Appendix F—Congestion Management Process Technical Memo

CAROLINA
CROSSROADS
I-20/26/126 Corridor Project

Congestion Management Process Technical Memo

Carolina Crossroads
I-20/26/126 Corridor Improvement Project
Lexington and Richland Counties, South Carolina

FEIS May 2019

SCDOT
South Carolina Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

Prepared for South Carolina Department of Transportation and the Federal Highway Administration

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Prepared by

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SCDOT U.S. Department of Transportation Federal Highway Administration

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1 Introduction

Congestion management is the application of strategies to improve transportation system performance and reliability. FHWA's Congestion Management Process (CMP) is a systematic approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meet state and local needs. CMP is intended to move these congestion management strategies into the funding and implementation stages.[1]

A CMP is required for all metropolitan areas with a population over 200,000. The intent of the CMP is to outline a decision-making that is fully integrated into the metropolitan transportation planning process.

FHWA's CMP model defines eight actions of a successful CMP, which are outlined in the text box.

Congestion Management Process (CMP)

- **Develop regional objectives for congestion management.**
- **Define CMP Network.**
- **Develop multimodal performance measures.**
- **Collection of data and monitor system performance to define the extent and duration of congestion.**
- **Analyze Congestion Problems and Needs.**
- **Identify and assess congestion management strategies.**
- **Program and implement strategies.**
- **Evaluate strategy effectiveness.**

FHWA also defines the types of strategies that could aid in congestion management which "will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures"[2]; these strategies include:

- Travel demand management (TDM) - strategies that reduce demand for single occupancy vehicle trips (SOV) or to shift demand out of the peak travel periods. Examples include: non-automotive travel modes (bicycle/pedestrian), ride-sharing, land use controls, flexible work patterns, and managed lanes.
- Traffic operations - strategies that aim to optimize the safe, efficient, and reliable use of existing transportation infrastructure. Examples include: HOV lanes, ramp metering, signal optimization, interchange reconfigurations, geometric improvements to roads and intersections.
- ITS technologies/Incident Management - strategies that apply technological solutions to improve the operation, safety and security of existing transportation systems. Examples include incident management, crash investigation areas.
- Public transportation improvements – strategies that improve transit operations, improving access to transit, and expanding transit service can help reduce the number of vehicles on the road by making transit more attractive or accessible. Examples include: expanded service, enhanced transit amenities,

[1] FHWA's *Congestion Management Process Guidebook*, April 2011 https://www.fhwa.dot.gov/planning/congestion_management_process/cmp_guidebook/chap01.cfm#sec1.1
[2] 23 CFR 450.320 (c)4

bike/pad connection accommodations at interchanges, improved access, bus rapid transit, and reserved travel lanes during peak hours.

- Addition system capacity – strategies that add more capacity to the road network, such as additional lanes and new highways, as well as redesigning specific bottlenecks (such as interchanges and intersections) to increase their capacity.

2 Existing CMP Documents Relevant to the Study Area

2.1 COATS Congestion Management Plan

The Columbia Area Transportation Study (COATS) Metropolitan Planning Organization (MPO) developed their *2015 Congestion Management Plan*[3] to meet the unique needs of the Columbia metropolitan area, in conjunction with development of the Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP) and corridor studies.

The COATS CMP identified strategies consistent with federal guidance that could be assessed for congested corridor and intersections within the CMP network. Five congestion mitigation strategies included:

- Decreasing the need for trip making (strategies at regional level versus corridor level) – land use policies and regulations, flexible work hours.
- Shifting trips from automobiles to other modes – transit improvements, transit operational improvements, non-motorized modes (sidewalks, bicycle facilities, transit park and ride).
- Increasing the use of High Occupancy Vehicles (HOV) – vanpooling, ride share matching services.
- Enhancing operations on existing roadway facilities – intersection improvements, signal coordination, incident management, and access management.
- Increasing roadway capacity through additional arterial roadway capacity – widening and new roads.

The CMP network included approximately 500 miles of arterial roads, major collectors and minor collectors with the COATS MPO boundary. Interstates were not included in the plan because all performance monitoring, analysis and funding for interstate projects is programmed and implemented by SCDOT.

The CMP network overlaps sections of the proposed Carolina Crossroads I-20/26/126 Corridor Improvement Project (Carolina Crossroads) study area. Although the I-26 and I-20 interstates themselves are not included, several of the crossing routes within study area were included in the network, including St Andrews Road, Bush River Road, Broad River Road, Harbison Boulevard and Lake Murray Boulevard. One transit corridor identified in the CMP also crosses through the study area– Corridor #7: Broad River/Harbison.

Based on the CMP assessment of congestion of the network, sections of Broad River Road, Bush River Road, Harbison Boulevard and Lake Murray Boulevard met the criteria for LOS E or LOS F near the interchanges of I-26 and/or I-20 and were considered congested.

[3] Columbia Area Transportation Study Metropolitan Planning Organization Congestion Management Plan, September 24, 2015

2.2 Columbia Corridors Corridor Management Plan

The Columbia Corridors Corridor Management Plan[4,5] is a planning-level study that considered approximately 90 miles of interstate corridors and 50 interchanges around the Columbia area, including I-26, I-126, I-20, I-77 and SC 277, with the intent of planning and prioritizing projects for the region that would improve traffic conditions through 2040. This study area focused on the entire Columbia area but overlapped the Carolina Crossroads project study area; coordination occurred between the project teams on traffic data collection, development of the traffic model (Transmodeler), growth projections, et cetera.

The Columbia Corridors plan was intended to establish plans of action to address the corridors' existing and anticipated traffic volume and associated congestion. The plan accounted for the regions' economic development and the existing environmental restrictions of the surrounding area while assessing effective methods to manage new and existing facilities through the development and implementation of Transportation Demand Management (TDM) Strategies[4]; Alternate Mode Strategies[5]; Traffic Operational Projects and Programs, and Capacity Improvements.

3 CMP Strategies

3.1 Travel Demand Management (TDM)

Travel Demand Management (TDM) is a general term referring to a set of strategies to increase the overall transportation system efficiency by reducing demands for single occupancy vehicle trips (SOV) or to shift demand out of the peak travel periods. These strategies are behavior-based and aim to discourage driving by increasing the cost to drive or to incentivize participation by providing other mobility options at a lower cost than driving a SOV. Since the approach is behavior-based, true success will be gauged by how well the users of the transportation network utilize TDM strategies to solve transportation issues.

A brief description of the TDM strategies considered are presented below:

- Regional TDM/Employer-based:
  - Work Flextime provides employees flexibility to adjust their work schedules to avoid peak hour congestion.
  - Telecommuting allows employees to work from the convenience of their home rather than working in a centralized office.
  - Compressed Work Week allows employees to work a full work week in fewer than five days. The direct benefit is the removal of vehicles on the roadway network during the peak hours.
  - Transit incentives are employer-based subsidized programs with the local transit providers to provide pretax or paid-in-full programs to encourage transit usage for travel to and from work.
- Park and Ride Facilities are commuter- based strategies that provide convenient and centralized parking for commuters to park to access transit, ridesharing, or vanpooling.

[4] Columbia Corridors Travel Demand Management Strategies Report, CDM Smith, October 2017
[5] Columbia Corridors Transit Modal Strategies, CDM Smith, September 2017

- Managed Lanes are defined as highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions.[6] These are operational strategies and examples of operating managed lane projects include high-occupancy vehicle (HOV) lanes, value priced lanes, high-occupancy toll (HOT) lanes, or exclusive or special use lanes (tolling).[7] Because managed lanes considered are operational in nature, they are addressed under Section 3.2 Traffic Operations for this corridor analysis.

3.1.1 OTHER TDM STRATEGIES

3.1.1.1 Land use

TDM can also include long-term planning strategies/policies that are designed to blend a variety of strategies into new development patterns through zoning and development regulations, including transit-oriented development. The focus of these strategies is regional and is intended to encourage the majority of trips to occur within the development and not on the adjacent roadway network. This strategy can include requirements for sidewalks, greenways, density thresholds, location of development around transit corridors and nodes, and mixtures of uses (office, retail, and residential) in a single development. These regional strategies are the responsibility of local planning bodies and are further discussed in the COATS CMP.

3.1.1.2 Bicycle/Pedestrian

Pedestrian and bicycle amenities are facilities such as sidewalks, bicycle lanes, and sidepaths that encourage walking or riding a bicycle as a mode of transportation. These are commuter-based strategies. The placement of pedestrian and bicycle facilities depends on many factors including land use, travel patterns, and vehicle and pedestrian characteristics. This TDM strategy can be focused towards commuting for work, but also for general mobility. Traditional strategies include providing sidewalks, greenways, bikeways, and shared use paths. Non-traditional strategies include providing showers and changing facilities at work.

This corridor study focused on interstate and freeway facilities where bicycle and pedestrian activities are prohibited by state law. However, sidewalks are provided along many arterial streets and local streets within the study area, though some arterials and local streets do not have sidewalks on one or both sides of the road.

SCDOT is prepared to assist the City of Columbia and CMCOG efforts through such measures as evaluating the recommendations from the *Walk Bike Columbia* plan that may be appropriate for inclusion in the proposed Carolina Crossroads project at crossing routes and interchanges and accommodating recommendations if warranted and feasible.

3.1.2 EXISTING TDM WITHIN THE CAROLINA CROSSROADS STUDY AREA

As described previously, there are existing park and ride facilities identified within the Carolina Crossroads project study area or that provide access to previously provided commuter transit services that traveled through

[6] FHWA Office of Operations, https://ops.fhwa.dot.gov/publications/managelanes_primer/, accessed 1/29/18
[7] Ibid.

the I-26/126 and I-20 corridors. These sites have been unofficially adopted as park and rideshare opportunities and are located at private business facilities within communities and the surrounding study area. Public agency sponsored park and ride facilities providing rideshare or commuter transit components serving the study area were identified at the following locations:

- US 378 at Riverchase Way- I-20 Exit 61– Rideshare opportunity only – provides 46 parking spaces
- Newberry Shopping Center – (previously SmartRide access)
- Gazebo Parking Lot – Little Mountain – (previously SmartRide access)
- Exxon Gas Station – Chapin – (previously SmartRide access; now labeled as No Parking)

Ridership for the previous SmartRide service (Newberry Express) ranged from 12,000 in 2010 to 10,000 in 2015. Peak ridership numbers were in 2012 at approximately 14,000 riders per year. This service is not currently active but may be reactivated if funding becomes available.

For input into the Columbia Corridors Management Plan, 49 employers were surveyed for the study to determine the travel demand strategies currently being offered to employees in the region. Seven of the employers provided TDM options including:

- telecommute;
- compressed work week/flextime;
- transit subsidy;
- guaranteed ride home; and
- carpool/vanpool.

3.1.2.1 Employer and public input on TDM

The Columbia Corridors Management Plan also conducted steering and stakeholder meetings, surveyed major employers in the area and surveyed the public to determine which TDM strategies may be supported in the area.

Surveys, meetings and stakeholder workshops were used to gauge the interest and viability of specific TDM strategies in the area. Ridesharing and flexible work weeks were the two strategies that emerged as the most viable and most effective tools for the region.

The employer survey showed the existing TDM options most frequently offered by the area employers:

- Information on alternative commuting opportunities
- Flextime
- Remote worksite

The TDM strategies most valued by employers when asked what improvements would change employee commuting habits were:

- None – employees are not interested

- Park and Ride opportunities
- More bus routes
- Free or discounted transit passes

In the public survey, 5,700 respondents provided the following as their most preferred TDM options that would encourage them to change their commuting habits:

- Convenient park and ride lots (35%)
- Flexible work hours (30%)

3.1.3 ANALYSIS OF TDM STRATEGIES

3.1.3.1 Regional TDM Analysis

In the Columbia Corridors Plan, for analysis purposes of analyzing TDM strategies on a regional level for employer based initiatives, the TRIMMS (Trip Reduction Impacts of Mobility Management Strategies) model was utilized. TRIMMS evaluates:

- Strategies affecting the cost of travel, (public transportation subsidies, parking pricing, pay-as-you-go pricing). Subsidies are provided to the employee by the employer to reduce the costs associated with the use of a particular method of commuting.
- Strategies impact on access and travel times and a host of employer-based program support strategies such as alternative work schedules, telecommuting and flexible work hours, and worksite amenities.

TRIMMS predicts mode share, vehicle miles of travel (VMT), and peak hour trip changes brought about by the above TDM initiatives using constant elasticity of substitution trip demand functions. These functions estimate changes from baseline trip demands, taking into account users' responsiveness to changes in pricing and travel times.

TDM program support includes rideshare matching services, the provision of guaranteed ride home or emergency ride home for vanpool and carpool users, vanpool formation support, program promotion, and employee transportation coordinators. Alternative work schedules include compressed work week, flexible working hours, and telecommuting. Worksite amenities with the presence of sidewalks providing connection to transit stops within or nearby the worksite.

The TDM strategies analyzed in TRIMMS were:

- Compressed work week/ flextime
- Transit incentives – match existing agency subsidy of $0.25. Note: this subsidy was increased to $0.50 to account for inflation to the 2040 horizon.

To assess the impacts that various TDM strategies could have on the study area network, the Columbia Corridors project team studied the output from the 2040 TRIMMS Model run results were compiled and organized according to each strategy. The summarized results are shown in Table 3.1.

Table 3.1 TDM Strategies

TDM strategy	Peak change in trips	AM peak trips	AM peak trips % reduction	PM peak trips	PM peak trips % reduction	Total AM + PM trip reduction	Total AM + PM % reduction
Compressed work week/ flextime	5,687	142,588	4.0%	152,209	3.7%	11,374	3.9%
Transit incentive - $0.50 subsidy	6,753	142,588	4.7%	152,209	4.4%	13,505	4.6%
Overall	12,440	142,588	8.7%	152,209	8.1%	24,879	8.5%

All TDM strategies included in the TRIMMS Model were found to have an expected traffic reduction greater than 3% during the peak hours for the entire network. The strategy with the greatest anticipated traffic reduction is Transit Incentive - $0.50 Subsidy, which shows an anticipated reduction in overall model trips of 4.7% in the AM peak, 4.4% in the PM peak, and 4.6% if the two peak hours are combined.

While regional TDM strategies may be warranted within the area, they are not considered as a part of the proposed Carolina Crossroads project.

SCDOT will coordinate with the CMCOG, which is the planning organization housing the COATS MPO, on future updates to their federally required congestion management plan to assess and implement recommended demand management strategies for the Interstate 26 corridor, if warranted and feasible.

3.1.3.2 Park and Ride Analysis

For the Columbia Corridors Management Plan, the evaluation of park and ride facilities, the peak hour volumes at each interchange were analyzed to determine the greatest influx into the roadway network within the corridor based on the network traffic model. Utilizing the entering AM and exiting PM volumes for each interchange due to the heavy commuter pattern identified, the interchanges were prioritized for possible park and ride facilities.

To measure the anticipated effectiveness of each park and ride location, it is assumed that each parking space will reduce the adjacent mainline volume by one trip each during the AM and PM peak hours.

Due to the short length (approximately three miles) and system functionality of I-126, (interstate connection into the City of Columbia), no park and ride locations were proposed. The majority of I-126 traffic is loaded from the terminus of I-26 and Huger Street/Elmwood Avenue interchanges and then carried over the entire segment.

I-20

A review of the 2040 AM peak entering volume for all interchanges along I-20 revealed five interchanges where the entering volume accounts for 25 percent or greater of the I-20 mainline volume after the interchange when traveling toward the project corridor/I-20/26 interchange. For the 2040 PM peak, these same interchanges represented 17 to 42 percent of the exiting mainline volume. These interchanges are all outside of the Carolina

Crossroads project area but traffic would travel through the corridor to the downtown area. These interchanges are noted below, in order of exit numbering:

- Exit 51 – Longs Pond Road
- Exit 55 – SC 6
- Exit 58 – US 1
- Exit 61 – US 378
- Exit 80 – Clemson Road

For the Columbia Corridors plan, specific parcels were identified to accommodate the development of park and ride facilities at each interchange and a maximum number of parking spaces were estimated. For further detail on the specific locations at each interchange, see the *Columbia Corridors Travel Demand Strategies Report*.

Table 3.2 provides a summary of these locations and their potential reduction of peak hour trips on adjacent mainline segments.

Table 3.2 I-20 Potential Park and Ride Volume Reductions

Exit/Roadway	Park and ride spaces	AM base volume	AM PnR build volume	AM % reduction (based on full capacity)	PM base volume	PM PnR build volume	PM % reduction (based on full capacity)
Exit 51/Longs Pond Rd	550	3,486	2,936	16%	2,673	2,123	21%
Exit 55/SC 6	450	4,781	4,331	9%	4,099	3,649	11%
Exit 58/US 1	300	5,678	5,378	5%	3,907	3,607	8%
Exit 61/US 378	150	5,755	5,605	3%	4,539	4,389	3%
Exit 80/Clemson Rd	550	5,118	4,568	11%	4,649	4,099	12%
Total	2,000	24,818	22,818	8%	19,867	17,867	10%

The volume reductions summarized in Table 3.2 were derived based on an assumption that 100% of the park and ride spaces would be used and the lot at capacity. Based on this assumption, it was found that if each potential park and ride location were to be utilized to its maximum capacity, total traffic reductions of 8% and 10% could be expected in the AM and PM peak hours, respectively, along the I-20 corridor.

I-26

A review of the 2040 AM peak entering volume for all interchanges along the I-26 study corridor, excluding system to system interchanges, revealed three interchanges where the entering volume account for 16 percent or greater of the I-26 mainline volume after the interchange when traveling toward the center of the study area, and toward downtown Columbia. For the 2040 PM peak, these same interchanges represented 23 to 29 percent of the exiting mainline volume. The listing of the interchanges is noted below in order of the exit numbering (note that Exit 101 and Exit 102 are within the Carolina Crossroad project corridor):

- Exit 91 – Columbia Avenue (Chapin)

- Exit 97 – US 176 (Peak)
- Exit 101 – US 76/176
- Exit 102 – SC 60 - included because of previous park and ride use at this interchange location

Each of these interchanges exhibits a typical commuting pattern of heavy AM inbound flow toward the center of the study area and return flow during the PM period. This flow pattern is conducive for rideshare facilities. Noting that the Newberry SmartRide previously utilized I-26 for routing, these interchanges could serve as an extension of the SmartRide routing if the service was reinitiated.

For the Columbia Corridors plan, specific parcels were identified to accommodate the development of park and ride facilities at each interchange and a maximum number of parking spaces were estimated. For further detail on the specific locations at each interchange, see the *Columbia Corridors Travel Demand Strategies Report*.

Table 3.3 provides a summary of these locations and their potential reduction of peak hour trips on adjacent mainline segments.

Table 3.3 I-26 Potential Park and Ride Volume Reductions

Exit/roadway	Park and ride spaces	AM base volume	AM PnR build volume	AM % reduction*	PM base volume	PM PnR build volume	PM % reduction*
Exit 91/Columbia Ave	500	3,182	2,682	16%	3,534	3,034	14%
Exit 97/Peak	500	4,173	3,673	12%	4,255	3,755	12%
Exit 101/US 1	550	5,033	4,483	11%	5,047	4,497	11%
Exit 102/US 378	100	4,987	4,887	2%	5,271	5,171	2%
Total	**1,650**	**17,375**	**15,725**	**9%**	**18,107**	**16,457**	**9%**

*Based on 100% occupancy of spaces

The summarized data provided in Table 3.3 was derived based on an assumption that each park and ride lot would be at capacity. Based on this assumption it was found that if each potential park and ride location were to be utilized to its maximum capacity, total traffic reductions of 12% and 11% could be expected in the AM and PM peak hours, respectively, along the I-26 corridor.

Park and ride locations were evaluated for the *Central Midlands RTA Park-and-Ride Study*[8] within the project study area, including the I-26 and Broad River Road interchange and the I-26 at St. Andrews Road interchange, which were recommended for implementation. Regional objectives in the COATS CMP include the addition of transit park-and-ride facilities at location(s) on Lake Murray Boulevard between SC 6 and Broad River Road, which crosses I-26; and at Bush River Road in a location(s) between St. Andrews Road and Broad River, which crosses I-20 and I-26.

As part of the Carolina Crossroads project, SCDOT evaluated park and ride locations as part of the Final Environmental Impact Statement to validate the data summarized above and to explore potential sites for

[8] Central Midlands RTA Park-and-Ride Study, Connetics Transportation Group, January 2010

future consideration of inclusion in the Recommended Preferred Alternative and Refined Recommended Preferred Alternative. See Appendix A..

3.2 Traffic Operations

Overall, freeway operations and traffic management involves the proactive management of freeway facilities to balance the capacity of the transportation system and the prevailing demands, and response to out-of-the-ordinary conditions (e.g., incidents, adverse weather, work zones, special events, and emergency evacuations).[9] Traffic operations encompasses a broad set of strategies that aim to optimize the safe, efficient, and reliable use of the existing system.

