Volume	218	14%	232	15%
	GP Volume	3,333	83%	3,073	77%
2049	HOV Volume	228	14%	244	15%
	GP Volume	3,513	88%	3,244	81%

*HOV Lane capacity assumed to be 1,600 vehicles per hour. GP Lane capacity assumed to be 4,000 vehicles per hour (2 lanes).

7.5.5 HOT Lanes Results

By considering HOT in addition to HOV lanes, single occupancy vehicles would also be allowed to take advantage of the leftover capacity not used by HOV vehicles. Forecasts of toll and HOT lane traffic were produced using Stantec's HOT lane market share model, which pivoted off of BCDCOG corridor traffic forecasts and are shown in Table 7-12. HOT lane traffic and revenue (T&R) forecasts demonstrate that by 2049, HOT travel demand on a typical weekday (Monday to Thursday) would peak at 568 vehicles, or 36 percent of capacity. Vehicles would be charged a toll of 87 cents in 2012 dollars to make the full 4.35 mile eastbound trip during the AM peak hour. The competing general purpose lanes would have nearly 3,200 vehicles, a volume to capacity ratio of 79 percent. This ratio suggests the general purpose lanes would be operating at uncongested speeds.

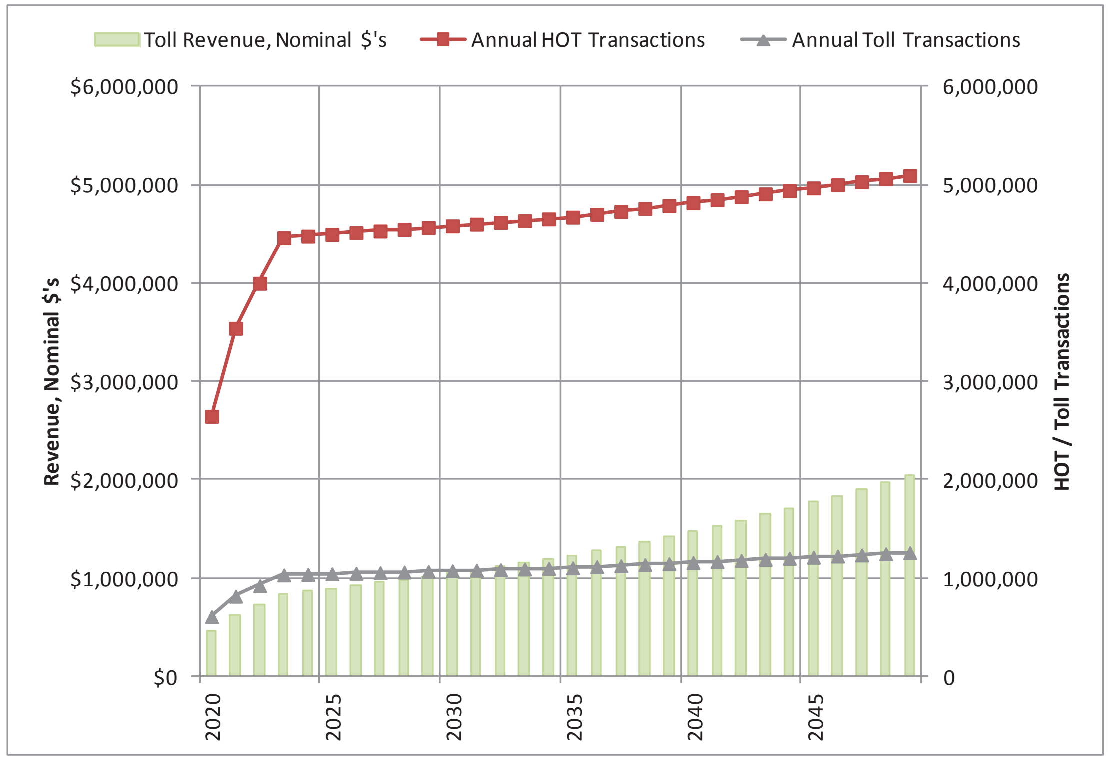
Table 7-12: I-526 Build HOT Scenario, Peak Hour Traffic, 2015, 2035, 2049

YEAR	STATISTIC	EASTBOUND AM	% OF CAPACITY*	WESTBOUND PM	% OF CAPACITY*
2015	HOT Volume**	446	28%	402	25%
	GP Volume	2,941	74%	2,736	68%
	Toll (2012$'s)	$0.80		$0.80	
2035	HOT Volume**	500	31%	448	28%
	GP Volume	3,051	76%	2,857	71%
	Toll (2012$'s)	$0.87		$0.80	
2049	HOT Volume**	568	36%	508	32%
	GP Volume	3,173	79%	2,980	75%
	Toll (2012$'s)	$0.87		$0.87	

*HOT Lane capacity assumed to be 1,600 vehicles per hour. GP Lane capacity assumed to be 4,000 vehicles per hour (2 lanes).
**Tolls are assessed only on single occupancy vehicles. HOT Lane volume includes HOV.