3.2.1 ANALYSIS OF TRAFFIC OPERATIONS STRATEGIES

3.2.1.1 Interchange Reconfigurations

For the proposed Carolina Crossroads project, the majority of the traffic congestion and safety concerns occur at or near to the interchange locations along the I-20/26/126 corridor. The project team initially focused on these locations by developing potential interchange improvement options for each of the 12 interchanges located in the corridor. The project team selected potential interchange alternatives from common interchange types. Each of the interchange options were evaluated at every interchange location. Interchange types included the following, or variations of the following:

- Trumpet interchange
- Fully directional interchange
- Diamond interchange
- Diverging diamond interchange
- Partial cloverleaf Interchange (Parclo)
- Roundabout interchange
- Single point urban interchange
- Turbine interchange

Based on the purpose and need for the project, the following criteria were established for assessing the effectiveness of each interchange design:

- Reduce the number of conflict points
- Improve operations on the mainline
- Improve the connections to/from the mainline
- Reduce geometric deficiencies currently on the mainline and/or crossing roadway
- Interchanges under, at, or over capacity in the design year

[9] FHWA Office of Operations, *Highway Traffic Operations and Freeway Management, State-of-the-Practice*: https://ops.fhwa.dot.gov/freewaymgmt/publications/documents/frwy_mgmtSOPv7_2_1.htm, accessed 1/16/18

Interchange designs were not required to meet all of these criteria to be incorporated into representative alternatives but had to show an overall improvement in traffic operations and congestion.

To further ascertain the merits of each interchange option, the project team also developed lists of pros and cons for each option. Pros and cons typically included, but was not limited to, the footprint, traffic operations, and public feedback. With this exercise, the project team also noted any fatal flaws which could stem from the answers to the screening criteria and/or the pros/cons discussions. For further information on the interchange screening process, please see the Carolina Crossroads *Alternatives Development and Screening Report* in Appendix C of the FEIS.

Improved interchange configurations were found to be warranted to meet the purpose and need of the project and were incorporated the Recommended Preferred Alternative and Refined Recommended Preferred Alternative. 32 interchange options were carried forward, 6 were added (to account for no-action options and to accommodate the potential elimination of the I-126/Bush River Road interchange), and 16 were eliminated. For further information on the methodology on the evaluation of interchange options, refer to Alternatives Development and Screening Report (Appendix C of the FEIS).

3.2.1.2 High Occupancy Vehicles Lanes (HOV)

High Occupancy Vehicle (HOV) or managed lanes are strategies that control lane usage along a roadway, typically interstates, during the peak hour period or throughout the entirety of the day. The vehicle restrictions can also apply for vehicles types, transit, ridesharing, fuel efficient vehicles (hybrid and motorcycle), and providing priority over single occupancy vehicles.

HOV facilities serve to increase the total number of people moved through a congested corridor by offering two kinds of travel incentives: a substantial savings in travel time, along with a reliable and predictable travel time. Because HOV lanes carry vehicles with a higher number of occupants, they move significantly more people during congested periods, even if the number of vehicles that use the HOV lane is lower than on the adjoining general purpose lanes. In general, carpoolers, vanpoolers, and bus patrons are the primary beneficiaries of HOV lanes by allowing them to move through congestion.

FHWA's *Program Guidance on HOV Facilities* (2016) and the NCHRP, Report 414, *HOV Systems Manual* (1998), identifies the following key criteria for HOV lanes:

1. Anticipated Use of the HOV Lane: Prefer 400 to 800 vehicles per hour per HOV lane during operating hours of the HOV in order to avoid underutilization.
2. Travel Time Savings: The HOV lane should result in travel time savings of 1 minute per mile over mixed use lanes and have an overall travel time savings of at least 5 minutes, preferably 8 minutes or more.
3. Congestion Levels: If congestion results in a LOS D or E and average speeds are less than 30 mph, an HOV lane may be warranted.
4. Constraints: If the corridor is either at or near capacity and the physical and/or financial feasibility of expanding the roadway capacity is limited, an HOV lane may be justified.

The alternatives being considered for the I-26 corridor and their associated benefits to LOS, speeds and travel time, as detailed in the *Carolina Crossroads Alternatives Development and Screening Report* (Appendix C of the FEIS), are anticipated to provide the benefits that an HOV facility could potentially provide and therefore negate the need for an HOV facility. Specifically:

- Regarding anticipated use of an HOV lane, there could be 400 to 800 vehicles per hour (VPH) usage, but this is highly subject to the exceptions associated with the types of vehicles and the occupancy requirements imposed for the HOV lane. Beyond vehicle occupancy of 2+ or 3+, other exceptions may include electric vehicles, transit vehicles, over-the-road buses, energy efficient vehicles, motorcycles, low-emission vehicles, etc. These exceptions can be added or subtracted in order to get the proper amount of lane use.
- Regarding travel time savings, the projected travel time savings for the project range from 13 to 14.5 minutes along the length of the I-26 study corridor during the peak periods. This would meet or exceed the suggested travel time savings benefit of an HOV lane.
- Regarding congestion levels, the projected LOS in the design year 2040 would generally be a LOS C during the AM peak and both LOS C and LOS D during the PM peak on I-26. In addition, average projected speeds would be approximately 55mph on I-26 during the peak periods, for the general purpose lanes. At 55 mph, the general purpose lanes will function at close to free-flow conditions since the design speed of the corridor is 60mph and would not be signed any higher than that. Redesignating one of the general purpose lanes into a managed lane would not result in the managed lane achieving significantly higher speeds or reduced travel times. Therefore, the minimum criteria above would not be met.
- Regarding physical constraints with designating an HOV or managed lane, the I-26 corridor is currently not unduly limited physically from being expanded. Sufficient physical space is available, as indicated in the preliminary design, to accommodate the expansion of the existing facilities. Regarding financial constraints, the current project budget is capable of supporting the proposed alternatives.

There are several design conditions factors in the Recommended Preferred Alternative and Refined Recommended Preferred Alternative that complicate designating continuous HOV or managed lanes through the study area as part of the proposed alternatives. The proposed alternatives reconfigure the alignment of I-26 and I-126.

With the existing alignment, eastbound and westbound managed lanes could run adjacent to the medians of I-26 and I-126 between the western project limits to downtown Columbia. A managed lane continuing on I-26 would have to run along the outside of the interstate, coming into conflict with on- and off-ramp movements of the service interchanges.

Under the proposed alignments, the I-26/I-126 system interchange is being reconfigured to allow I-26 to continue as the through-corridor movement. This change treats I-126 as three-lane ramps exiting and entering to the right of the I-26 mainline lanes. Eastbound I-126 separates to the right of eastbound I-26 in the vicinity of the I-20 system interchange, and would require an outside managed lane for traffic traveling to downtown

Columbia, creating conflicts with on- and off-ramp movements of the service interchanges west of the split. In the opposite direction, westbound I-126 merges to the right side of I-26, again requiring an outside managed lane and creating conflicts with service interchange ramp traffic upstream and downstream of the merge location.

Based on this preliminary analysis and geometric problems with an outside managed lane, further examination of the inclusion of an HOV lane as an alternative or as a part of the Recommended Preferred Alternative and Refined Recommended Preferred Alternative within the project corridor is not warranted. The benefits to LOS, travel time, and speeds derived from the planned improvements to the corridor via the proposed project are projected to offset the need or benefit of including an HOV lane at this time.

3.2.1.3 High Occupancy Toll (HOT) & other managed lanes

As described above, due to the reconfiguration of the I-26 and I-126 interchange, I-26 lanes will continue as the thru-movement of the corridor and the I-126 lanes will exit the corridor on the right to continue downtown. Because of this configuration, an HOT or other managed lane continuing on I-126 would have to run along the outside of the interstate, coming into conflict with on- and off-ramp movements of the service interchanges.

With these geometric complications and the fact that proposed Recommended Preferred Alternative and Refined Recommended Preferred Alternative designs offer LOS C through the project corridor, there would be no significant advantage of proposing managed lanes for this movement. HOT lanes and other managed lanes are not considered warranted for the project.

3.2.1.4 Geometry

Geometric design includes the design of cross sections, horizontal alignment, vertical alignment, intersections, and various design details, including sight distances and shoulder width. These design elements "combine to create a facility that serves traffic safely and efficiently, consistent with the facility's intended function."[10]

Sight distances

Sight distance is a length of road that a driver can see with an acceptable level of clarity. Sight distance plays an important role in geometric highway design because it establishes an acceptable design speed, based on a driver's ability to see and stop for an unforeseen roadway hazard. Throughout the project study area, areas of insufficient sight distances were documented along the mainline and within interchanges.

As proposed designs were developed, sight distance was evaluated for all movements. Sight distance criteria have been met with the proposed alternatives.

Shoulder widths

The shoulder is the portion of the roadway adjacent to the travel way for accommodation of stopped vehicles for emergency use. The paving and width of the shoulder is related to improved traffic operations and enhanced

[10] AASHTO *A Policy on Geometric Design of Highways and Streets*, 6th Edition, 2011.

highway safety. Throughout the project study area, sub-standard interior shoulder widths currently exist along the interstate.

Based on the purpose and need for the project, one of the criteria established for assessing the alternatives was the alternatives ability to reduce geometric deficiencies currently found on the mainline and/or crossing roadways.

Design Criteria have been established to include full shoulder widths throughout the corridor.

Table 3.4 Design Criteria

Facility type	Inside paved shoulder	Inside earth shoulder	Inside total shoulder	Outside paved shoulder	Outside earth shoulder	Outside total shoulder
Mainline freeway	12 ft	2 ft	14 ft	12 ft	2 ft	14 ft
Collector-distributor roadways	10 ft	2 ft	12 ft	10 ft	2 ft	12 ft
Ramps (single lane)	4 ft	6 ft	10 ft	6 ft	4 ft	10 ft
Ramps (multi-lane)	4 ft	6 ft	10 ft	6 ft	4 ft	10 ft

3.2.1.5 Conflict points

One of the major operational issues within the existing corridor is conflicting/weaving movements. With 12 interchanges, including two system-to-system interchanges within the corridor, ramp spacing is considerably tight. In addition, the interchange at I-26/I-20 currently includes a full-cloverleaf design with tight ramp spacing and significant weaving issues. Over 69 weaving movements and conflict points have been identified in the existing corridor.

Based on the purpose and need for the project, reduction of the number of conflict points currently being experienced by users of the mainline and/or the crossing roadway was established as criteria for evaluating alternatives.

One of the primary focuses while developing alternative was to eliminate as many weaving conflicts as possible. The purpose and need included criteria for "reduction in conflict points, improved traffic operations, improved connections, and reduction/elimination of geometric deficiencies. As a result, proposed designs incorporate current design standards, minimize conflicts throughout the corridor and significantly improve geometric deficiencies. Through the use of collector-distributer (CD) routes, revisions to interchange types, braided ramps, and other design features, the proposed designs offer enhancements over existing conditions to meet the purpose and need.

Improved geometric designs, including sight distances, improved shoulder widths and reduced conflict points were found to be warranted to meet the purpose and need of the project and were incorporated into the Recommended Preferred Alternative and Refined Recommended Preferred Alternative.

3.2.1.6 Ramp Metering

Ramp meters are traffic signals installed on freeway on-ramps to control the frequency at which vehicles enter the flow of traffic on the freeway. As seen in Figure 3.1, vehicles traveling from an adjacent arterial onto the ramp form a queue behind the stop line. The vehicles are then individually released onto the mainline, often at a rate that is dependent on the mainline traffic volume and speed at that time.[11]

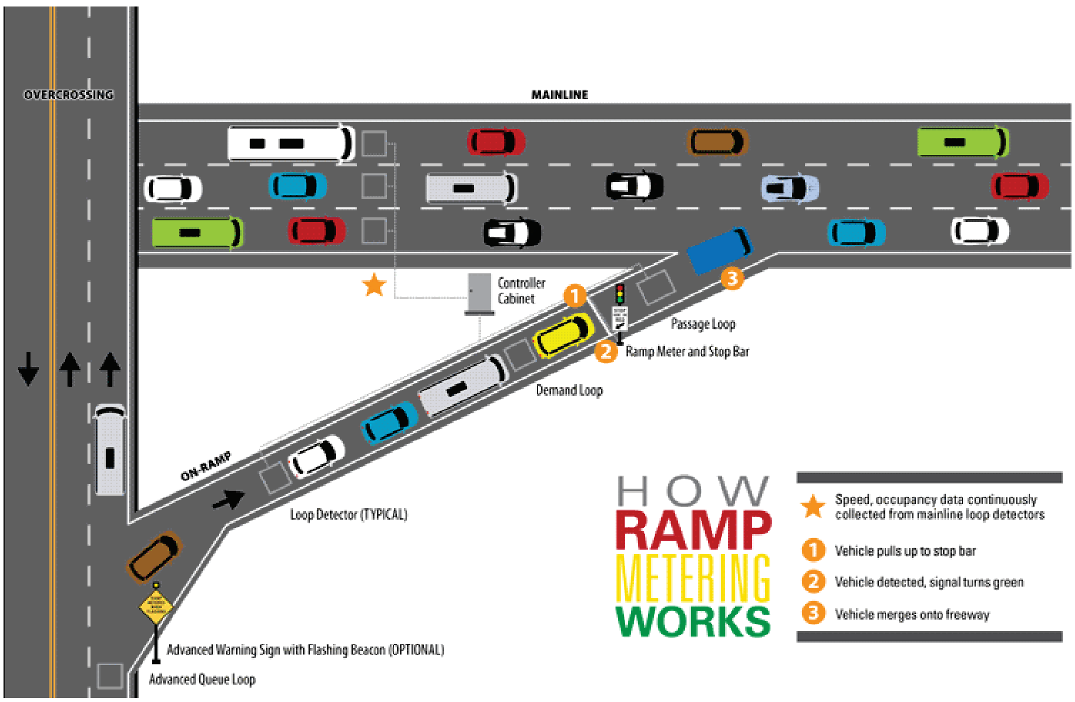

Figure 3.1 Ramp metering allows control of vehicles entering the traffic flow

Ramp metering is used to manage volumes entering the mainline and to avoid overloading and creating issues with mainline traffic flow.

An important consideration when considering ramp metering is the available storage for the metered vehicles and the geometry of the existing facility. “Key geometric issues include inadequate acceleration length, mainline weaving problems because of closely spaced ramps, and limited sight distances on a horizontal or crest vertical curve.”[12] These geometric issues exist within the project corridor, limiting the ability to implement ramp metering effectively under existing conditions.

Another challenge related to ramp metering is “…ramps that are shorter in length or have less storage space are at a higher risk of arterial backup than longer ramps with similar demand. If the meter’s release rate is less than the rate at which vehicles approach the ramp, the queue will lengthen. If too long, a queue could spill onto

[11] FHWA Office of Operations https://ops.fhwa.dot.gov/freewaymgmt/ramp_metering/about.htm, accessed 1/16/18
[12] FHWA Research and Technology, *Public Roads, Stop or Go?* Colyar, Klein, Jacobsen https://www.fhwa.dot.gov/publications/publicroads/16janfeb/02.cfm, accessed 2/1/18

arterials and result in inefficient arterial operations."[13] All service interchanges west of the system to system interchange have high volumes of traffic (600-1200 vehicles per hour) entering the I-26 corridor during the AM peak hour. Queue lengths at ramp meters at these locations could further impact the operation of the arterial streets that are already congested, including St. Andrews Road, Piney Grove Road and Harbison Boulevard.

Given the additional lane proposed in the designs for the Recommended Preferred Alternative and the Refined Recommended Preferred Alternative, ramp metering is not warranted to achieve acceptable levels of service in the design year for mainline traffic under Build conditions and it is not recommended to be pursued on this corridor.

3.3 Public Transportation Improvements

The purpose of this transit analysis in the Columbia Corridors Management Plan was to identify and evaluate transit modal strategies that may provide alternative transportation choices and serve as a catalyst for decreasing automobile traffic along the interstate corridor assessed in the study, including I-20, I-26, and I-126.

In addition to a traffic analysis of the area, a community assessment was conducted to better understand socio-economic factors that are known to impact transit ridership, including a review of population, housing, and employment densities as well as indicators of transit dependency – elderly and youth populations, low-income populations, as well as zero-vehicle households. These factors all provide insights into where services are most needed to meet overall transportation needs, help to target transit improvements that may assist in relieving congestion from the study area corridors and identify gaps in service and where transit modal options and improvements are most needed.

3.3.1 EXISTING TRANSIT WITHIN THE CORRIDOR

3.3.1.1 Rail Service

There are currently no premium transit (commuter rail, light rail) services available in the region.

The only regional/interstate passenger rail services in the Central Midlands region is provided by Amtrak.

3.3.1.2 Fixed-Route Bus Service

The Central Midlands Regional Transit Authority (CMRTA), known as the COMET, is currently the only public transit service provider that operates in the vicinity of the Carolina Crossroads study area. The CMRTA provides fixed-route bus service, and though CMRTA routes do not travel directly within the I-20/26/126 corridor, they do parallel and/or cross it via major arterials such Broad River Road, Piney Grove Road and others. CMRTA is currently in the process of developing a plan for a more connected and accessible transit system, including development of high frequency service along high-capacity corridors and limited stop express routes, as well as restructuring of service to lower density routes such as neighborhoods.

[13] Ibid

Two existing COMET routes cross I-20, I-26 and I-126 within the proposed Carolina Crossroads project study area:

- Route 34 – Saint Andrews: This route travels from the Columbiana Centre to downtown Columbia at hourly headways on the weekdays.
- Route 34B – Saint Andrews: This route travels from the Dutch Square mall to downtown Columbia at hourly headways on the weekdays. It also connects with Route 34 on St. Andrews Road.

These routes are two of eight routes which comprise approximately sixty percent of COMET's annual ridership, carrying approximately 14,284 weekday passengers or 8.90% of the total weekday ridership as of January 2017. This core route was analyzed for transit improvement opportunities due to its intersection and proximity with the interstate.

3.3.1.2.1 Population

The Institute of Transportation Engineers (ITE), has developed guidelines for successful transit service frequency based on residential densities that was reviewed alongside study area housing densities and existing services. The ITE guidelines, provided in Table 3.5, help to focus in on locations within the study area where additional transit service frequency or new services may be useful based on existing residential densities.

Table 3.5 Transit Service Frequency Guidelines

Service type	Transit frequency (minutes)	Dwelling units per acre	Dwelling units per square feet
Bus	60	4-5	2,560-3,200
Bus	30	7	4,480
Bus	10	15	9,600
Light rail or bus rapid transit	5-10	30-50	22,400-32,000

The neighborhoods where there is a significant amount of housing density are Arthurtown, Forest Acres and Seven Oaks. Of these, Seven Oaks is the only community near the Carolina Crossroads study area, off of the St. Andrews Road interchange.

3.3.1.2.2 Employment

Employment densities were also examined to understand concentrations of commuting needs. there are three main areas that lend themselves to increased frequency for bus service. The St. Andrews, Forest Acres and downtown areas could potentially have bus service increased to 30-minute frequencies. Of these three areas, only St. Andrews is within the proposed Carolina Crossroads project corridor. In the future as the population increases and more jobs are needed, more areas may require higher frequencies or newer types of public transportation service.

3.3.1.2.3 Transit-dependent populations

Elderly population density of the study area. This population is defined by the amount of person who are sixty-five years of age or older that are living within a specific census block group. The Forest Acres and Seven Oaks neighborhoods have overall significant densities for the elderly population. While there are a significant number of routes in these areas as well, more frequent service could be helpful to this population demographic.

As the elderly population continues to grow, more frequent service may be required, as well as additional routes, particularly to the St. Andrews area.

Youth populations within the study area often lack the ability to use other modes to meet their transportation needs. There were no areas of significant denisities of youth populations found within the Carolina Crossroads study area.

Low-income populations in the study area are defined as those who are currently living under the poverty line, which for a four-person household was $24,257 a year. The Seven Oaks and St. Andrews areas were noted as having high densities of low-income households.

Currently, portions of St. Andrews have higher density areas of low-income populations, and more service may be necessary for Route 34 and 34B to provide better mobility for this population.

Vehicle availability directly influence transportations decisions and is a primary indicator of transit usage. Based on the number of households that do not have access to a personal vehicle, no areas within the Carolina Crossroads study area have this issue.

Based on the findings of the community assessement, the St. Andrews/Irmo areas along the intersection of I-20, I-26 and I-126 were found to have high densities of transit dependent populations. While there is currently transit service within these areas, investments in public transportation to and along these corridors could provide benefits to the populations which rely on these services.

3.3.2 ANALYSIS OF PUBLIC TRANSPORTATION STRATEGIES

A variety of transit modal opportunities were investigated to complement roadway improvements and enhance existing transit services. These types of strategies included:

- Operational improvements - Improvements to Existing Routes, Bus-On-Shoulder Improvements, High Occupancy Vehicle Lanes, Improvements to Bus Shelters/Stations, Technology Improvements
- Adding transit capacity - Interstate Express Bus Services, Bus Rapid Transit (BRT) Improvements, Park-and-Ride Lot Improvements, Other Regional and Multimodal Improvements Identified
- Coordinated strategies to enhance the transit environment - Promote Travel Demand Management (TDM) Strategies, First- and Last-Mile Improvements, Land Use Decisions, Other Built Environment Strategies (roads, sidewalks, parking, bus stops, bicycle lanes, etc.)

Consideration of strategies for the I-26/126 Corridor in these categories include:

3.3.2.1 Improvements to existing service

COMET Route 34 currently serves portions of the Irmo/St. Andrews/Seven Oaks area of Columbia, which were areas that were previously identified as having potentially dense populations of transit dependent populations. There is a significant amount of low-income and youth populations in this area, as well as significant housing and population densities. It was also found to be one of the COMET's "core routes," which is one of the eight routes that make up a bulk of their overall ridership. Finally, this route was in one of the noted transit corridors from the LRTP and the 2015 CMP that should have transit improvements.

Decreasing the headways for this route could have a significant impact on the traffic congestion within this area and provide greater connectivity and mobility for this portion of the region. Route 34 has sixty-minute headways, leaving from the transit center in downtown and arriving near the Columbiana Centre on weekdays, which is also near Exit 103 on I-26.

3.3.2.2 Express Bus Service on Interstates and Park-and-Ride Lots

Exits 91, 97, and 101 were identified as having sufficient land available for the construction of park-and-ride lots; further details can be seen in the *Columbia Corridors Travel Demand Management Strategies Report*. These park-and-ride lots could be used in conjunction with other services to provide options for commuters to travel into downtown Columbia. An express bus service that operates mainly in the peak periods of the day could travel from Exit 97 near the Columbiana Centre and into the downtown area. Headways would likely be fifteen minutes to provide a sufficient level of service.

3.3.2.3 BRT on Parallel Facilities

U.S. 176 is a candidate for developing a parallel BRT line, beginning from where is crosses I-26 at Exit 101 and terminating at the downtown transfer center. This would be a 12-mile BRT line and would likely require stations every half mile. The headways should be 15 minutes during the peak periods, and if there is service during the non-peak period, it should be 30 minutes. This type of improvement was also suggested within the Newberry – Columbia Alternatives Analysis (AA) that was conducted by the CMCOG.

3.3.2.4 Rail Service

In the last decade, there have been several regional studies on mass transit services, including rail service, that include the Carolina Crossroads study area as a portion of their areas of evaluation. In 2006, the CMCOG published the Commuter Rail Feasibility Study and assessed three corridors for rail investment. One of the three corridors was a 48-mile Newberry-to-Columbia corridor that largely runs parallel to I-26 and US 76, within an active freight railroad corridor, adjacent to the I-26 portion of the proposed Carolina Crossroads project. The other two corridors – the Camden corridor and Batesburg-Leesville corridor – largely parallel I-20, but include only small sections of the I-20/26/126 Carolina Crossroads project study area. In this study, the Camden corridor scored the highest and was recommended for priority consideration. The Newberry and Batesburg-Leesville corridors were not recommended for priority consideration. Many preliminary development recommendations resulted from the study including seeking a "champion" for transit advocacy in the region. SCDOT can support and accommodate what initiatives other organizations are doing progressing in an effort to develop transit supportive roadway facilities that do not preclude future enhanced transit services.

In 2008, CMCOG updated the Central Midlands Regional Transit & Coordination Plan Update identified the Commuter Rail Feasibility Study, focusing on the three rail corridors identified in the 2006 study. The 2008 update concluded that the region should strengthen local transit service, and place focus on implementing interim express bus service as an impetus for future higher-capacity services.

In 2015, CMCOG completed a Regional Transit Needs Assessment and Feasibility Study. Rail was ranked as a "best" option, but the implementation assessment, which factored in several elements including capital and operating costs, determined that it would be more realistic as a long-term option.

The project team for the proposed Carolina Crossroads project met with COMET leadership in April 2016. COMET indicated that the premium transit (rail) is not yet feasible in the area due to relatively high cost of implementation and operation and low ridership projections. Commuter rail ridership projections are estimated at 1,200-1,500 boardings daily. Compared to number of vehicles that travel the I-20/26/126 corridor each day (approximately 133,600), elimination of 1,500 vehicles would offer a reduction of less than 2 percent. As noted, in lieu of premium transit (rail), CMRTA has a stronger interest in expanding the existing bus service.

3.3.3 EVALUATION OF STRATEGIES FOR THE I-26/I-126 CORRIDOR

Transit strategies are typically evaluated through various elements, such as increased transit ridership and reduced automobile traffic and vehicle miles traveled (VMT). The cost of transit improvements can then be compared to benefits associated with reducing automobile travel to understand the overall impact of an improvement.

Transit improvement costs include annual fleet operating and maintenance, fleet purchase, roadway infrastructure, stations/stops, infrastructure maintenance, and fare revenue. Transit improvement benefits include reduced personal vehicle operations costs, taxi usage, congestion costs, roadway fatalities, and pollution emissions.

The costs, ridership-based variables, and benefits were calculated for each transit strategy. Results for individual transit strategies, by year, are included in Appendix B.

Table 3.6 and Table 3.7 present the total average weekday AM and PM peak ridership, automobile VMT reduction, automobile trips, and automobile VMT for the total program in 2018 and 2040, respectively. The 2018 and 2040 automobile trips and VMT were taken from the SCSWM model output.

Table 3.6 2018 Average Weekday AM and PM Peak Ridership-Based Variables

	Total transit	Total automobile	% Change in automobile trips
AM peak unlinked passenger trips	50,292	5,051,476	-1.0%
PM peak unlinked passenger trips	71,845	7,336,268	-1.0%
AM peak automobile VMT reduction	29,001	1,488,088	-1.9%
PM peak automobile VMT reduction	41,429	2,160,888	-1.9%

Table 3.7 2040 Average Weekday AM and PM Peak Ridership-Based Variables

	Total transit	Total automobile	% Change in automobile trips
AM peak unlinked passenger trips	95,340	6,082,819	-1.6%
PM peak unlinked passenger trips	136,200	8,813,509	-1.5%
AM peak automobile VMT reduction	54,978	1,814,839	-3.0%
PM peak automobile VMT reduction	78,540	2,607,737	-3.0%

The results indicate that implementation of the total program in 2018 would result in a 1.0 percent decrease and a 1.9 percent decrease in automobile trips and VMT, respectively, in both the 2018 AM and PM peaks. Similarly, implementation of the total program in 2018 through 2040 would result in a 1.5-1.6 percent decrease and a 3.0 percent decrease in automobile trips and VMT, respectively, in both the 2040 AM and PM peaks.

There are numerous short-term transit strategies that may be warranted to enhance existing transit service and increase overall ridership. Existing services could be enhanced during the short-term and increases in service could be targeted based on the overall benefits that were identified for each route, including those within the corridor. CMRTA would be responsible for implementation of these strategeis.

SCDOT will continue to coordinate with CMCOG on future updates to their regional transit plan and the implementation of any transit strategies within the corridor, if warranted and feasible.

3.4 ITS/Incident Management

Intelligent Transportation Systems (ITS) is the application of technology (electronic sensing, computer processing and communications) to manage transportation on roadways. The goals are to increase throughput, improve safety, and reduce adverse impacts to the environment. ITS technologies collect and fuse traffic data into meaningful information that can be used to actively manage traffic: provide on-going monitoring of the transportation network; provide traveler information; reduce incident response times; and optimize the use of transportation assets.

Incident Management consists of a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. Effective incident management reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims and emergency responders.

3.4.1 EXISTING ITS/INCIDENT MANAGEMENT WITHIN THE STUDY AREA

3.4.1.1 Traffic Management Center

Traffic operations center owned by SCDOT that is responsible for traffic management activities within the location of the TMC. SCDOT currently has a TMC in Columbia that covers the proposed Carolina Crossroads project study area. The typical activities include traffic monitoring, traffic data collection, operation of ITS elements (CCTV, DMS, etc.), detection and verification of incidents, traffic signal monitoring, and other traffic management related activities.

3.4.1.2 First Responders

Law enforcement agencies include South Carolina State Highway Patrol, Lexington and Richland County Sheriffs, City of Columbia Police and other agencies which have officers sworn to enforce traffic laws. Law enforcement agencies are first responders at traffic incident scenes, providing 24-hour emergency response and incident investigation.

Fire and rescue services are provided by county and municipal fire departments. Typical roles and responsibilities at traffic incidents assumed by fire and departments include protecting the scene, providing medical care, rescuing crash victims, and providing incident clearance.

The primary responsibilities of Emergency Medical Services (EMS) are the triage, treatment, and transport of crash victims. Emergency medical services have evolved as primary care givers to individuals needing medical care in emergencies. They focus on providing patient care, crash victim rescue, and ensuring the safety of their personnel.

3.4.1.3 State Highway Emergency Program (SHEP)

SCDOT provides aassistance to motorists whose vehicles are experiencing mechanical problems and providing support, traffic control and assistance to emergency response teams during incidents. SHEP currently patrols the entire project corridor for disabled vehicles and provides assistance with traffic control for crashes.

SCDOT plans to expand SHEP, ITS, Work Zone ITS and changeable message signs along the I-26 corridor between Exit 101 and Exit 85, under the ongoing I-26 widening/improvement project.

3.4.2 ANALYSIS OF ITS/INCIDENT MANAGEMENT STRATEGIES

3.4.2.1 TMC/SHEP

As the proposed project develops, the Carolina Crossroads project team will continue to coordinate with both TMC and SHEP for the incorporation of appropriate ITS and Incident Management into the project.

3.4.2.2 Crash Investigation Sites

Crash Investigation Sites (CIS) can be established along heavily traveled freeways. These bump-outs provide a safe refuge for vehicles that have been involved in a minor crash, getting them out of the way of freeway traffic while crash reporting is conducted. CIS can assist with the timely removal of incidents, the safety of motorists and responders, and the reduction of secondary crashes.

There were a total of 2,370 crashes reported along I-26 from January 1, 2012 to December 31, 2014 (Figure 3.2). These were split nearly evenly in the eastbound (1,171 accidents) and westbound (1,199 accidents) directions. Overall, crashes are uniformly disturbed through both the I-26 and I-20 corridors. Two locations accounted for 15-25 percent of collisions within the corridor – I-26 eastbound between Piney Grove Road and St. Andrews Road and I-20 eastbound near the Bush River Road interchange. One location accounted for greater than 25 percent of the collisions within the corridor – I-20 westbound at the Broad River Road interchange. See Figure 3.2.

Improved traffic operations throughout the corridor, including reduced conflict points and weaving movements and improved traffic flow should reduce the number of crashes experienced at these locations. Under build conditions, if crash concentrations continue to occur, CIS consideration may be warranted in the future.

3.4.2.3 Visual Barriers

Concrete barrier wall currently exists through the entire project corridor along I-26, I-126 and I-20. The height of the existing barrier wall varies through the corridor. Old-style low wall exists for the majority of the corridor; however, there are small section of high wall on I-26 between Exits 101 and 102 and on I-20 between the I-26 interchange and Bush River Road. Glare paddles/screens currently exist along I-126 in interstate curves to deflect headlight glare.

Engineering design standards for median barrier walls have changed and median barrier walls are currently constructed at a height of 4’8” tall. The height of new walls would eliminate the need for the glare screens to improve night time visibility for motorists and reduce rubber necking at crash sites on the other side of the interstate within the corridor. This strategy is considered warranted for the corridor.

The Recommended Preferred Alternative and the Refined Recommended Preferred Alternative would include the new standards for median barrier walls.

Figure 3.2 I-20/26/126 corridor collision summary

3.4.2.4 Move Accident from Travel Lane Signs

Driver Removal laws require drivers involved in typically minor incidents to move the vehicles from the travel lanes, exchange information, and report the crash information as required. These laws are intended "to expedite removal of damaged or disabled vehicles from the travel lanes to enhance the overall level of safety on the roadway and reduce associated congestion and delay. Drivers remaining in a travel lane put themselves, as well as approaching motorists, at risk. When responders arrive on-scene, they too are at a greater risk in the travel lane; particularly when outside their vehicles because of the threat of being struck by a passing vehicle."[14] Few states actively publicize or enforce these laws, limiting their overall potential for effectiveness.

The state of South Carolina does have a driver removal law (Title 56, Chapter 5 §56-5-1220) however, there are no notification signs currently within the project corridor.

This strategy may be warranted within the corridor as a part of the signing plan for the Recommended Preferred Alternative or the Refined Recommended Preferred Alternative.

3.5 Capacity Improvements

This strategy considers increasing roadway capacity where it is deficient and all previous mitigation strategies do not provide the most effective solution or do not provide for a timely solution to existing deficiencies. These projects involve construction additional general purpose lanes and/or the construction of new roads.

Based on project development for the Carolina Crossroads project, the purpose of the proposed project is to implement a transportation solution(s) that would improve mobility and enhance traffic operations by reducing existing traffic congestion within the I-20/26/126 corridor while accommodating future traffic needs. Other CMP strategies were assessed for the corridor however, only capacity improvement alternatives met the overall purpose and need for the project. The alternatives under consideration (the Recommended Preferred Alternative and the Refined Recommended Preferred Alternative) are both capacity improvements that incorporate other operational improvements (interchange reconfigurations, geometric improvements) within the corridor. The Recommended Preferred Alternative and Refined Recommended Preferred Alternative are further assessed within the FEIS.

3.6 Recommendations for the Carolina Crossroads Project

3.6.1 TDM RECOMMENDATIONS

3.6.1.1 Alternative Work Schedules

Alternative work schedules include compressed work week, flexible working hours, and telecommuting. From workshop participant and public survey responses, compressed work week/flextime and rideshare were identified as the most viable and effective of the TDM strategies discussed.

[14] FHWA Office of Operations, https://ops.fhwa.dot.gov/publications/fhwahop09005/driv_removal.htm

- Work Flextime provides employees flexibility to adjust their work schedules to avoid peak hour congestion.
- Telecommuting allows employees to work from the convenience of their home rather than working in a centralized office.
- Compressed Work Week allows employees to work a full work week in fewer than five days.

The direct benefit is the removal of vehicles on the roadway network during the peak hours. Applying these TDM strategies across the major employment sectors could result in an overall trip reduction on the 2040 network by up to 3.9%.

This regional strategy would require stakeholder/employer coordination and buy-in.

3.6.1.2 Park and Ride Facilities

As part of the TDM strategies for the Carolina Corridors analysis, it was recommended that park and ride facilities be implemented along the study area corridors. Assuming that each parking space within a park and ride facility will reduce the mainline interstate volumes by one trip each in the AM and PM peak hours, ridesharing and/or transit at park and ride lots can cumulatively have a significant impact on the total traffic volumes within the study area.

Overall, if all park and ride locations are implemented, it is estimated that there could be a reduction in travel demand of up to 9% in the AM peak hour and 10% in the PM peak hour within the study area.

CMRTA completed a *Park-and-Ride Study* in 2010 to determine which areas and specific locations would be best suited for such facilities. Many locations were evaluated within the I-20/26/126 project corridor, including the I-26 and Broad River Road interchange and the I-26 at St. Andrews Road interchange, which were recommended for implementation.

The COATS 2015 CMP recommended the addition of transit park-and-ride facilities at location(s) on Lake Murray Boulevard between SC 6 and Broad River Road, which crosses I-26; and at Bush River Road in a location(s) between St. Andrews Road and Broad River, which crosses I-20 and I-26.

As part of the proposed Carolina Crossroads project, the project team studied existing park-and-ride facilities in the Carolina Crossroads project area and studied existing and future needs for a continuous and adequate supply of parking for rideshare commuters. SCDOT completed a park-and-ride study to identify and recommend preliminary sites for future implementation to service rideshare commuters (Appendix A). The park-and-ride study analyzed population and employment density, worker demographics, work trip origins and destinations, park-and-ride best practices and siting criteria. Five park-and-ride sites were evaluated through Tier 1 and Tier 2 evaluation, and two sites were determined to be most favorable based of the aforementioned criteria. One site is located within the Carolina Crossroads project limits near the I-26/Broad River Road interchange; and the other site is located to the west of the project limits near the I-20/Lake Drive interchange. -SCDOT would work with CMRTA and CMCOG to develop two park-and-ride lots to improve mobility during construction and mitigate congestion resulting from the project. SCDOT would construct the two sites and maintain them during construction of the project. Engineering feasibility, timing and continued maintenance of the sites would be determined in coordination with CMRTA and the CMCOG prior to the start of construction. In the event a permanent site cannot be developed, SCDOT would work with CMRTA and CMCOG to identify and provide funding for existing parking lots that could be leased for park-and-ride use.

3.6.2 OPERATIONS RECOMMENDATIONS

Improved interchange configurations have been incorporated into the overall design in order to meet the purpose and need of the project.

Geometric improvements, including improved sight distances and shoulder widths, have been incorporated into the design to meet the purpose and need of the project.

3.6.3 PUBLIC TRANSPORTATION RECOMMENDATIONS

With the support of funding from the penny sales tax in Richland County, the COMET has developed a transit vision for public transportation which would create a more connected accessible system. A primary component of this includes the development of high frequency service along high capacity corridors to provide added convenience for riders during peak hours so they can get to work, school and retail in a more efficient manner. The planned high capacity and enhanced local routes that were the focus of the CMP included one route within the Carolina Crossroads project study area.

Corridor #7: Broad River/Harbison: Enhanced with 30 minute peak frequencies; enhanced evening and weekend service, including Sundays. Expanded frequency to Dutch Square Mall, state employment centers and Harbison Boulevard retail/employment sites. High ridership would build toward a downtown shopping weekend express service. Operational improvements in service would be enhances by the implementation of transit based ITS solutions, including:

- CMRTA will take the next step in technology by adding automated vehicle location (AVL) to allow real time arrival and departure information for customers at stops or on smart phones.
- GPS tracking on buses can help trigger lights to turn green on major corridors helping push the buses through clogged city traffic and speed up commute times.
- New technology will text passengers when their buses will arrive (with user defined settings) and even let them track the closest bus while waiting on the street corner and use web based trip planning on the new CMRTA website.
- Smartphone apps for visitors can link them to transit and QRT/bar code technology around town can tell tourists about routes and services on-the-go.
- Smartcard fare payment technology will allow customers to ride with the tap of their card and can recharge their transit passes at terminals (similar to an ATM). This also provides real-time bus arrival information, general passenger information and advertising revenue for the system.

SCDOT is prepared to assist COMET/CMRTA efforts through such measures as accommodating transit (bus) stops at interchange locations, if warranted and feasible. SCDOT evaluated the addition of transit signal priority (TSP) for buses at congested intersections in the project limits to help facilitate the movement transit vehicles. Howveve, given current headways, it was determined that TSP would not directly benefit route efficiency based on deployment costs (Appendix C).

3.6.4 ITS/INCIDENT MANAGEMENT RECOMMENDATIONS

Accident Investigation Sites – Improved traffic operations throughout the corridor, including reduced conflict points and weaving movements and improved traffic flow should reduce the number of accidents experience at these locations. Under build conditions, if accidents concentrations continue to occur, AIS consideration may be warranted.

Visual Barriers – Current design standards would require increased height of the median barrier walls, reducing glare from oncoming traffic and reducing rubber necking during crashes. The project would incorporate new standards for median barrier walls.

Move Vehicles From Lane Signs – Consider placement signs within project corridor as part of signing plan for RPA.

Table 3.8 Congestion Management Toolbox for Carolina Crossroads Corridor

Congestion management strategy		Performance measures	Under consideration for RPA	Responsible party
TDM	Flextime, compressed workweek, transit subsidy	Peak hour reduction in trips	Regional, ongoing coordination	Local employers
	Park and ride	Reduction in traffic volumes	Additional evaluation	
Operations	Interchange reconfiguration	Reduce conflict points Improve operations on mainline Improve connection to/from mainline Reduce geometric deficiencies Interchange under, at, or over capacity	Yes	SCDOT
	HOV/HOT lanes	Benefits to LOS, speeds and travel time; geometric considerations	No	
	Geometry	Reduce geometric deficiencies	Yes	SCDOT
	Ramp metering	N/A	No	
Public transportation	Improved Existing service	Percent reduction in automobile trips	Ongoing coordination	CMRTA/COMET
	Express Bus		No	
	BRT		No	
	Rail	N/A	No	
ITS/incident management	TMC/SHEP	N/A	Ongoing coordination	SCDOT
	Accident investigation sites	N/A	No	
	Move vehicle signs	N/A	Yes	SCDOT
	Visual barrier		Yes	
Capacity	Add general purpose lanes	Improve mobility and enhance traffic operations by reducing existing traffic congestion	Yes	SCDOT

Appendix A—Park-and-Ride Assessment

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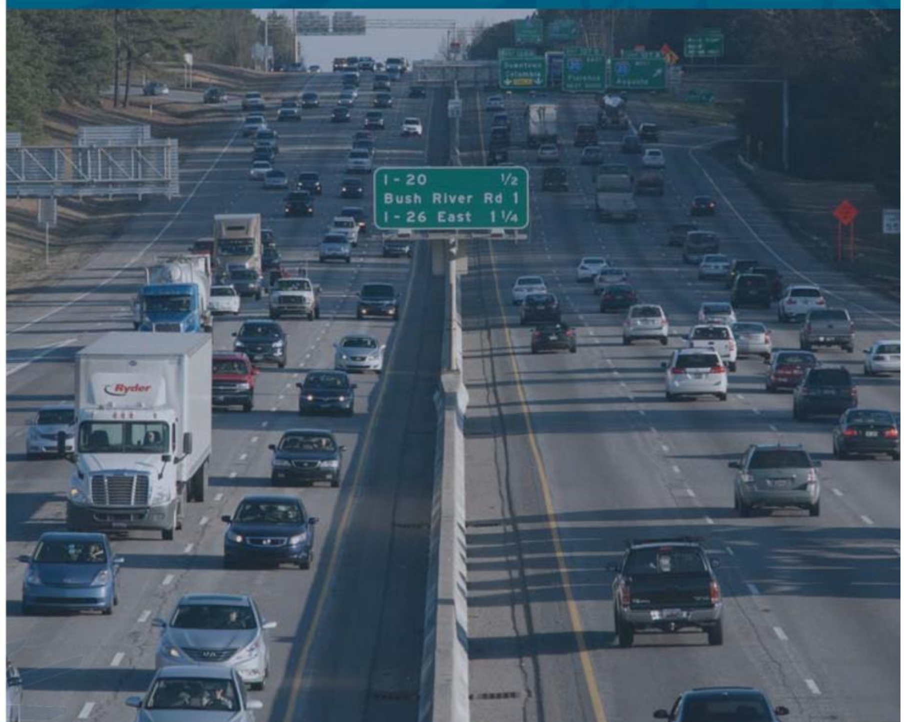
Appendix B—COATS CMP Recommendations for Roads within the Project Area

CAROLINA
CROSSROADS
I-20/26/126 Corridor Project



Park-and-Ride Assessment

Carolina Crossroads
I-20/26/126 Corridor Project
Lexington and Richland Counties, South Carolina

03/01/2019
Draft.01

SCDOT
South Carolina Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

Prepared for South Carolina Department of Transportation and the Federal Highway Administration

Contents

CAROLINA CROSSROADS

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Introduction

Background

The South Carolina Department of Transportation (SCDOT), in cooperation with the Federal Highway Administration (FHWA), prepared a Draft Environmental Impact Statement (DEIS) for the Carolina Crossroads I-20/26/126 Improvement Project (the Project).