Annual traffic and revenue forecasts were made based on the results of the market share analyses, and are illustrated in Exhibit 7-6. Market share analyses were performed for years 2015, 2035, and 2049, for a typical Monday to Thursday, Friday, Saturday, and Sunday. Results were aggregated to form a typical week and then scaled up to represent a year. Traffic and revenue for years between 2015, 2035, and 2049 were estimated by interpolation. During the initial years of operations, HOT lanes traffic are forecast to start low and rapidly "ramp-up" as motorists become aware of and grow accustomed to using the road. During the first year of operations, the project would generate $0.5 million on a nominal dollar basis, and grow to $0.8 million by year 2023, the year that ramp-up is assumed to be complete. By 2035, toll revenue is forecast at $1.23 million and $2.05 million by year 2049, the end of the thirty year forecast period.

Exhibit 7-6: Annual HOT and Toll Transactions and Revenue (nominal $'s)



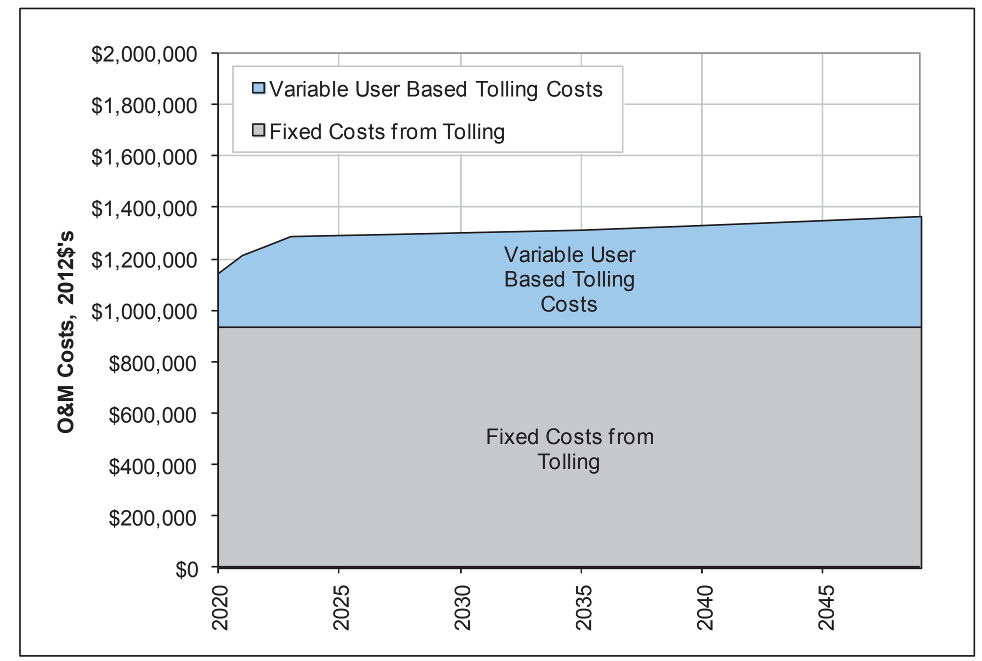
7.5.6 Operations and Maintenance Costs

Costs attributable to the implementation of HOT lane tolling were considered in this analysis, and are broken down into fixed and variable components. The cost analysis was limited to those costs that would be incurred beyond that needed to operate and maintain a HOV lane facility. The analysis considered the "fixed" day to day and maintenance costs of tolling, including staffing and toll systems maintenance. These fixed costs would be independent of the amount of traffic present on the HOT lanes. User based costs, would rise as the amount of demand for the facility rises. These costs include the cost of processing each toll transaction, un-recovered costs of violation enforcement, and the fee on processing credit card transactions. Costs associated with roadway maintenance, including repaving, restriping, and sign maintenance were not included in the costs estimates because these costs would be incurred under either a HOV or HOT lane implementation.