The DEIS will promote informed decision making in the development of a transportation solution(s) to improve mobility and enhance traffic operations by reducing existing traffic congestion within the I-20/26/126 corridor, while accommodating future traffic needs through the year 2040.

The DEIS considers potential community and environmental impacts to identify a solution that benefit the greater Columbia area, as well as the regional mobility of commerce, travelers, and commuters between the Upstate and the Lowcountry.

The DEIS is for the public, stakeholders, and decision makers. The DEIS describes why the project is needed, the alternatives considered, the potential impacts and how they will be mitigated, and the recommended alternative.

At the beginning of the Project, several alternatives were identified to reduce congestion and improve mobility with the corridor. Mass transit was one of the alternatives identified and considered the current availability of public transit operators and services in the vicinity of the Project.

The data gathered for the Project showed that mass transit alone would not sufficiently reduce congestion and improve mobility within the corridor. However, SCDOT realizes that mass transit is an essential component to the larger mobility solution for the Midlands region. Therefore, as part of the Project, a mobility input group was established to provide input and ensure coordination on the project not only from a transit perspective but also for bicyclists and pedestrians. This park-and-ride study is a result of the coordination with the mobility group.

This technical memorandum summarizes the park-and-ride facility analysis for the Project. This is a high-level evaluation and includes two tasks: a service demand screening and a park-and-ride site identification. Figure 1 illustrates the process utilized to identify, evaluate and recommend the park-and-ride locations for the Project.

FIGURE 1. PARK-AND-RIDE SITE IDENTIFICATION PROCESS

Step 1 - Study area refinement and previous studies
- Refine study area
- Literature review

Step 2 - Study area existing transit service
- Fixed route
- Paratransit

Step 3 - Overall travel demand analysis
- Population and employment density
- Worker demographics
- Work trip origins and destinations

Step 4 - Park-and-ride best practices and siting criteria
- Practices enticing commuters
- Best practices in determining park-and-ride sites

Step 5 - Recommended park-and-ride locations
- Tier 1 screening
- Tier 2 screening and preferred sites

Study Area Refinement

The Project follows the I-20/26/126 corridor (refer to Figure 2). The Project is located in an urbanized area associated with the Columbia, South Carolina metropolitan area. Specifically, the corridor is located within the city limits of Lexington, Columbia, and West Columbia in both Richland and Lexington counties. Land use within and adjacent to the Project is comprised primarily of commercial development, residential development, industrial development, and undeveloped forestland.

The Project area is generally bound by:

- Along I-26: From Broad River Road to the north and Sunset Boulevard to the south.
- Along I-20: From Saluda River to the west to Broad River to the east.
- Along I-126: From I-26 junction to the north to Stone Ridge Drive to the south.

FIGURE 2. CAROLINA CROSSROADS STUDY AREA

Source: Carolina Crossroads, 2018

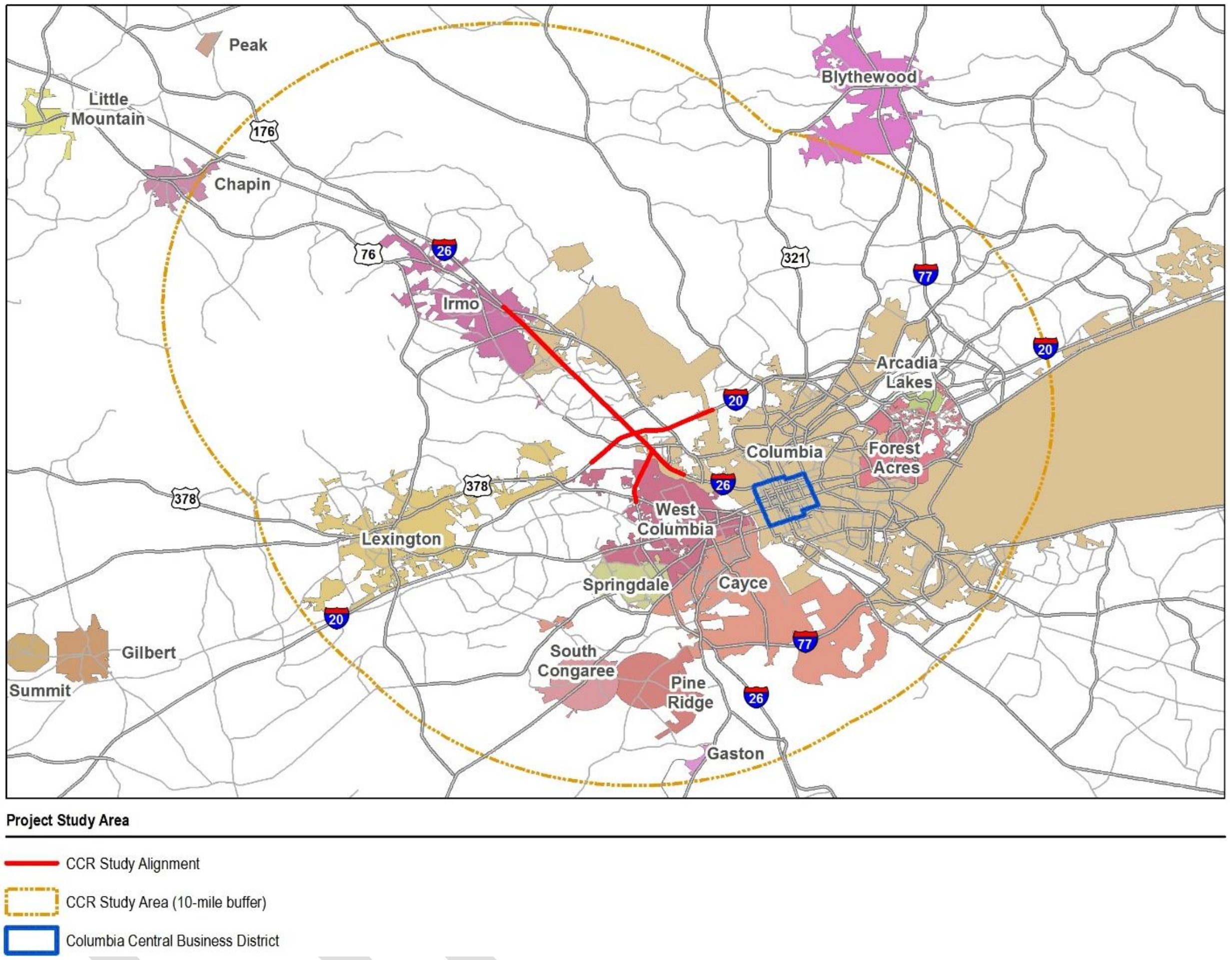
For the purpose of the park-and-ride analysis, the Project area was expand in order to effectively capture commuter travel patterns outside of and traveling through the Project area, mainly into the area's Central Business District (CBD), i.e. downtown Columbia, SC. The CBD was selected based on the

major destinations in the area such as the State Capitol, University of South Carolina (USC), municipal services, and a high concentration of employment in and immediately around the CBD.

Based on a review of the Transit Cooperative Research Program's (TCRP) "Decision-Making Toolbox to Plan and Manage Park-and-Ride Facilities for Public Transportation", a 10-mile buffer distance from the Project alignment was drawn to effectively capture commuter travel into and out of the CBD (Figure 3). For purposes of this study, commuter travel is defined by an individual's travel to/from home and work. The park-and-ride analysis focuses on commute travel on roadways because it is during peak hours that the roadway system is strained. To effectively capture travel patters into the CBD a travel influence area was added to the Project. The following areas were expanded to include:

- Along I-26: Near the Town of Chapin to the north and Downtown Columbia to the south.
- Along I-20: To about the Town of Lexington to the west to US 321 to the east.
- Along I-126: From I-26 junction to the north to near the City of Cayce to the south.

FIGURE 3. CCR PARK-AND-RIDE STUDY AREA



Source: HDR, 2018

Previous Studies

To ensure consistency with previous efforts and the community's vision, the study team reviewed and synthesized five previous park-and-ride related studies completed within or in the vicinity of the park-and-ride study area. The key findings/recommendations from these studies informed the recommended park-and-ride sites. The studies reviewed included:

- Central Midlands Regional Transit Authority Park-and-Ride Study (2010)
- SCDOT 2040 South Carolina Multimodal Transportation Plan (2014)
- CMCOG Regional Transit Needs Assessment and Feasibility Study (2015)
- CMCOG Columbia Area Transportation Study 2040 Long Range Plan (2015)
- SCDOT Draft I-20/I-26/I-77 Transit Demand Management Strategies (2017)

CENTRAL MIDLANDS REGIONAL TRANSIT AUTHORITY (CMRT) PARK-AND-RIDE STUDY – 2010

CMRT analyzed 47 potential park-and ride facilities. The purpose of the assessment was to help determine which areas are best suited for having a park-and-ride facility, potential sites for establishing park-and-ride facilities, and the type of ownership. The study performed a market area analysis, identified potential service corridors and park-and-ride sites, estimated demand, prioritized corridors, developed service concepts, cost estimates, and a final location analysis for various park-and-rides (see Appendix 1).

SCDOT 2040 SOUTH CAROLINA MULTIMODAL TRANSPORTATION PLAN – 2014

The 2040 Regional Transit & Coordination Plan Update for the Central Midlands Region provided information relative to services from 2009-2013. The plan evaluated existing transit services (including park-and-ride facilities), regional trends, multimodal integration, and human services transportation coordination. The plan also identified regional transit needs through enhancing and expanding services, identified potential funding sources, and developed a financial plan.

CMCOG REGIONAL TRANSIT NEEDS ASSESSMENT AND FEASIBILITY STUDY – 2015

The Central Midlands Council of Governments (CMCOG), in coordination with Lexington County and Richland County, conducted a regional transit needs assessment to assess the public's perception of transit needs throughout the two counties. Transportation needs were identified, ranked as good, better, and best, and prioritized based on several factors relating to the ease of implementation. Study area recommended transportation alternatives include bus on interstate shoulders, voucher programs, a volunteer driver vanpool program, an employee vanpool program, park-and-ride lots (see Appendix 2), a bike share program, grant-funded vehicles, education programs, and regional rail service.

CMCOG COLUMBIA AREA TRANSPORTATION STUDY 2040 LONG RANGE PLAN – 2015

CMCOG is the designated Metropolitan Planning Organization (MPO) responsible for carrying out the urban transportation planning process for the Columbia Area Transportation Study (COATS). The COATS MPO 2040 Long-Range Transportation Plan (LRTP) serves as the comprehensive plan for transportation investment to support the safe and efficient movement of people and goods within the Columbia urbanized area through the plan horizon year of 2040. The 2040 LRTP is the MPOs primary transportation policy document. It establishes the purpose and need for major projects included in the

Federal transportation funding program, identifies activities to address major transportation issues, and prioritizes investments in the transportation system addressing freeways and other highways, streets, transit, airports, bicycle and pedestrian facilities, freight, demand management, system management including intelligent transportation systems (ITS), and safety. The LRTP notes proposed transit service enhancements and opportunities, including park-and-ride service, in the CMCOG planning area.

SCDOT DRAFT I-20/I-26/I-77 TRANSIT DEMAND MANAGEMENT STRATEGIES – 2017

Transit Demand Management (TDM) is a general term referring to a set of strategies to increase the overall transportation system efficiency by reducing demands for single occupancy vehicle trips (SOV) or to shift demand out of the peak travel periods. The SCDOT TDM Strategies study reviewed TDM best practices and provided recommendations to help address roadway travel demands and increased congestion beyond widening roadways or developing other operational improvements. The study eventually identified recommended strategies and developed an implementation approach and cost benefit analysis. Draft study recommendations include:

- Implement alternative work schedules
    - Compressed work week; flexible working hours; telecommuting
- Establish park-and-ride facilities
    - Shared-use agreement park-and-rides
    - Park-and-ride facilities at:
        - Along I-20 corridor:
            - Exit 51 – Longs Pond Road
            - Exit 55 – SC 6
            - Exit 58 – US 1
            - Exit 61 – US 378
            - Exit 80 – Clemson Road
        - Along I-26 corridor:
            - Exit 91 – Columbia Avenue
            - Exit 97 – US 176 (Peak)
            - Exit 101 – US 76/176
            - Exit 102 – SC 60
        - Along I-77 corridor:
            - Exit 9 – US 378
            - Exit 22 – Killian Rd
- Conduct marketing and public outreach
- Expand Mass transit services

Existing Transit Service

There are several transit providers in the general area of the Project. Fixed route transit providers in the park-and-ride study area include University of South Carolina shuttles and The COMET. The Fairfield Connector and Newberry Council on Aging provide paratransit service beyond the study area. The following subsections summarize the services of providers in the park-and-ride study area.

Carolina Shuttle

Carolina Shuttle is a transit service provided by the University of South Carolina in downtown Columbia. Shuttles are free of charge for all university students, faculty and staff. The service includes six local routes, one express route, one evening route, and game day shuttles. The shuttles operate in downtown Columbia, serving the university campus. None of the shuttles intersect the Project. However, the shuttles do connect to The COMET and provide a first/last-mile connection to university students and personnel that may be using transit or other alternate forms of transportation.

The COMET

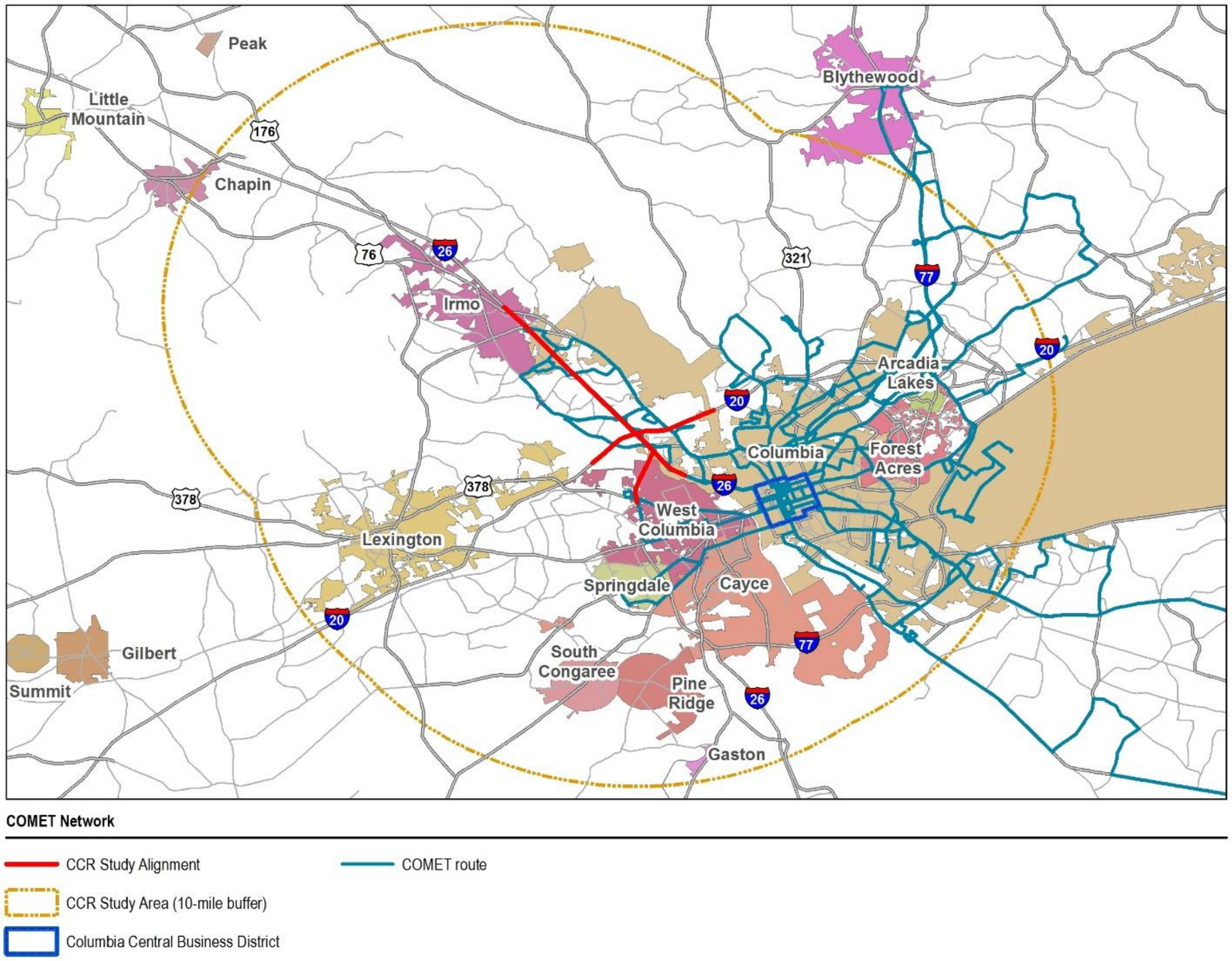
The COMET, previously known as the Central Midland Regional Transit Authority (CMRTA), serves the greater Columbia metropolitan region, covering both Richland and Lexington counties. The transit system was owned by South Carolina Electric & Gas (SCE&G) until 2002 when an agreement with the City of Columbia was reached and CMRTA was established. In 2013, CMRTA was re-branded as The COMET.

From 2002 to present The COMET has seen fluctuations in funding that have caused system expansion and contraction. Existing transit services are also illustrated in Figure 4.

As of October 2018, The COMET operates the services listed below.

- Soda Cap Connector Route 1
- Soda Cap Connector Route 2
- Route 101 – North Main
- Route 201 – Rosewood
- Route 301 – Farrow Road
- Route 401 – Devine St.
- Route 501 – Two Notch Road
- Route 601 – Shop Road
- Route 701 – Forest Drive
- Route 801 – Broad River
- Route 6 – Eau Claire
- Route 11 – Fairfield Road
- Route 12 – Edgewood
- Route 22 – Harden
- Route 26 – West Columbia
- Route 28 – Midlands Tech Airport Campus
- Route 31 – Denny Terrace
- Route 32 – North Main/Hardscrabble
- Route 42 – Millwood Avenue
- Route 45 – Leesburg / Hazelwood
- Route 46 – Lower Richland Blvd
- Route 47 – Eastover
- Route 52 X – Blythewood Express
- Route 53 X – Killian Road Express
- Route 55 – Sandhills
- Route 57 L – Killian / Clemson Road Local
- Route 62 – ReFlex
- Route 63 – Bluff
- Route 74 – Harrison /Trenholm Road
- Route 75 – Decker Blvd/Parklane Road
- Route 76 – Ft. Jackson
- Route 77 – Polo Road
- Route 82 X – Harbison Express
- Route 83 L – St. Andrews Local
- Route 84 – St. Andrews/Bush River
- Route 88 – Beltline Crosstown
- 2001: Gamecock Express
- Route 1870: Allen University to Irmo High School
- Dial-A-Ride Tran

FIGURE 4. THE COMET ROUTE ALIGNMENTS AND STOPS



Source: The COMET, 2018

Of all COMET routes noted above, only five routes traverse or travel in or bisect the Project. Those routes are 26, 82X, 83L, 84, and 801.The following is a brief overview of each route. Additional information on this service is available at http://catchthecomet.org/.

ROUTE 26 – WEST COLUMBIA

Route 26 West Columbia travels inbound and outbound from the transit center in downtown Columbia to Lexington Medical Center (Figure 5). The route operates Monday through Friday from about 6:20AM to 7:30PM with 120 minute headways. The route operates Saturday from about 10:20AM to 7:30PM also with 120 minute headways. The route intersects the Project at Sunset Boulevard and I-26.

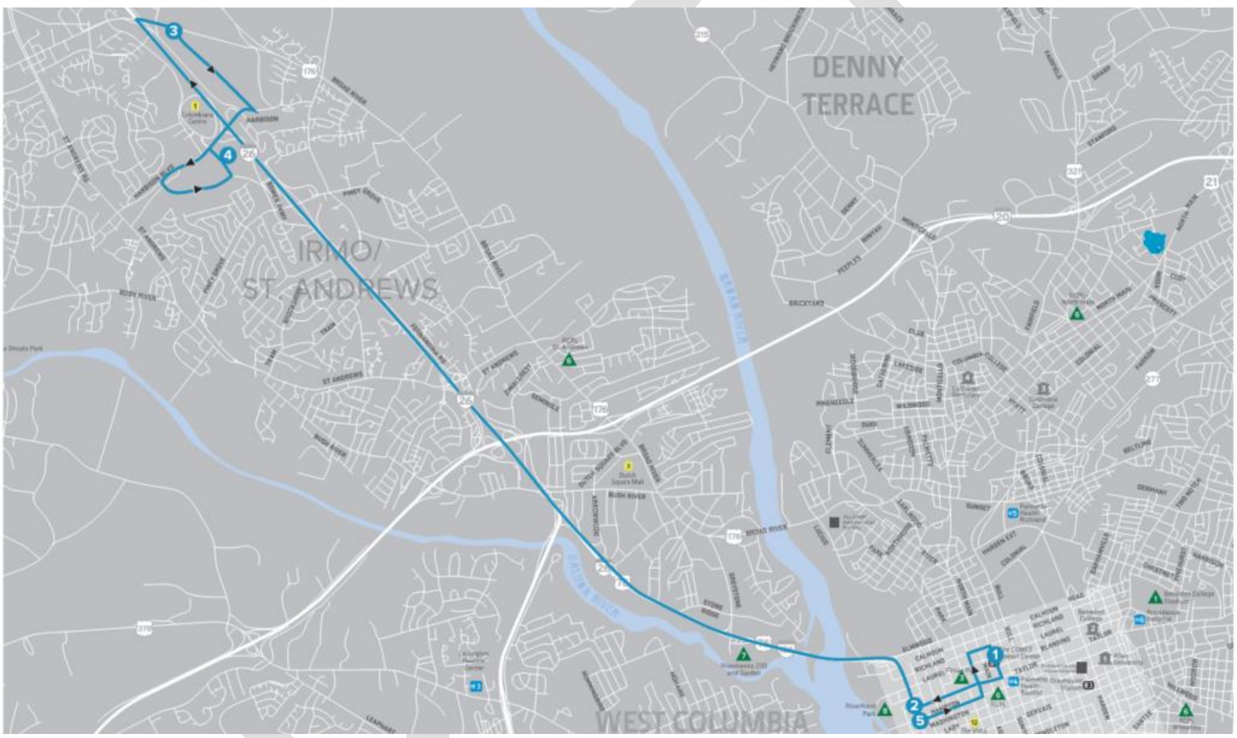
FIGURE 5. ROUTE 26 WEST COLUMBIA

Source: The COMET, 2018

ROUTE 82X – HARBISON EXPRESS

Route 82X Harbison Express travels inbound and outbound from the transit center in downtown Columbia to the Walmart at Harbison Boulevard and I-26, with stops at Lake Murray Boulevard and Park Ridge Drive (Figure 6). The route operates inbound and outbound Monday through Sunday in the morning from about 6:30AM to 10:30AM at 60 minute headways (four round trips); early afternoon from 12:30PM to 2:30PM at 60 minute headways (two round trips); and afternoon from 4:30PM to 10:30PM at 60 minute headways (six round trips). This is the only route that travels almost in its entirety in the Project. The route travels on I-126 from Stoneridge Drive north onto I-26 eventually reaching Lake Murray Boulevard and Park Ridge Drive.

FIGURE 6. ROUTE 82X HARBISON EXPRESS

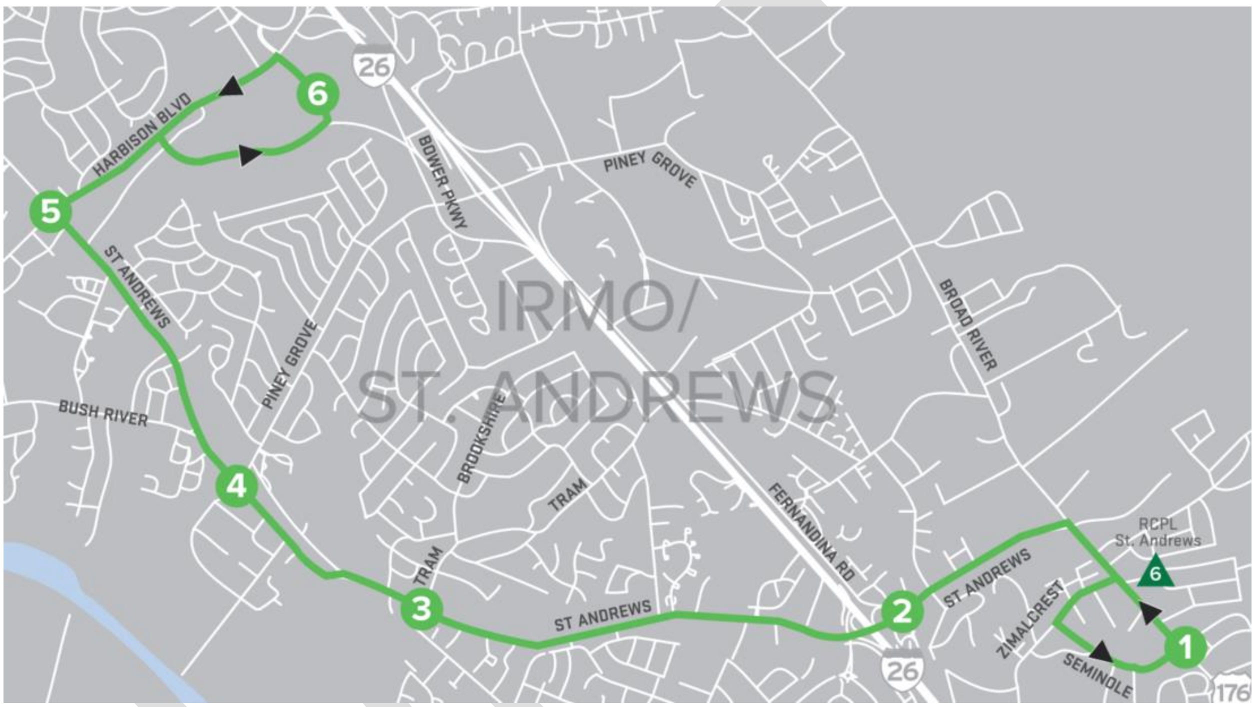


Source: The COMET, 2018

ROUTE 83L – ST. ANDREWS LOCAL

Route 83L St. Andrews Local travels inbound and outbound from the Zimalcrest Drive and Seminole Road to Harbison Boulevard and Bower Parkway (Figure 7). The route operates Monday through Friday from about 6:30AM to 1:30PM with 60 minute headways and from 3:30PM to 9:30PM with 60 minute headways. The route operates Saturday and Sunday from about 8:30AM to 1:30PM with 60 minute headways and again from 3:30PM to 9:30PM with 60 minute headways. The route intersects the Project at St. Andrews Road and I-26.

FIGURE 7. ROUTE 83L ST. ANDREWS LOCAL

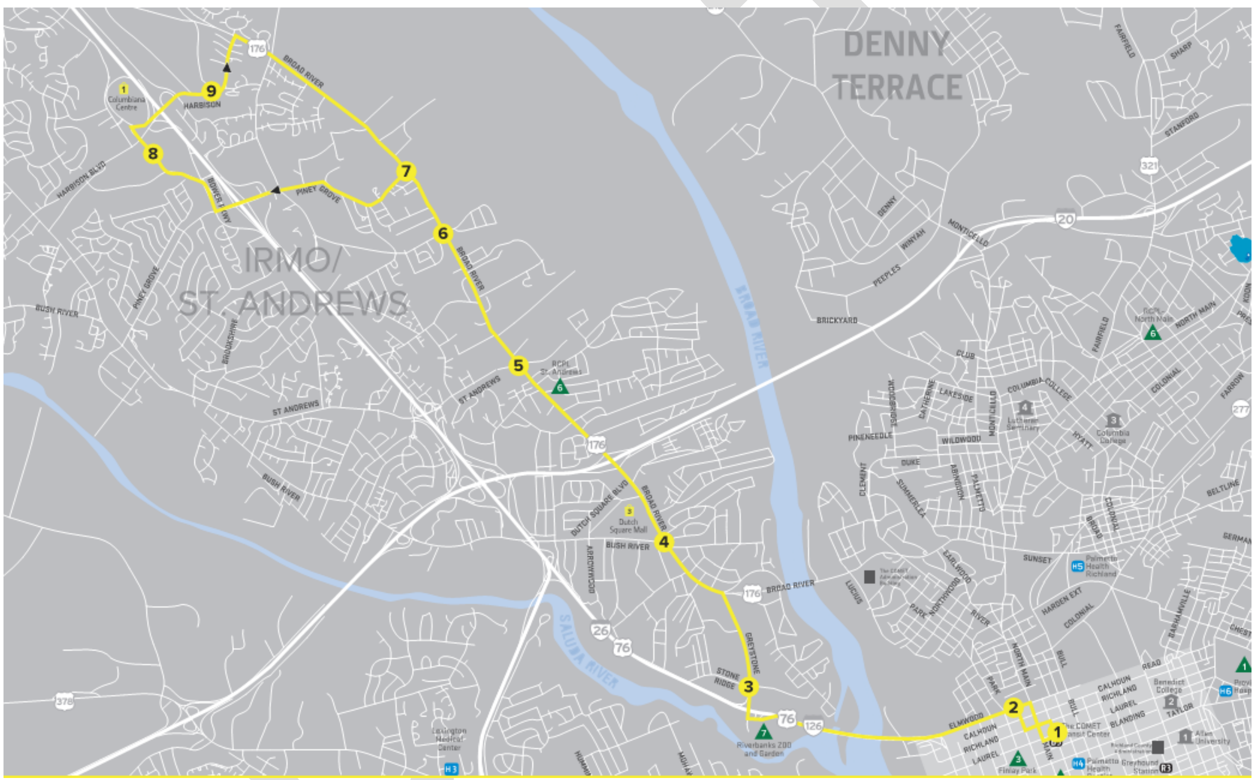


Source: The COMET, 2018

ROUTE 801 – BROAD RIVER

Route 801 Broad River travels inbound and outbound from the transit center in downtown Columbia to Broad Rive Road and Harbison Boulevard (Figure 8). The route operates Monday through Friday from about 5:20AM to 10:50PM at 60 minute headways. The route operates Saturday and Sunday from about 6:00AM to 10:30PM with 60 minute headways. The route intersects the Project at four places: 1) at Piney Grove Road and I-26, 2) Harbison Boulevard and I-26, and 3) Broad River Road and I-20. Route 801 parallels the I-26 portion of the Project from about Harbison Road at the north to Stone Ridge Drive to the south.

FIGURE 8. ROUTE 801 BROAD RIVER



Source: The COMET, 2018

FUTURE SERVICE MODIFICATIONS

On September 7, 2018 the CCR Project Team held the second mobility input group meeting to begin the next phase of coordination regarding the DEIS. At the meeting COMET staff shared several comments including potential service changes that should be noted for the park-and-ride study. COMET staff shared summaries about their upcoming September 2018 public hearings aimed at gathering input on proposed fare and service changes for 2018 and 2019. A summary of potential changes in the vicinity of the Project is provided below.

- **Route 26**: redesign the route to only operate in West Columbia and Cayce in a one way loop every 60 minutes and connect at Walmart, 6:00 AM to 6:00 PM weekdays 8:00 AM to 4:00 PM (Saturday) as well as change route name to Route 96.
- **Route 82X**: possible elimination of 12:30 PM and 1:30 PM trips based on ridership.
- **Route 83L**: fill in gap, midday and weekends.
- **Route 801**: add 30-minute service during peak period, Monday-Friday from 6:00 AM to 9:00 AM to 4:00 PM to 7:00 PM.
- **Route 93X**: new route connecting Columbia and Newberry via Chapin, Little Mountain, and Ballentine with one AM and one PM trip, Monday through Friday.

Fairfield Connector

Fairfield County has provided public transportation service to Fairfield County residents. The county operates both a demand response and a deviated fixed route transportation service. Transportation services are offered in varying frequencies. Some routes operate every weekday. An express route traveling to and from downtown Columbia operates on Monday and Wednesday during select times of the day. Route deviation service is available to the general public for an extra charge to the normal route fare. Additional information on this service is available at http://www.fairfieldsc.com/secondary.aspx?pageID=268.

Newberry Council on Aging

The Newberry Council on Aging Transportation program provides transportation for non-emergency medical appointments with at least three days prior notice. The program serves varied trip needs that may or may not travel within the park-and-ride study area. Additional information on this service is available at http://www.nccoa.org/.

Travel Demand Analysis

A key step in identifying park-and-ride sites is to identify corridors that have the demand to attract commuters to such facilities. A travel demand analysis was conducted using the following data sources: statewide travel demand model (current and 2045 projections), home-based work travel demand from the Census Bureau's OnTheMap tool, and population densities. The following subsections summarize the findings of the analysis.

Work Trip Origins and Destinations

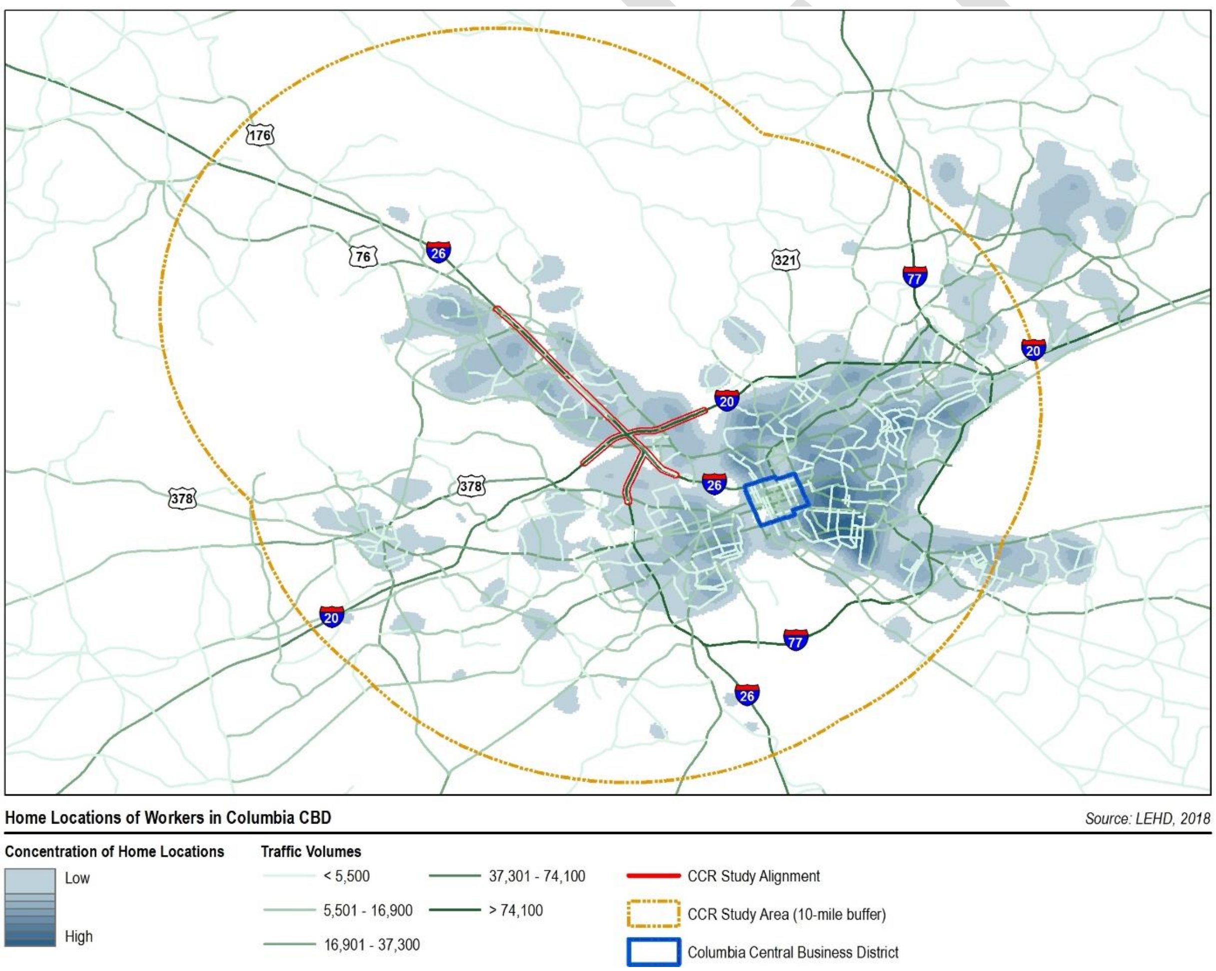
The study team examined both home-based work travel to the Columbia CBD and all trips in the park-and-ride study area to help identify the potential park-and-ride markets. Data from the Census Bureau's

Longitudinal Employer-Household Dynamics (LEHD) program as well as current and project data from the South Carolina statewide travel demand model were used for this analysis.

LEHD HOME-BASED WORK TRIPS

The Census Bureau's OnTheMap tool identified 48,200 workers in the Columbia CBD. Approximately 24,000 of these workers live in the park-and-ride study area, which is focused on the intersection of I-20 and I-26. Nearly 37 percent of these workers whose home is in the park-and-ride study area are located in the I-26 corridor northwest of downtown Columbia. Figure 9 illustrates the density of home locations for workers in the Columbia CBD. Figure 9 also shows 2017 traffic volumes for the roadway network with thinner and light green lines representing average daily traffic counts of 5,500 vehicle or less, to thicker dark green lines with over 74,000 vehicles. Heavy traffic volumes are shown on I-20, I-26 and I-77.

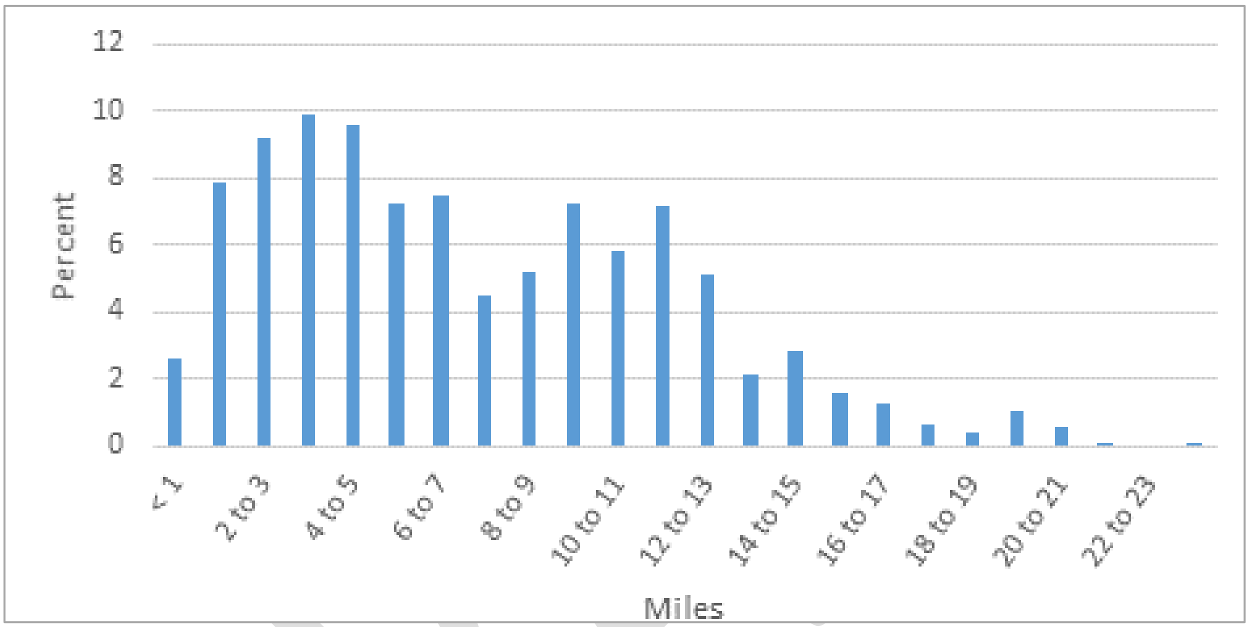
FIGURE 9. HOME LOCATION OF THE WORKERS IN THE CBD



Source: HDR, 2018

In terms of proximity to the CBD, more than half of the CBD workers living in the park-and-ride study area are located within six miles of downtown Columbia; almost three quarters are located ten to eleven miles or less. Figure 10 shows the home location frequency distribution for Columbia CBD workers living in the park-and-ride study area.