Operations and maintenance (O&M) unit cost data were obtained from a variety of sources including projects that are actually operating as well as those that are planned for the future. These projects include SR 167 in Seattle, I-394 in Minneapolis, I-85 in Atlanta, I-15 in Salt Lake City, several facilities in Houston and information documented in *Charlotte Region Fast Lanes Study (Draft Final Report, March 2009)*. The unit cost breakdown in the Fast Lanes study was the most detailed and was generally used to estimate tolling related costs for the I-526 HOT lanes.

As illustrated in Exhibit 7-7, yearly O&M costs on a constant dollar basis are estimated to be $1.15 million during the opening year 2020, and grow to $1.32 million by year 2035 and $1.37 million by year 2049. Fixed costs account for the majority of O&M costs attributable to tolling, consistent with a facility that serves little toll traffic.

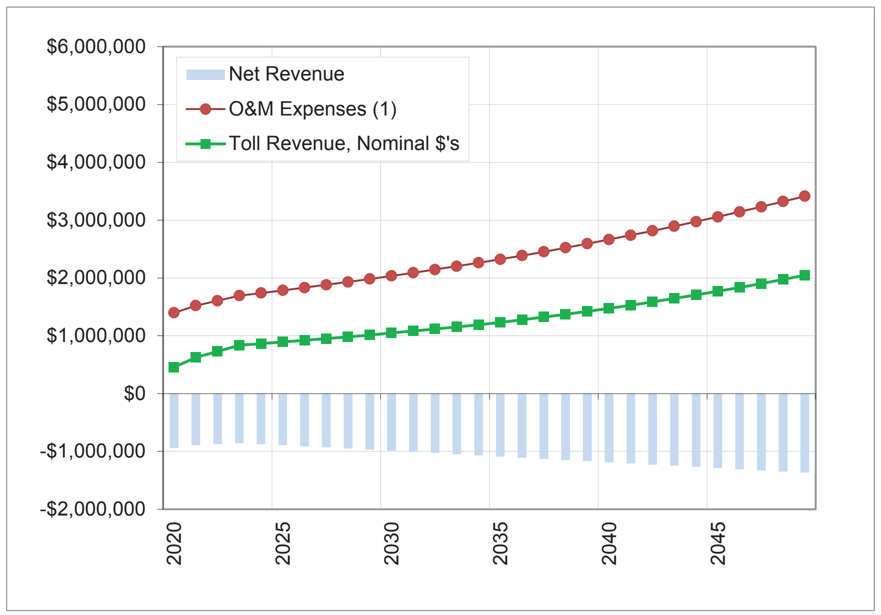
Exhibit 7-7: Build HOT Lanes Scenario, Annual Tolling Operations & Maintenance Costs, 2012$'s



7.5.7 HOT Lane Financial Feasibility

The HOT lanes are not expected to generate sufficient revenue to pay for O&M costs attributable to tolling. During the assumed opening year, 2020, the facility would generate just under $0.5 million while O&M attributable to tolling would cost approximately $1.40 million. By year 2035, revenues would grow to $1.23 million, while O&M would cost $2.32 million. By the end of the 30th year of operations, revenue would still be below O&M; $2.05 million in toll revenue at a cost of $3.41 million in O&M. In 2012 dollars, the project in total would generate $20.3 million, but cost $38.4 million in toll collection costs. Exhibit 7-8 compares total O&M costs attributable to tolling, by year, against annual toll revenue in nominal dollars. Aside from the comparison of toll revenues and O&M costs, the implementation of a HOT lane concept would require further capital investments to purchase tolling systems and related equipment (toll gantries, automatic traffic recorders, computers, servers, etc.). The analysis presented herein does not examine these capital costs however because the project is not expected to generate sufficient revenue to pay for day to day O&M. If the project is to be advanced to later stages of study, estimates of capital costs related to HOT lane implementation would be required.

Exhibit 7-8: Annual Toll Revenue and Operations & Maintenance Costs, Nominal $'s



1 – O&M expenses shown are those expenses attributable to daily toll operations only.

It should be noted that an analysis of revenue and O&M costs using a more aggressive forecast of corridor traffic for year 2035 and 2049 also demonstrated that costs would exceed revenues until at least 2035. Taken as a 30 year project, costs would still exceed revenues but by a lesser amount than they would using the more conservative traffic forecasts presented herein.