FIGURE 10. HOME LOCATION DISTANCE FROM CBD



Source: LEHD, 2018

WORKER DEMOGRAPHICS AND INCOME LEVELS

The 2015 LEHD data shows that 22 percent of workers are age 29 or younger; 56 percent are age 30 to 54; and 22 percent are age 55 or older. Approximately 23 percent of workers earn $15,000 per year or less. Workers earning between $15,000 and $40,000 annually account for 46 percent of the downtown labor force. Workers with annual wages greater than $40,000 account for 42 percent of the downtown labor force. Female workers outnumber male workers 57 percent to 43 percent.

South Carolina Statewide Travel Demand Model

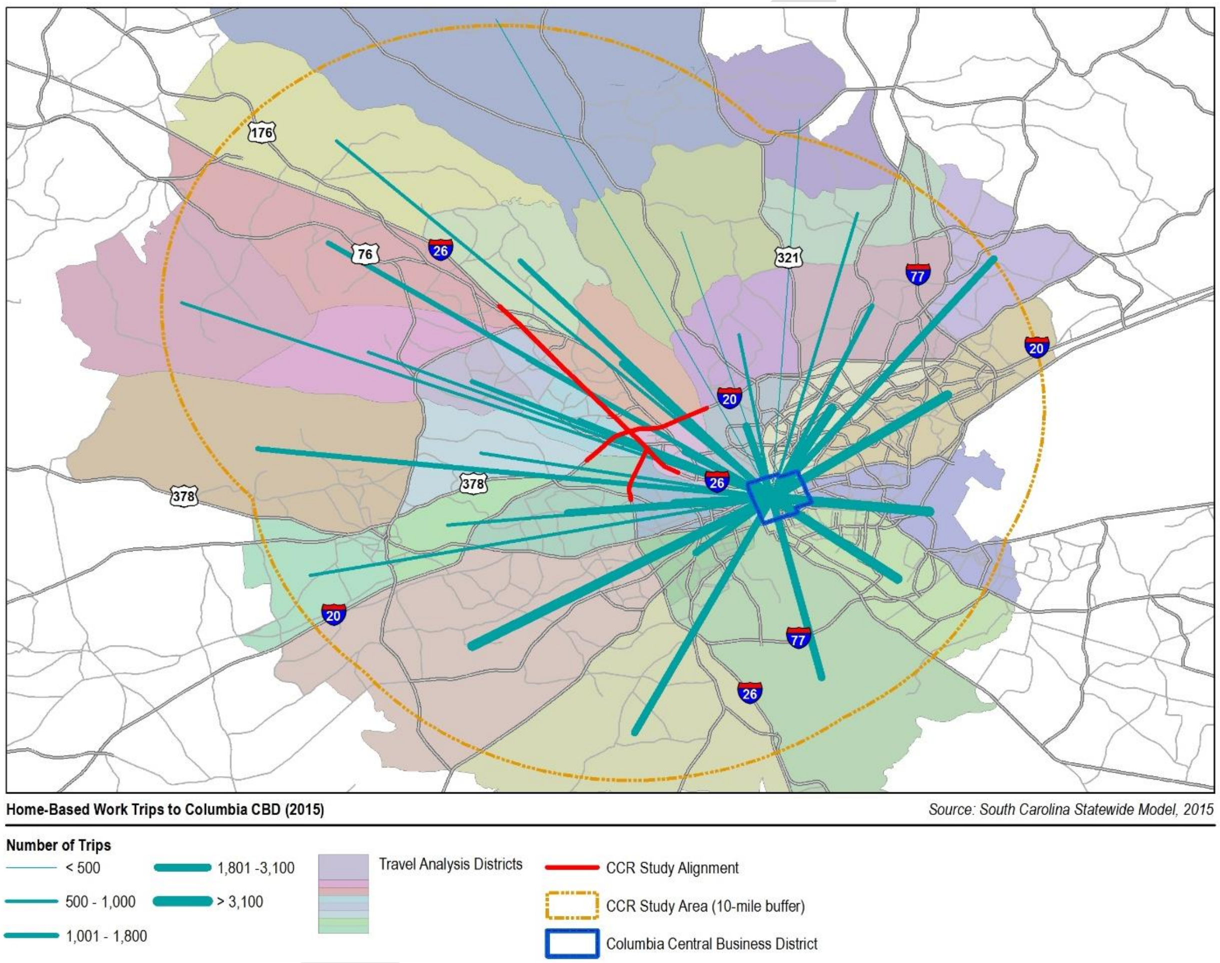
Data from the South Carolina statewide travel demand model was used to analyze the trips between traffic analysis zones of the CBD and surrounding areas as well as current and future trip pairs between all the traffic analysis zones.

CURRENT AND FORECASTED HOME-BASE WORK TRIPS

Using the statewide travel demand model 2015 base year, desires lines were created to represent the total number of trips between the CBD and the regional traffic analysis zones (Figure 11). Trip pairs from the CBD radiate in multiple directions, however, strongest traffic analysis zone trip pairs flow east to west as well as trip pairs to the north of the CBD approximately parallel to the traffic analysis zone to the east of I-26.

The South Carolina statewide travel demand model 2045 forecasts shows that the number of work trips from the park-and-ride study area to the Columbia CBD remaining steady through the planning horizon.

FIGURE 11. HOME-BASED TRIPS TO CBD

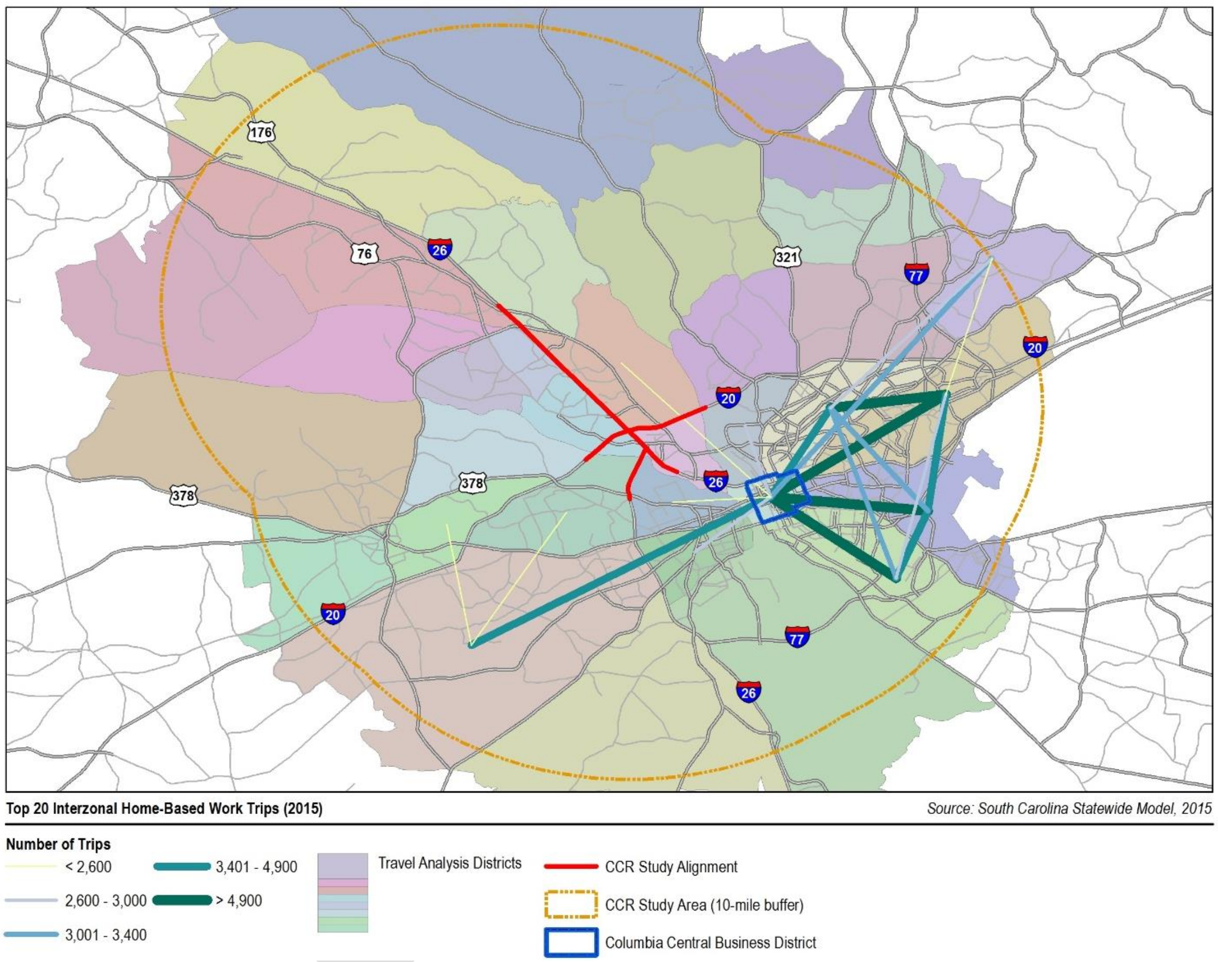


Source: HDR, 2018

INTERZONAL HOME-BASED WORK TRIPS

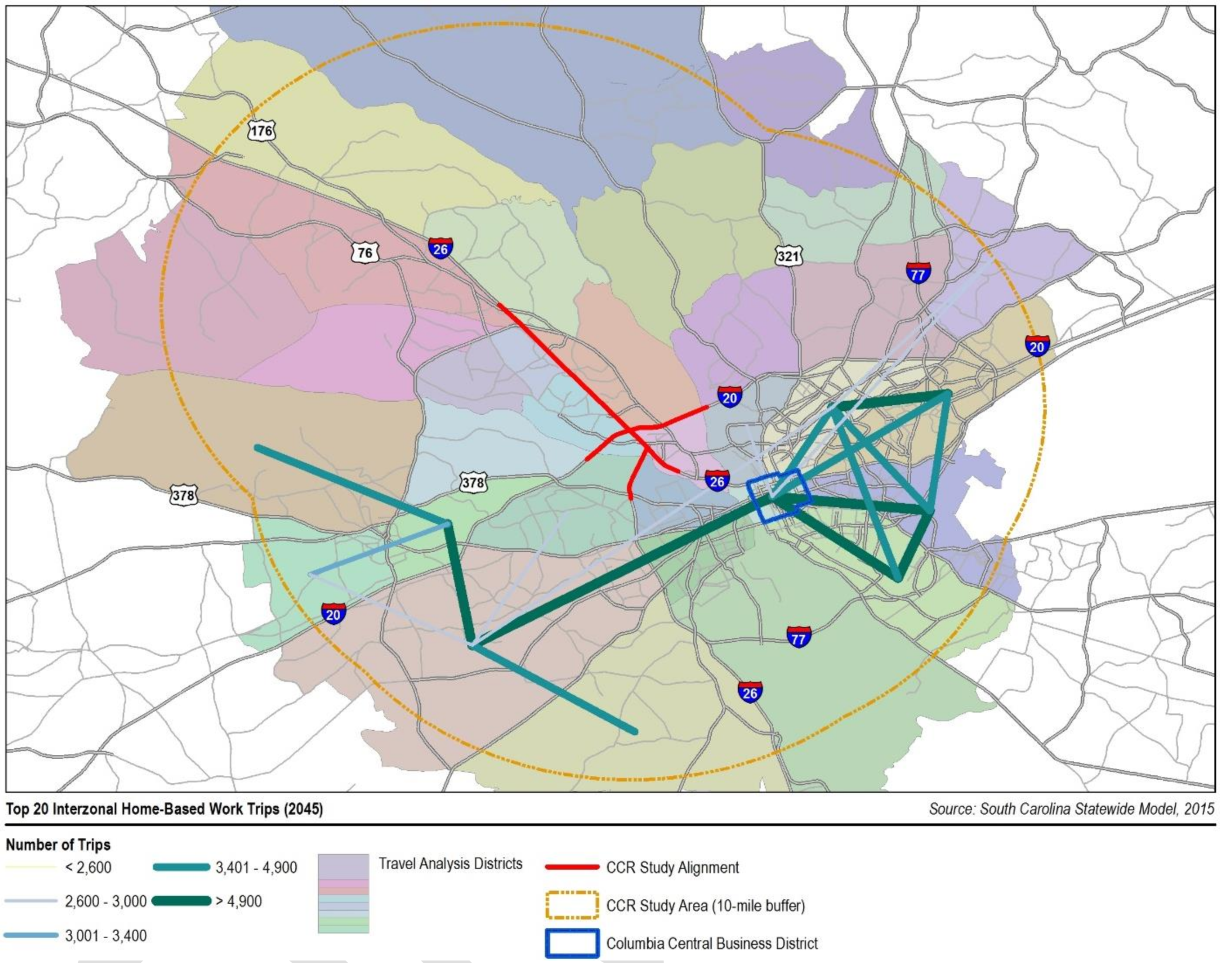
In addition to the home-based work trips between the study area traffic analysis zones and the CBD, interzonal home-based work trips were developed for the 2015 model base year and 2045 horizon year (Figure 12 and Figure 13). The interzonal trips show the top 20 trip links between each traffic analysis zones. Figure 12 shows that for the traffic analysis zones in the park-and-ride study area, the majority of the top 20 interzonal trip exchanges are between traffic analysis zones immediately to the east of the CBD, with many of the trip pairs connecting to the CBD. Figure 13 shows interzonal trips for the 2045 horizon year. Between 2015 and 2045 strong trip pairs have shifted to the south as well as to the west of the CBD, with many of the trip pairs still connecting to the CBD.

FIGURE 12. TOP 20 INTERZONAL HOME-BASED WORK TRIPS (2015)



Source: HDR, 2018

FIGURE 13. TOP 20 INTERZONAL HOME-BASED WORK TRIPS (2045)

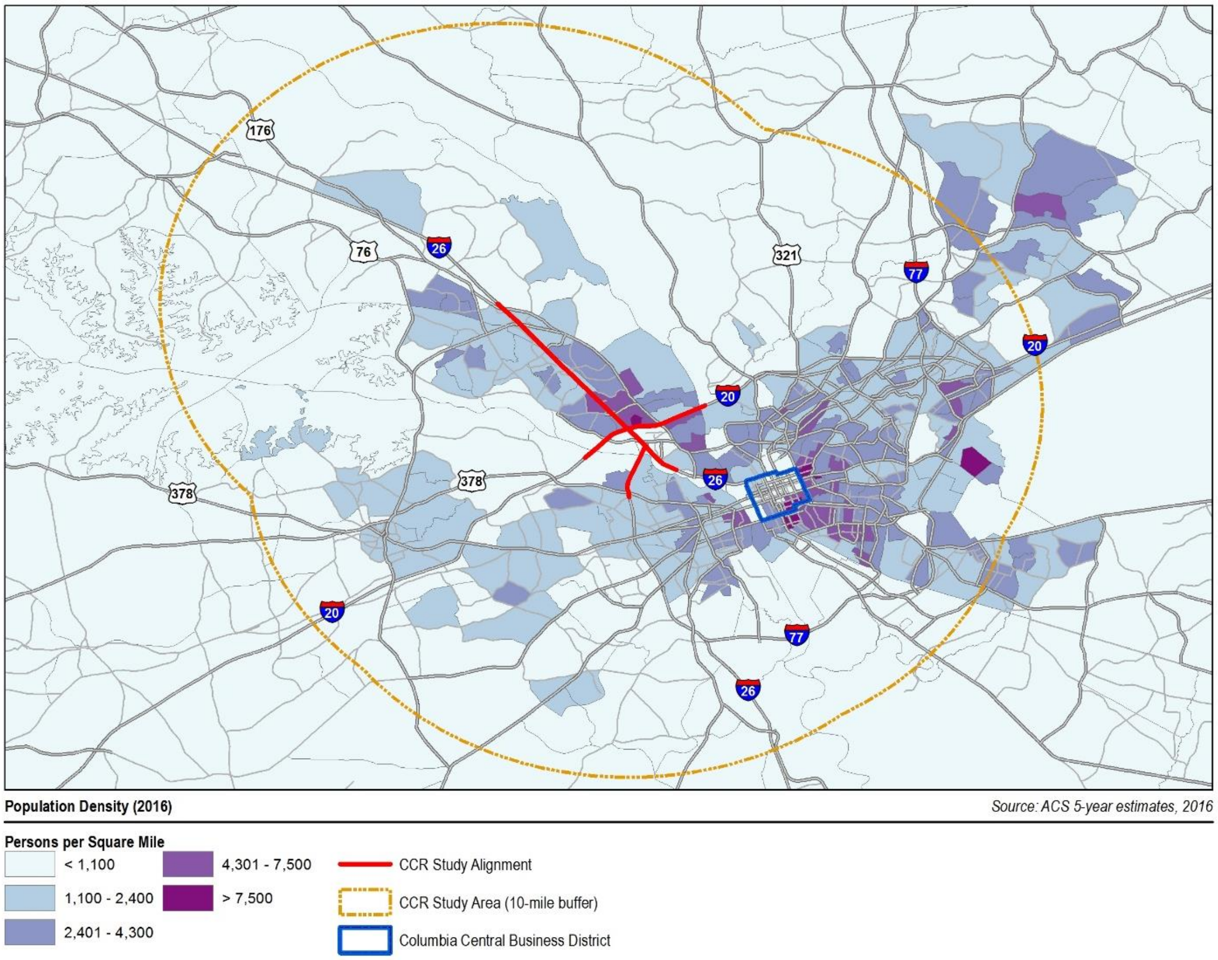


Source: HDR, 2018

Population and Employment Density

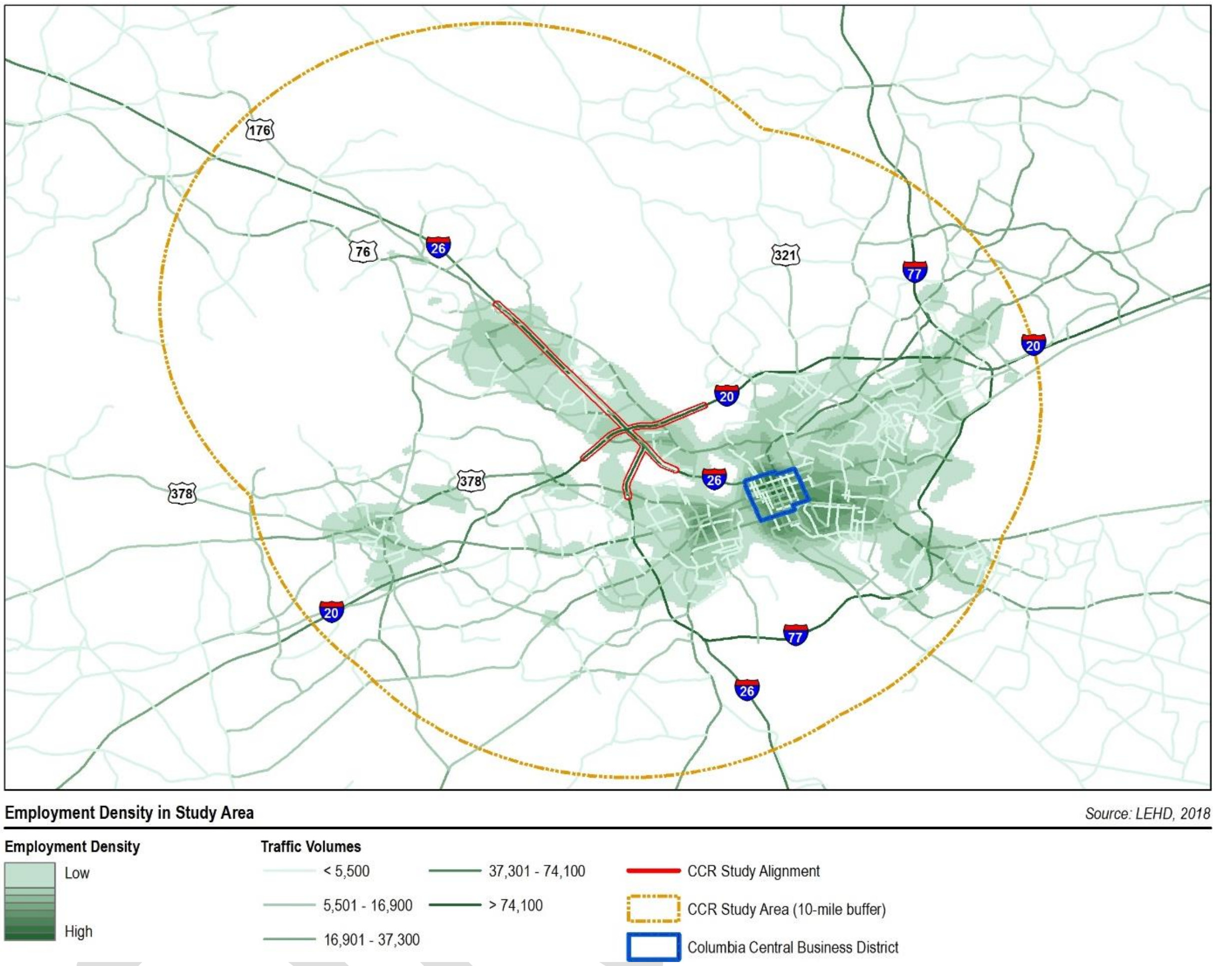
Existing population and employment densities were also examined as part of this study. Figure 14 shows the highest population densities around the City of Columbia and in particular the CBD. Other areas with high population densities include the area near the I-26 and I-20 interchange and the I-77 and I-20 interchange (Two Notch Road). Figure 15 shows the highest employment density near the CBD. Beyond the CBD, the area bound by I-20, I-26 and I-77 as well as north of I-20 along I-26 have high employment densities.

FIGURE 14. POPULATION DENSITY



Source: HDR, 2018

FIGURE 15. EMPLOYMENT DENSITY



Source: HDR, 2018

Park-and-Ride Characteristics and Siting Criteria

General Characteristic of Successful Park-and-Rides

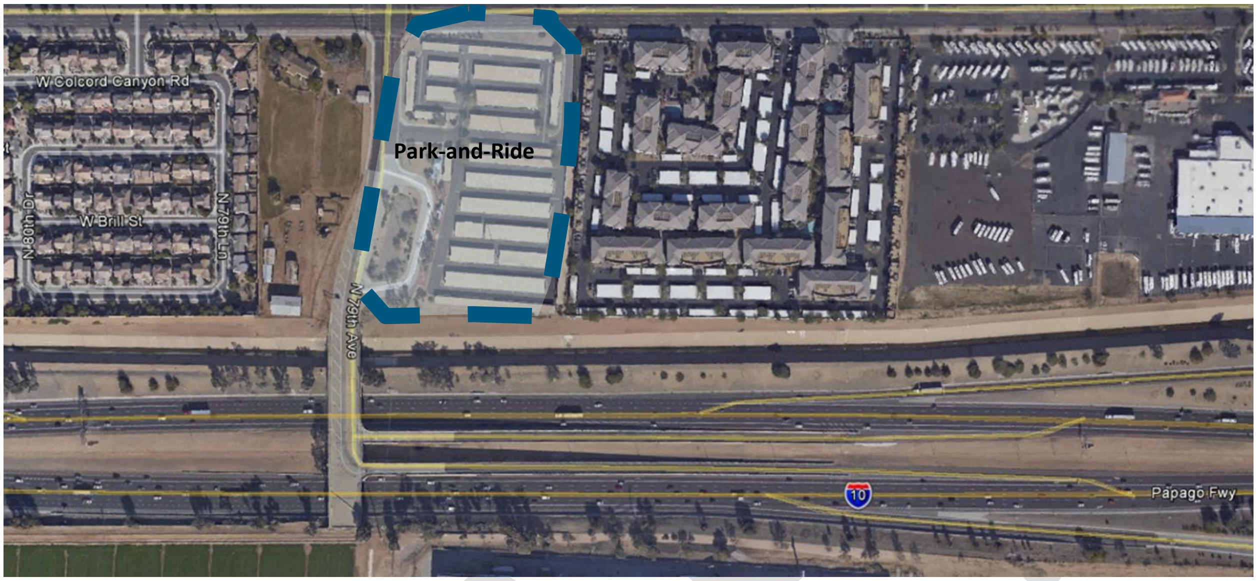
There are several best practices characteristics that make for a successful park-and-ride. Those characteristics include:

- **Easy site access**: provide convenient access points for easy ingress/egress of the park-and-ride site from major roads for both small (e.g. private automobiles) and large (e.g. commuter transit) vehicles.
- **Designated access**: provide separate ingress/egress for buses and automobiles to minimize conflicts between the two.

- **Proximity of freeway**: facilities should be adjacent or in close proximity (e.g. one mi. or less) to the interstate system and located on the inbound side of the interstate heading in the direction of travel.
- **Far side of freeway**: facilities should be placed on the far side of the interchange to provide ease of access onto the highway.
- **Direct access to High Occupancy Vehicle (DHOV) lane**: if an HOV lane is available, park-and-rides usage is more attractive if a flyover or direct connection exists between the park-and-ride and the HOV lane.
- **Adequate parking capacity with ability to expand**: it is important to provide an adequate amount of parking to serve current demand but retain space for potential expansion to meet future demand.
- **High level of service**: if public transit service such as commuter buses is available, those services should be provided frequently, such as every 10 to 15 minutes during morning and evening peak hours. Midday service, if provided, could have lower headways.
- **Visibility**: locate the facility where is it visible from adjacent arterial streets and provide adequate wayfinding to direct users to the facility.
- **Designated pickup and drop-off zones**: provide easily accessible pickup and drop-off zones for users, for example, zones for kiss-and-rides as well as Transportation Network Companies (TNCs), such as Uber and Lyft, to stage and provide first/last mile connections.
- **Priority parking**: provide parking stalls for vanpools at the very edge of the main ingress/egress of the site to allow for faster departure of a group of commuters form the site.

FIGURE 16. PARK-AND-RIDE ACCESS EXAMPLE

FIGURE 17. PARK-AND-RIDE DHOV EXAMPLE

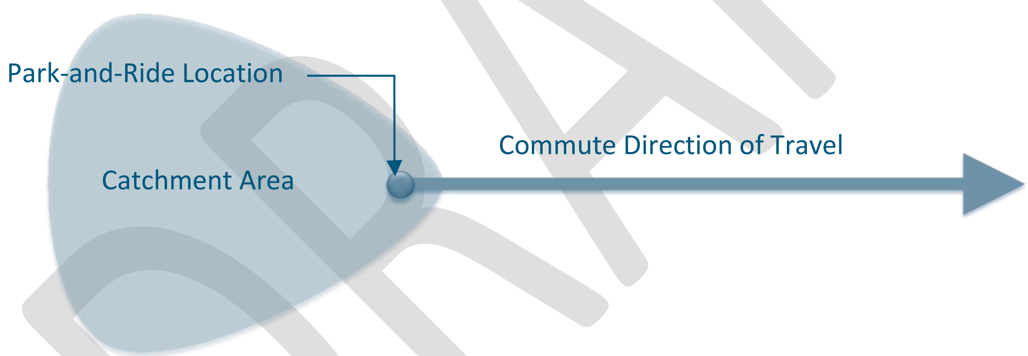


- **Amenities:**
  - **Shade**: parking stall shade canopies provides an additional amenity for transit users. Shade structures could be maximized by installing solar panels to minimize operations and maintenance cost of the facility.
  - **Fare convenience**: if fixed route transit is available on-site fare vending machines, monthly employer passes, or mobile apps, for example, provide an added convenience for users to board the vehicle and not spend time feeding fareboxes.
  - **Safety and security**: safety and security measures such as on-site personnel, sufficient lighting, or video cameras provide additional amenity for transit users to try and continue using the facilities.
  - **Drinking fountain**: provide drinking fountain for passenger or operator convenience.
  - **Bike storage**: provide bike storage facilities (e.g. bike rack or lockers) for those that live in the vicinity of the park-and-ride and choose to bike.
  - **Trash receptacles**: provide adequate trash receptacles and maintenance to ensure a clean site.
  - **Information**: provide adequate information such as electronic display boards showing real-time bus information if transit service is available and the transit system has the ability to communicate with the display boards.
- **Other considerations**:
  - **Coordination and outreach**: park-and-ride facilities should be supported by an effective public outreach campaign that promotes using the facility for vanpool, carpool, and/or

transit connections (if available). Effective marketing and outreach will make the facility and/or service attractive to a broader spectrum of commuters.

- **Efficient commuter services**: commuter services serving the park-and-ride should be efficient in terms of pickup from the site to drop-off at the final destination. For example, commuter transit services that meander, make multiple stops, or take too much time to reach the final destination will not be attractive to park-and-ride users.
- **Destination connectivity**: provide mobility connections at the final destination for those opting to leave their car behind at a park-and-ride, such as sidewalks, fixed route services, bikeshares, e-scooters, TNCs, etc.
- **Rider catchment areas**: catchment area refers to the area where users travel from to access the facility. Given varying geographic constraints, park-and-ride catchment areas vary but are generally parabolic, or teardrop shape, in nature. For example, those living immediately south of the park-and-ride may reverse travel a mile or two back to the park-and-ride to then travel south to the main travel destination; those living north of the facility travel farther distances to access the park-and-ride downstream and utilizes it.

FIGURE 18. RIDER CATCHMENT AREA



Site Selection Criteria

Based on a best practices review of Transit Cooperative Research Program (TCRP) park-and-ride research, two key criteria have been selected to site park-and-ride facilities for this study: distance from the CBD and placement relative to congestion area.

DISTANCE FROM THE CBD

Distance to the CBD refers to an average area of about 10 to 15 miles away from the CBD that commuters may choose to use transit, carpool, or other transportation demand management strategies, to reach a the CBD.

PLACEMENT RELATIVE TO CONGESTION AREA

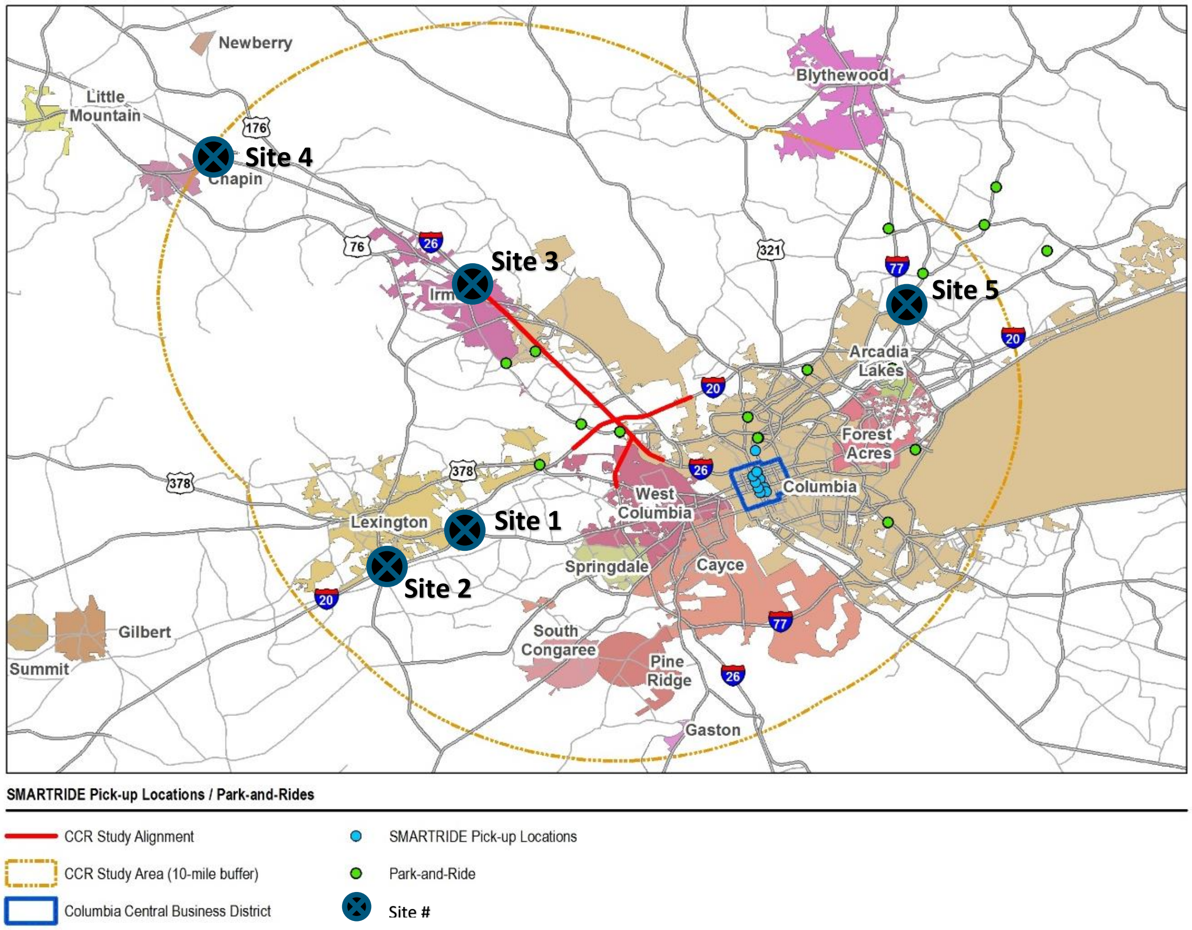
Placement relative to congestion area refers to highway segments that show traffic congestion in direction of the CBD that makes using park-and-rides transportation demand management strategies worthwhile than driving alone.

Park-and-Ride Site Screening

The Park-and-Ride Site Screening was done based on the Selection Criteria and General Characteristics of Successful Park-and-Rides as detailed above. The rider catchment area (as shown in Figure 18 above) was used to determine five best fit locations for park-and-rides (shown in Figure 19). An initial site assessment of properties around these locations provided five sites that were advanced to the Tier 1 Evaluation. Those sites are:

- 4904 Augusta Highway, Lexington SC
- 937South Lake Drive, Lexington SC
- 7608 Broad River Road, Irmo SC
- Ellett Road and Brentwood Court, Chapin SC
- 8500 Farrow Road, Columbia SC

FIGURE 19. BEST FIT LOCATIONS



TIER 1 EVALUATION

The Tier 1 evaluation was a fatal flaw analysis and review of obvious issues or constraints that may preclude implementation of a park-and-ride. The five sites identified from the initial site assessment exercise were evaluated and graded based upon two key criteria – (distance to the CBD, and the location relative to congestion area) and thirteen general site characteristics (parcel size, site availability-Publicly Owned-, site land use, surrounding land uses, ease of access, designated bus access, proximity of freeway, parking capacity, parking expansion, public transit – high level of service, visibility, and rider catchment areas). Other than a review utilizing Lexington and Richland County's online GIS applications, no property studies, surveys, or coordination of availability with the property owners have been completed. Publicly owned properties includes parcels owned by the counties; municipalities; and state departments. The Tier 1 sites were selected based on their proximity to the nodes shown in Figure 19 above and the rating summary and assumptions are shown in the Tier 1 Evaluation Matrix.

Table 1. Tier 1 Evaluation Matrix

Evaluation Criteria	Assumptions	Description of Criteria Scoring	Evaluation Criteria Weight	Site No. 1 4904 Augusta Highway (Lexington TMS 004498-02-012)		Site No. 2 937South Lake Drive (Lexington TMS 005499-01-010)		Site No. 3 7608 Broad River Road (Richland TMS R04000-05-16)		Site No. 4 Ellett Road/Brentwood Court (Lexington TMS 000300-04-051)		Site No. 5 8500 Farrow Road (Richland TMS R17102-01-01)	
				Rating	Details	Rating	Details	Rating	Details	Rating	Details	Rating	Details
Key Criteria													
Distance to CBD	Average area of about 10-15 miles from CBD is optimal	Miles from CBD: 10 to 15 mi = 3; >8 to <10 or >15 to < 20 mi = 2; <8 or >20 mi = 1	2	3	Approx. 12 miles via interstate travel	3	Approx. 14 miles via interstate travel	3	Approx. 12 miles via interstate travel.	1	Approx. 24 miles via interstate travel.	3	Approx. 10 miles via interstate travel.
Location Relative to Congestion Area	Site Rider Catchment side of congestion areas	No Concerns = 3; Minor Concern = 2; Major Concern = 1	2	2	Congestion is a point of concern along US Hwy 1 (August Road) leaving the Town of Lexington.	2	Congestion is a point of concern along SC 6 (South Lake Drive) leaving the Town of Lexington.	2	Site is within the approximated area of congestion	3	Site is outside of approximated area of congestion.	2	Site is within the approximated area of congestion
General Site Characteristics													
Parcel Size	5 acres is considered optimal	> 5 acres = 3; >4 to <5 acres = 2; <3 acres = 1	1	3	5.55 Acres	3	7 Acres	3	Approx. 9 acres. But is part of a larger 18 acre tract separated by Western Lane.	3	20.89 Acres	3	363 acres
Parcel Availability	Vacant, Public, compatibility w/ Econ. Dev.	Vacant and Public Owned = 3; Public and Compatible w/ Econ. Dev OR Privately Owned and Listed for Sale = 2; Privately Owned and Not Listed for Sale = 1	1	1	N/F Owned by Caughman, Marguerite W. Etals.	1	N/F Owned by Chatham Capital LLC	2	N/F Owned by Elzie Thomas Meetze Sr Trust. Parcel is listed for sale.	3	N/F Owned by County of Lexington	3	N/F Owned by State Park Complex
Land Use (Site)	Existing or Planned Land Use	No Concerns = 3; Minor Concern = 2; Major Concern = 1	1	1	Land Use - Rural-Unimproved	3	Land Use - General Commercial Unimproved	1	Site is currently single family residential but is listed for sale	2	Site is a part of Chapin Technology Park master plan.	3	Site is large enough to be included in the master plan.
Land Use (surrounding)	Existing/Planned Land Use or Zoning	No Concerns = 3; Minor Concern = 2; Major Concern = 1	1	2	Agricultural, single family residential, and a hotel adjacent/across Cedar Road.	3	Industrial/Commercial in the surrounding area.	3	Undeveloped and commercial development.	3	Undeveloped Industrial Park.	2	Residential, schools, and commercial development.
Ease of Access	Arterial road access or physical constraint	No Concerns = 3; Minor Concern = 2; Major Concern = 1	1	3	Parcel is at the intersection of US Hwy 1 (Augusta Road) and Cedar Road	2	Lack of secondary frontage or more than 500-LF of main frontage.	3	Direct access to Broad River Road and Western Lane.	2	No direct access to a secondary route but does have access to a frontage road	3	Direct access to Parklane Road or Farrow Road but too far for access to both.
Designated Bus Access	Separate access for busses	No Concerns = 3; Minor Concern = 2; Major Concern = 1	1	3	Secondary frontage on Cedar Road should allow for separate bus access.	1	Less than 500-LF of frontage	3	Secondary frontage on Western Lane should allow for separate bus access.	2	No direct access to a secondary route but does have access to a frontage road and industrial park road.	2	Direct access to Parklane Road or Farrow Road but too far for access to both.
Proximity of Freeway	Site should be adjacent to or close to interstate	Miles to interstate: Adjacent = 3; <0.5 mi = 2; >0.5 mi = 1	1	2	Parcel is approximately 600-LF beyond interchange	3	Parcel is adjacent to the Exit ramp	3	Parcel is adjacent to the Entrance ramp	2	Parcel is adjacent to the Frontage Road.	1	> 0.5 miles from freeway.
Far side of Freeway	Site on Rider Catchment side of interchange	Nearside of interchange = 3; Far side but <0.5 mi = 2; Far side >0.5 mi = 1	1	2	Parcel is approximately 600-LF beyond interchange	3	Parcel is adjacent to the Exit ramp on the near side.	2	Parcel is adjacent to the Entrance ramp on the far side.	3	Parcel is adjacent to the Frontage Road on the near side.	1	> 0.5 miles from freeway on the far side.
Parking Capacity	250 - 500 spaces optimal	>250 spaces (>5-acres)= 3; 200-250 (4-5-acres) = 2; <200 spaces (<4-acres) = 1	1	3	Over 5 acres is assumed to be >500-spaces	3	Over 5 acres is assumed to be >500-spaces	3	Over 5 acres is assumed to be >500-spaces	3	Over 5 acres is assumed to be >500-spaces	3	Over 5 acres is assumed to be >500-spaces
Parking Expansion	Availability for Expansion is preferred	>25% = 3; <25% = 2; None = 1	1	2	Adjacent tract is owned by same owner.	3	Tract is 7 acres and adjacent tract is an abandoned restaurant	3	Tract is large enough for expansion.	3	Tract is large enough for expansion.	3	Tract is large enough for expansion.
Public Transit - High Level of Service	Public Transit Service availability	Public Transit Service: Existing Service = 3; Known Planned Expansion = 2; No Exist./Planned Expan. = 1	1	1	No known Public Transit Service planned.	1	No known Public Transit Service planned.	1	No known Public Transit Service Planned	1	No known Public Transit Service planned.	3	Existing Bus Service to Midlands Tech Campus.
Visibility	Site should be adjacent to or close to interstate	Miles to interstate: Adjacent = 3; <0.5 mi = 2; >0.5 mi = 1	1	3	While the frontage is approx. 600-LF from interstate, the rear of the property is adjacent to the interstate for visibility.	3	Parcel is adjacent to the Exit ramp	2	Parcel is adjacent to the Entrance ramp	3	Parcel is adjacent to the Frontage Road.	1	> 0.5 miles from freeway.
Rider Catchment Areas	Site on the CBD end of catchment areas	No Concerns = 3; Minor Concern = 2; Major Concern = 1	1	3	Catchment area is considered to be the Town of Lexington.	3	Catchment area is considered to be the Town of Lexington.	2	A portion of the catchment area is estimated to be closer to the CBD.	2	Site is outside of large population densities that work in CBD	2	Site is outside of large population densities that work in CBD
			Total	**39**		**42**		**41**		**40**		**40**	

3 = Most Optimal; 2 = Less Optimal, 1 = Not Optimal

TIER 1 EVALUATION RESULTS

Sites 2 and 3 scored the highest based on the described criteria with scores of 42 and 41, respectively. Each site has at least five acres available; are relatively the same distance and have high visibility from the freeway; are in the approximate 10-15 mile distance from the CBD; and are easily accessible from roadway. These two sites advanced to the Tier 2 evaluation. Coincidentally the two sites are each on the edges of the study area. Site 2 is to the southwest side with a rider catchment area that includes the Town of Lexington. Site 3 is to the northwest with a rider catchment area that includes parts of Irmo and Ballentine.