7.6 Environmental Review

Improvements to the operational management of the current roadway network include geometric ramp and interchange modifications, improved signing and pavement markings, designation of high occupancy lanes, and other traffic management strategies. These efforts are reasonably un-intrusive towards outlying areas and many of these improvements represent minor stand-alone improvements which can be environmentally processed by way of Categorical Exclusions. These minor projects represent a low cost investment that would reduce traffic congestion and motorist travel time through improved traffic flow.

The implementation of the proposed traffic operation strategies will likely have minimal impacts and effects on the surrounding human and natural environments. These improvements will likely take place within SCDOT's existing right of way or require only minimal amounts of new right of way from adjacent parcels, most of which are developed in this urbanized area. Minimal impacts, if any, to wildlife or their habit, cultural, or recreational resources, HAZMAT or waste generating sites are anticipated. No displacement of homes, businesses, or institutions should be required to implement these improvements.

7.6.1 US 17/Sam Rittenberg Boulevard | Paul Cantrell Boulevard

Numerous traffic operation strategies are proposed for these interchanges to improve the existing conditions. These improvements include:

- Coordination and timing of traffic signals,
- Lane restriping and access management,
- Additional signage for improved driver expectancy, and
- Addition and improvement to selected ramps and turning lanes.

Due to the absence of wetlands or floodplains in the project area no impacts to these resources are anticipated. It is anticipated that these strategies as minor independent projects can be processed as Categorical Exclusions type A (CEA) or type B (CEB).

7.6.2 Leeds Avenue

Numerous traffic operation strategies are proposed for this interchange to improve the existing conditions. These improvements include:

- Coordination and timing of traffic signals,
- Installation of ramp meters and queue loops,
- Additional signage for improved driver expectancy, and
- Addition and improvement to selected acceleration and deceleration ramps.

The implementation of the traffic operation strategies, including the ramp improvements, poses minimal effects on the surrounding environment. In this location there is a greater potential for impacts to wetlands and floodplains from construction activities. This work activity can be permitted under the SCDOT General Permit for construction in wetlands. It is anticipated that these strategies as minor independent projects can be processed as Categorical Exclusions type A (CEA) or type B (CEB).

7.6.3 Dorchester Road/Paramount Drive

Numerous traffic operation strategies are proposed for this interchange to improve the existing conditions. These improvements include:

- Removal and elimination of a ramp, and
- Signal and signage improvements for improved driver expectancy.

The implementation of these traffic operation strategies poses minimal effects on the surrounding environment. It is anticipated that these strategies as minor independent projects can be processed as Categorical Exclusions type A (CEA).

7.6.4 International Boulevard | Montague Avenue

Numerous traffic operation strategies are proposed for these interchanges to improve the existing conditions. These improvements include:

- Additional signage for improved driver expectancy,
- Coordination and timing of traffic signals,
- Installation of queue loops for left turn lanes, and
- Addition and improvement to selected acceleration and turning lanes.

The implementation of the proposed traffic operation strategies at these interchanges will likely have minimal impacts and effects on the surrounding human and natural environments. In this location there is a greater potential for impacts to wetlands and floodplains from construction activities. This work activity can be permitted under the SCDOT General Permit for construction in wetlands. It is anticipated that these strategies as minor independent projects can be processed as Categorical Exclusions type A (CEA) or type B (CEB).

7.6.5 I-26 | Rivers Avenue

Providing additional signage to improve driver expectancy is the primary traffic operation strategy proposed for this interchange to improve the existing conditions. The implementation of this proposed strategy at the interchange will likely have minimal impacts and effects on the surrounding human and natural environments. It is anticipated that this strategy as a minor project can be processed as Categorical Exclusions type A (CEA).

7.7 Summary – Traffic Operations Strategies

For the traffic operations strategies, the measure of effectiveness for the geometric improvements was based upon the *VISSIM* analyses results, which are documented in chapter 10. Tables 7-13 and 7-14 detail the Traffic Operations strategies considered in the analysis, including the potential timing of the improvement strategies and approximate implementation costs. The timing of the improvements was based in part upon additional interim-year *VISSIM* Build analyses.

Table 7-13: Traffic Operations Summary

Label	Traffic Operations Category	Strategy Location	Description	Timing	Cost	Associated Strategies
OPS 1	Geometric Improvements	I-526 & Sam Rittenberg Boulevard	Remove the south leg of the Sam Rittenberg Boulevard & I-526 WB intersection, direct all traffic to Sam Rittenberg Boulevard	2020	$95,000	OPS 2, CAP 6
OPS 2	Geometric Improvements	I-526 & Sam Rittenberg Boulevard	Restripe SB approach to consist of dual left-turn and dual right-turn lanes at I-526 WB & Sam Rittenberg Boulevard	2025	$5,000	OPS 1, CAP 6
OPS 3	Geometric Improvements	I-526 & Sam Rittenberg Boulevard	Extend the I-526 WB Right-Turn Lane approaching Sam Rittenberg Boulevard	2015	$312,000	OPS 1, OPS 2, OPS 4, CAP 6
OPS 4	Geometric Improvements	US 17 & Sam Rittenberg Boulevard	Construct SB triple right-turn lanes on Sam Rittenberg Boulevard approaching US 17	2025	$472,000	CAP 6
OPS 5	Geometric Improvements	I-526 & US 17	Prepare Access Management Plan along US 17 through the I-526 Interchange	2013	$700,000	
OPS 6	Geometric Improvements	US 17 & Skylark Drive	Construct second SB approach lane to US 17	2020	$1,144,000	
OPS 7	Geometric Improvements	Sam Rittenberg Bl. & Skylark Dr.	Construct a Northbound Right-Turn Lane approaching Sam Rittenberg Boulevard	2025	$320,000	
OPS 8	Geometric Improvements	I-526 & Paul Cantrell Boulevard	Lengthen deceleration lane along I-526 WB to Paul Cantrell Boulevard EB loop	2015	$819,000	
OPS 9	Geometric Improvements	I-526 & Paul Cantrell Boulevard	Lengthen deceleration lane along I-526 WB to Paul Cantrell Boulevard WB	2015	$830,000	
OPS 10	Geometric Improvements	I-526 & Paul Cantrell Boulevard	Lengthen deceleration lane along I-526 EB to Paul Cantrell Boulevard WB loop	2015	$341,000	
OPS 11	Geometric Improvements	I-526 & Paul Cantrell Boulevard	Lengthen acceleration lane along I-526 EB from Paul Cantrell Boulevard	2020	$830,000	
OPS 12	Geometric Improvements	Paul Cantrell Bl. & Tobias Gadson Bl.	Construct EB dual left-turn lanes from Paul Cantrell Boulevard to Tobias Gadson Boulevard	2025	$795,000	
OPS 13	Geometric Improvements	Paul Cantrell Bl. & Tobias Gadson Bl.	Provide Signage for Paul Cantrell EB Right Lane Approach	2013	$2,000	
OPS 14	Geometric Improvements	I-526 & Leeds Avenue	Improve Ramps to I-526 to allow Dual Left-Turn Lanes from Leeds Avenue EB and WB	2030	$750,000	
OPS 15	Geometric Improvements	I-526 & Leeds Avenue	Extend acceleration lane from Leeds Avenue to I-526 WB	2015	$790,000	OPS 29
OPS 16	Geometric Improvements	I-526 & Leeds Avenue	Provide Ramp Metering for the I-526 WB entrance ramp from Leeds Avenue	2025	$95,000	
OPS 17	Geometric Improvements	I-526 & Dorchester Road	Remove the north leg of the Paramount Drive & I-526 EB intersection, direct all traffic to Paramount Drive	2015	$105,000	
OPS 18	Geometric Improvements	I-526 & Paramount Drive	Provide Near-Side Signal Heads along Paramount Road at I-526	2013	$5,000	
OPS 19	Geometric Improvements	I-526 & Dorchester Rd./ Paramount Dr.	Restrict Right-Turn On Red Movements at the Paramount Drive and Dorchester Road Exit ramps from I-526	2013	$500	
OPS 20	Geometric Improvements	I-526 & International Boulevard	Extend the acceleration lane from the I-526 EB loop ramp through the intersection with the I-526 WB ramps	2025	$1,350,000	
OPS 21	Geometric Improvements	I-526 & International Boulevard	Provide dual Left-Turn Lane from International Boulevard to I-526 WB	2025	$710,000	
OPS 22	Geometric Improvements	International Bl. & South Aviation Av.	Construct EB dual left-turn lanes at International Boulevard & S. Aviation Avenue	2025	$300,000	
OPS 23	Geometric Improvements	International Bl.& Centre Pointe Dr.	Construct EB triple left-turn lanes at International Boulevard & Centre Pointe Drive	2035	$751,000	
OPS 24	Geometric Improvements	International Bl. & Centre Pointe Dr.	Construct SB dual right-turn lanes at International Boulevard & Centre Pointe Drive	2035	$394,000	
OPS 25	Geometric Improvements	International Bl. & Tanger Outlet Bl.	Construct a WB right-turn lane at International Boulevard & Tanger Outlet Boulevard	2025	$394,000	
OPS 26	Geometric Improvements	Montague Av. & International Bl.	Construct SB dual right-turn lanes at Montague Avenue & International Boulevard	2025	$394,000	
OPS 27	Geometric Improvements	I-526 & I-26	End the outside I-526 EB to I-26 WB ramp lane 500 feet prior to the current merge area	2013	$10,000	
OPS 28	Geometric Improvements	I-526 & Rivers Avenue	Extend the acceleration lanes from the I-526 EB loop ramp and I-526 WB loop ramp	2015	$1,576,000	