TIER 2 EVALUATION

Each of the two highest rated sites from the Tier 1 review have been further evaluated for physical constraints and schematic parking lot layouts have been completed. These two sites are rated 1-3 for each criteria with the most favorable condition receiving a 3 and the least optimal condition receiving a 1. The criteria evaluated for each site are:

- Site Availability
- Available acreage
- Public Transit Service
- Land Use (onsite)
- Land Use (surrounding)
- Capital Cost (Startup)
- Operational and Maintenance Costs
- Auto and Buss Access
- Internal Circulation
- Physical Constraints
- Environmental Issues
- Expansion

Sites 2 and 3 are briefly described below and their schematic layouts are shown in Figures 20 and 21, respectively. The Tier 2 Evaluation Matrix provides the comparison of the two sites.

Site 2 - A privately owned parcel located at 937 South Lake Drive. The site is vacant with the exception of a large gravel lot and is approximately seven acres in size. The adjacent site is an abandoned fast food restaurant and could potentially be used for expansion. Due to the topography and accessibility constraints a single ingress/egress driveway will likely be required. Site 2 schematic layout shows that the main ingress/egress would be from South Lake Drive and could include approximately 349 parking spaces. The park-and-ride is approximately 0.25 miles from the I-20/South Lake Drive interchange. An order of magnitude capital cost was developed for the park-and-ride facility, Site 2 would cost approximately $8.7M (this includes construction, contingency, professional services, and acquisition).

FIGURE 20. SITE 2 SCHEMATIC LAYOUT

Site 3 – A privately owned parcel located at 7608 Broad River Road. There is a single family home located on the southern end. A public search shows that the parcel is for sale for $2,990,000. The site is split in two tracts by Western Lane. The southern portion of the parcel has access to N Wingard Road and appears to be currently under development. Site 3 schematic layout shows that the main bus and automotive ingress/egress would be from Western Lane; automobile traffic ingress/egress would be from Western Lane. The side could accommodate approximately 333 parking spaces. The park- and-ride is approximately 0.75 miles from the I-26/Broad River Road interchange. An order of magnitude capital cost was developed for the park-and-ride facility, Site 3 would cost approximately $7.2M (this includes construction, contingency, professional services, and acquisition).

FIGURE 21. SITE 3 SCHEMATIC LAYOUT

TABLE 2. TIER 2 EVALUATION MATRIX

Evaluation Criteria	Description of Criteria	Evaluation Criteria Weight	Site 2 937South Lake Drive (Lexington TMS 005499-01-010) Zoned: Rural District (Richland County)		Site No. 3 7608 Broad River Road (Richland TMS R04000-05-16) Zoned: Industrial (Town of Lexington)	
			Rating	Details	Rating	Details
Site Availability	Public owned, listed for sale, etc.	1	1	The site is privately owned but it is unknown about availability.	3	The site is privately owned but is listed for sale.
Size	Is the parcel large enough to accommodate the Park-and-Ride.	1	3	5.55 Acres	3	Approx. 9 acres on one side of Western Lane (18-acres total)
Public Transit Service	Is there existing or planned public transit services near the site.	1	1	No known existing or planned public transit.	2	There is public transit under consideration from Columbia to Chapin which would pass this interchange.
Land Use (onsite)	Is the existing usage conducive for a Park-and-Ride?	1	3	Vacant Parcel	3	Single family home on site but site is for sale.
Land Use (surrounding)	Is the existing nearby usage conducive for a Park-and-Ride?	1	3	Commercial.	2	Commercial and undeveloped.
Capital Start Up Costs	Are there expected startup costs relative to the other sites?	1	1	Land acquisition is required.	1	Land acquisition is required.
Operational and Maintenance Costs	Are there expected O&M costs relative to the other sites?	1	2	Unknown but no more concern than other sites.	2	Unknown but no more concern than other sites.
Auto/Bus Access	Are there expected access concerns for users or buses?	1	1	Site is adjacent to interstate I-20.but will likely be restricted to a single entrance.	2	Site is adjacent to interstate I-26 and has access to Western Lane off or Broad River Road.
Internal Circulation	Are there expected internal circulation concerns for users or buses?	1	2	The site is relatively wide and flat but has a steep entrance.	2	The site is relatively flat. Having access to multiple roads.
Physical Constraints	Is there concerns about topography, drainage, visibility, etc. for the site relative to the other sites?	1	2	Topography shows little availability for stormwater to leave site - expanded detention areas expected.	2	Access will likely be restricted to the frontage road but is in close proximity to Broad River Road
Environmental Issues	Are there any known expected environmental concerns that may be discovered by further site studies?	1	2	Unknown past usage for the site.	2	Large parcel allows for site adjustments to account for environmental issues.
Expansion	How easily can the site be expanded beyond 5-acres?	1	1	Expansion is a concern for this site.	2	Expansion is a concern for this site but site has room for expansion.
		Total	**22**		**26**	
		Rank	**2**		**1**	

3 = Most Optimal; 2 = Less Optimal, 1 = Not Optimal

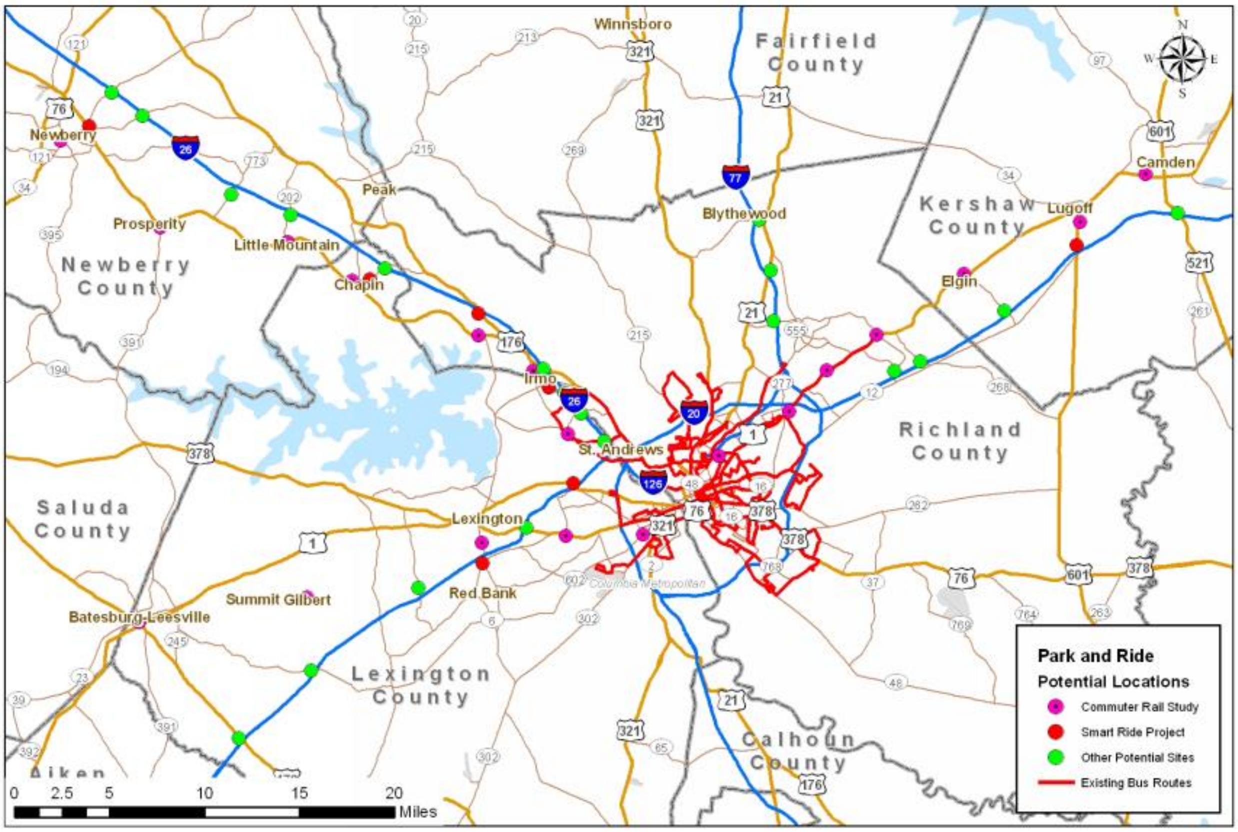
Conclusion

For purposes of the park-and-ride analysis the Project area was expanded to best understand park-and-ride based travel demand within and through the Project area. The park-and-ride study area analyzed population and employment density, worker demographics, work trip origins and destinations, park-and-ride best practices and siting criteria. Overall, there appears to be multiple areas within the greater I-26/I-20 corridor to develop Park and Ride facilities to assist in travel demand management during and after construction. For this effort, five park-and-ride sites were evaluated through Tier 1 and Tier 2 evaluation, in the end two sites scored best, those sites are noted below in order of highest to low scores: Site 3 - 7608 Broad River Road, Irmo SC; and Site 2 - 937South Lake Drive, Lexington SC, respectively. Site 3 scored four points higher than Site 2. Many of the advantages from Site 3 over 2 include availability, on-site land use, existing or planned transit service, and parcel size.

Appendix 1

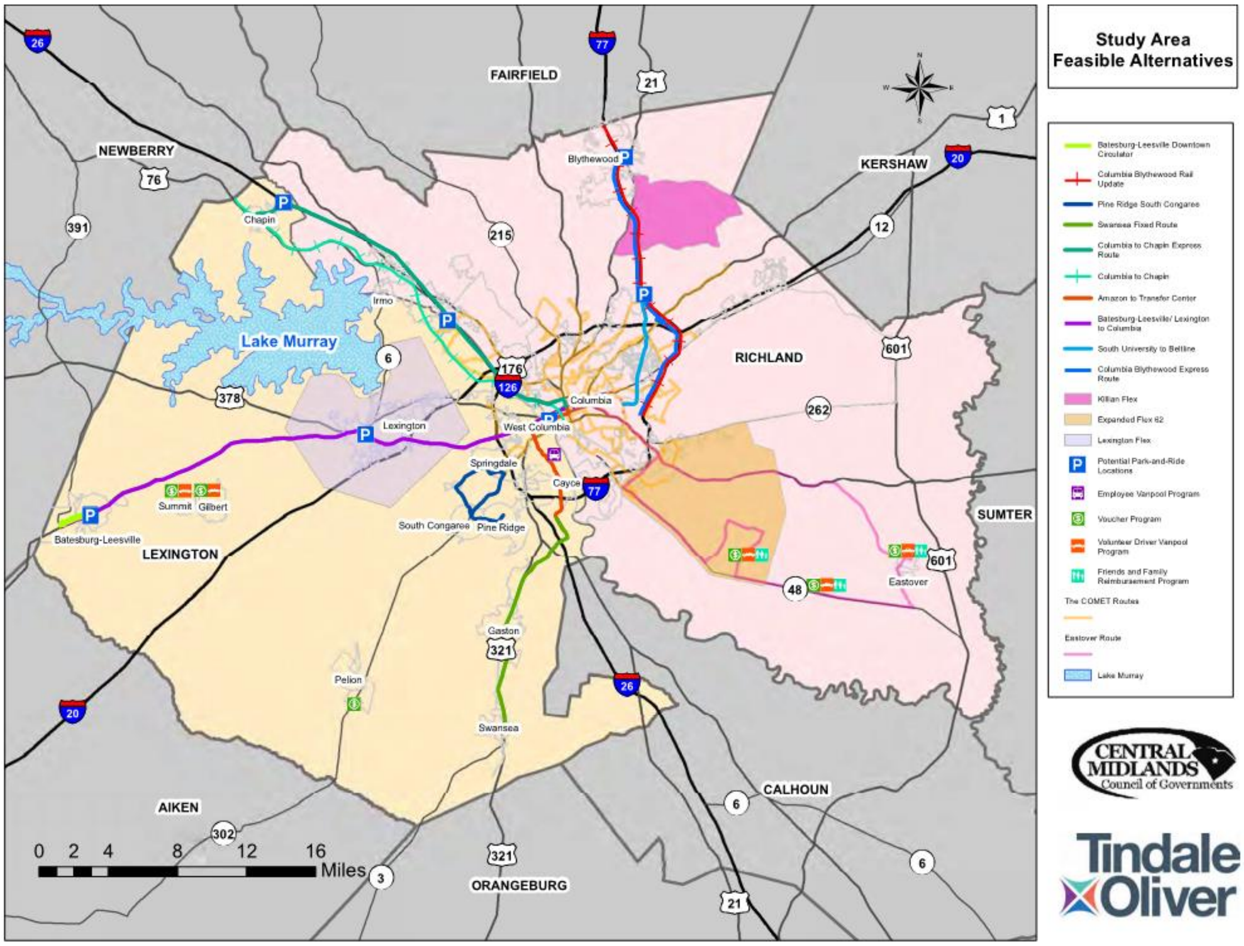
Central Midlands Regional Transit Authority Park-and-Ride Study (2010)

Figure 4-1: Potential Park-and-Ride Facilities



Appendix 2

CMCOG Regional Transit Needs Assessment and Feasibility Study (2015)


Study Area
Feasible Alternatives
Batesburg-Leesville Downtown Circulator
Columbia Blythewood Rail Update
Pine Ridge South Congaree
Swansea Fixed Route
Columbia to Chapin Express Route
Columbia to Chapin
Amazon to Transfer Center
Batesburg-Leesville/ Lexington to Columbia
South University to Beltline
Columbia Blythewood Express Route
Killian Flex
Expanded Flex 62
Lexington Flex
Potential Park-and-Ride Locations
Employee Vanpool Program
Voucher Program
Volunteer Driver Vanpool Program
Friends and Family Reimbursement Program
The COMET Routes
Eastover Route
Lake Murray
FAIRFIELD
NEWBERRY
KERSHAW
RICHLAND
LEXINGTON
SUMTER
AIKEN
CALHOUN
ORANGEBURG
Lake Murray
Blythewood
Chapin
Irmo
Columbia
West Columbia
Lexington
Springdale
Cayce
South Congaree
Pine Ridge
Batesburg-Leesville
Summit
Gilbert
Gaston
Pelion
Swansea
Eastover
0 2 4 8 12 16 Miles

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The COATS CMP recommended the following congestion mitigation strategies for each of these roads that intersect the proposed Carolina Crossroads project corridor:

Broad River Road

- Regional growth management through land use policies
- Transportation demand management (vanpool, ride share, telecommuniting)
- Transit service enaancement/expansion or commuter express buses
- Intersection widening/channelization and turn lanes
- Signal coordination
- Traffic survellience and control systems
- Driveway control
- Deceleration lanes
- Arterial lanes
- Interchange improvements

Bush River Road

- Transit park and ride facilities
- Transit marketing
- Service enhancement
- Sidewalks
- Transportation demand management (vanpool, ride share, telecommuniting)
- Signal Coodination

Lake Murray Boulevard

- Commuter-oriented transit services (express)
- Transit park and ride facilities
- Transit marketing
- Transportation demand management (vanpool, ride share, telecommuniting)
- Pedestrian grade separation between major trip generators
- Signal coordination
- Access management (driveway control)

Harbison Boulevard: No mitigation strategies were included.

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Appendix C—Traffic Signal Priority Assessment

CAROLINA
CROSSROADS
I-20/26/126 Corridor Project

Traffic Signal Priority

Carolina Crossroads
I-20/26/126 Corridor Project
Lexington and Richland Counties, South Carolina

03/01/2019
Draft.01

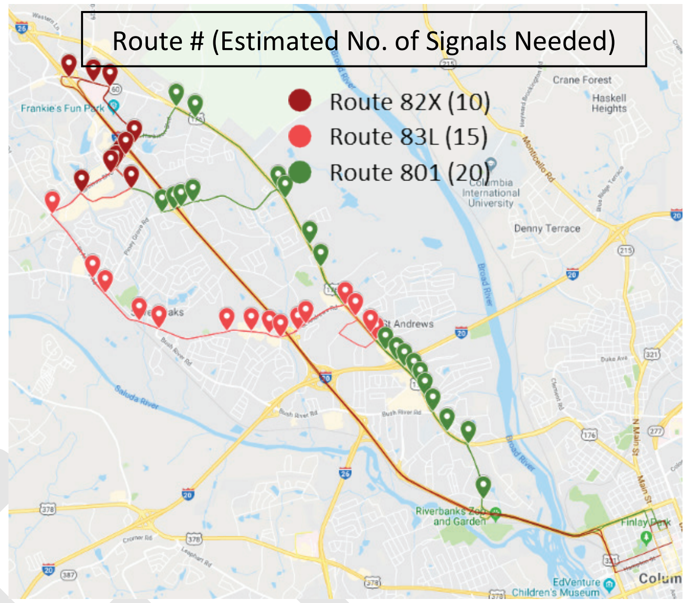
SCDOT
South Carolina Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

Prepared for South Carolina Department of Transportation and the Federal Highway Administration

PURPOSE

The purpose of this summary is to provide a high-level overview of potential Traffic Signal Priority (TSP) upgrades in the Carolina Crossroads project area to help facilitate the movement transit vehicles.



TSP DEFINITION

TSP Systems provide communication between transit vehicles to request the controller to modify signal timing or phasing. Transit vehicles may make a radio request either conditionally for late running vehicles or unconditionally for all arriving transit. TSP can be a powerful system to improve both schedule reliability and travel time, especially on corridors with long signal cycles.

TSP Systems require on-board radio systems to make the request, an intersection radio to receive and communicate to the controller, possible controller upgrades, and corridor fiber backbone to allow for remote monitoring.

SUMMARY (HIGH LEVEL ESTIMATES)

- 20 Miles of fiber; costs can be around $250K per mile to add fiber along a corridor.
- 45 signalized intersection; signal upgrades and intersection radios and programming cost per intersection $25K to $35K.
- Traffic operations central monitoring; software and/or equipment $175K.
- TSP equipment for 50 vehicles; onboard equipment of $5K per vehicle.
- Transit operations center control and monitoring; software and/or equipment $75K

	Unit	Cost / Unit Low	Cost / Unit High	Lower Bound	Upper Bound
Fiber	20	$ 250,000	$ 250,000	$5,000,000	$5,000,000
Signals	45	$ 25,000	$ 35,000	$1,125,000	$1,575,000
Traffic Ops.	1	$ 175,000	$ 175,000	$ 175,000	$ 175,000
Server Rack	1	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Vehicle Eqp.	50	$ 5,000	$ 5,000	$ 250,000	$ 250,000
Software	1	$ 75,000	$ 75,000	$ 75,000	$ 75,000
			Total	$6,675,000	$7,125,000

- Cost could decrease if there are existing signals that have Fire/EMS preemption, if the typical controller at each intersection is known, if there is fiber communication from central monitoring to each intersection, and by narrowing the number of signals in the study area.

THE COMET ROUTES AND CURRENT LEVEL OF SERVICE

- **Route 82X**
  - 7 DAYS
    - Hourly Morning 6:30 AM – 10:25 AM
    - Hourly Early Afternoon 12:30 PM – 2:25 PM
    - Hourly Afternoon 4:30 PM – 10:25 PM
  - Weekday route running time is 26 minutes, on weekends is 23 minutes.
- **Route 83L**
  - Weekdays
    - Hourly Morning 6:30 AM – 1:26 PM
    - Hourly Afternoon 3:30 PM – 9:26 PM
  - Weekends
    - Hourly Morning 8:30 AM – 1:26 PM
    - Hourly Afternoon 3:30 PM – 9:26 PM
  - Weekday and weekend route running time is 26 minutes.
- **Route 801**
  - Weekdays
    - Hourly 5:18 AM – 10:50 PM
  - Weekends
    - Hourly 6:00 AM – 10:33 PM
  - Weekday and weekend route running time is 50 minutes outbound and 48 minutes inbound from downtown Columbia.
- Currently it takes approximately 4 vehicles in the peaks to provide service in the corridor during weekdays; less vehicles during the weekend. On-time performance for January 2019 was 76% for route 82X, 54% for 83L and 55% for 801.

TSP BENEFITS

TSP provides a time saving benefit for transit vehicles. TSP allows for schedule adherence, improve travel time savings of 10 to 20%, and the opportunity to focus future transit enhancements in a particular corridor such as implementing 15 minute or better all day service. Beyond transit, TSP may provide travel time savings to fire and emergency medical service vehicles.

CONCLUSION

Installed at intersections near the CCR project, TSP would allow for improved bus on-time performance. However, current transit service is hourly to and from downtown Columbia, with two of the three routes providing intermittent service during the day. Given current headways, TSP would not directly benefit route efficiency based on deployment costs; other efforts such as adjusting route running times and applying day of week and time of day running time variants can help route on-time performance. In addition, TSP is transit specific and would not benefit commuters not traveling in transit vehicles such as personal vehicles, carpools and vanpools within the CCR project area.