Table 7-14: Traffic Operations Summary Continued

Label	Traffic Operations Category	Strategy Location	Description	Timing	Cost	Associated Strategies
OPS 29	Pavement Marking Improvements	I-526 across the Ashley River	Restriping the Mainline Shoulders over the Ashley River Bridge for 3 lanes in each direction	2020	$55,000	OPS 15, CAP 2
OPS 30	Pavement Marking Improvements	I-526 east of I-26	Restriping the Mainline Shoulders Rivers Avenue and east for 3 lanes in each direction	2020	$4,300,000	OPS 49
OPS 31	Pavement Marking Improvements	Interstate Route Shield	Provide "To I-526" markings on the eastbound I-26 approach to I-526	2013	$5,000	
OPS 32	Pavement Marking Improvements	Acceleration Lane Markings	Provide 45-degree Arrows & Mini-Skip Markings on Paul Cantrell Boulevard acceleration lane from I-526 EB and on the I-526 WB acceleration lane from International Boulevard	2013	$5,000	
OPS 33	Signing Improvements	I-526 & US 17/Sam Rittenberg Bl.	Provide updated signing for the interchange of I-526 & US 17 / Sam Rittenberg Boulevard	2013	$31,500	
OPS 34	Signing Improvements	I-526 & Paul Cantrell Boulevard	Provide updated signing for the interchange of I-526 & Paul Cantrell Boulevard	2013	$622,000	
OPS 35	Signing Improvements	I-526 & Leeds Avenue	Provide updated signing for the interchange of I-526 & Leeds Avenue	2013	$576,000	
OPS 36	Signing Improvements	I-526 & Dorchester Rd./Paramount Dr.	Provide updated signing for the interchange of I-526 & Paramount Drive / Dorchester Road	2013	$425,000	
OPS 37	Signing Improvements	I-526 & International Bl./ Montague Av.	Provide updated signing for the interchange of I-526 & Montague Avenue International Boulevard	2013	$456,000	
OPS 38	Signing Improvements	I-526 & I-26	Provide updated signs for the interchange of I-526 & I-26	2013	$273,000	
OPS 39	Signing Improvements	I-526 & Rivers Avenue	Provide updated signs for the interchange of I-526 & Rivers Avenue	2013	$328,000	
OPS 40	Signing Improvements	I-26 West of I-526	Provide updated signs for eastbound I-26, west of I-526	2013	$106,000	
OPS 41	ITS Improvements	I-526 & US 17/Sam Rittenberg Bl.	Prepare Signal Retiming Plans	2013	$25,000	
OPS 42	ITS Improvements	I-526 & Paul Cantrell Boulevard	Prepare Signal Retiming Plans	2013	$25,000	
OPS 43	ITS Improvements	I-526 & Leeds Avenue	Prepare Signal Retiming Plans	2013	$25,000	
OPS 44	ITS Improvements	I-526 & Dorchester Road	Prepare Signal Retiming Plans	2013	$25,000	
OPS 45	ITS Improvements	I-526 & Montague Avenue	Prepare Signal Retiming Plans	2013	$25,000	
OPS 46	ITS Improvements		Enhanced Traffic Camera Coverage	2015	$30,000/camera	
OPS 47	ITS Improvements		Enhanced SHEP	2015	--	
OPS 48	ITS Improvements		Provide 1 Accident Investigation Area along I-526	2015	$340,000	
OPS 49	ITS Improvements		Active Traffic Management (Design and Construction)	2020	$3,200,000	OPS 30
OPS 50	Managed Lanes		Managed Lanes (HOV, HOT, Truck Lanes)	--	--	