

# Atlanta Congestion Reduction Demonstration

## National Evaluation: Transit System Data Test Plan

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# **ATLANTA CONGESTION REDUCTION DEMONSTRATION**

## **NATIONAL EVALUATION: TRANSIT SYSTEM DATA TEST PLAN**

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## LIST OF ABBREVIATIONS

4Ts	Tolling, Transit, Telecommuting, and Technology
AFV	Alternative fuel vehicle
ALPR	Automatic license plate reader
ARC	Atlanta Regional Commission
AVL	Automatic vehicle location
CAC	Clean Air Campaign
CBA	Cost benefit analysis
CRD	Congestion Reduction Demonstration
CVO	Commercial vehicle operator
FHWA	Federal Highway Administration
FTP	File transfer protocol
GDOT	Georgia Department of Transportation
Georgia Tech	Georgia Institute of Technology
GFI	General Fares Industry
GRTA	Georgia Regional Transportation Authority
HOT	High occupancy toll
HOT3+	High occupancy toll lane allowing untolled travel by vehicles with three or more occupants
HOV	High occupancy vehicle
HOV2+	High occupancy vehicle with a minimum of two occupants
MARTA	Metropolitan Atlanta Rapid Transit Authority
MOE	Measure of effectiveness
RFID	Radio frequency identification
SOV	Single-occupant vehicle
SRTA	State Road and Tollway Authority
TDM	Travel demand management
UPA	Urban Partnership Agreement
U.S. DOT	United States Department of Transportation
VMT	Vehicle miles traveled

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# 1.0 INTRODUCTION

This report presents the test plan for collecting and analyzing transit system data for the national evaluation of the Atlanta Congestion Reduction Demonstration (CRD) under the United States Department of Transportation (U.S. DOT) CRD program. The transit system data will be used in one or more of the evaluation analyses contained in the Atlanta CRD National Evaluation Plan. This plan is one of ten test plans identified in the Atlanta CRD National Evaluation Plan.

The Atlanta CRD is one of several large field deployments around the United States that are receiving U.S. DOT funding and which are intended to demonstrate congestion pricing and supporting strategies. The Atlanta CRD national evaluation will address the four primary U.S. DOT evaluation questions shown in Table 1-1.

**Table 1-1. U.S. DOT National Evaluation “Objective Questions”**

<p><b>Objective Question #1</b></p>	<p>How much was congestion reduced in the area impacted by the implementation of the tolling, transit, technology, and telecommuting strategies? It is anticipated that congestion reduction could be measured by one of the following measures, and will vary by site and implementation strategy:</p> <ul style="list-style-type: none"> <li>• reductions in vehicle trips made during peak/congested periods;</li> <li>• reductions in travel times during peak/congested periods;</li> <li>• reductions in congestion delay during peak/congested periods; and</li> <li>• reductions in the duration of congested periods.</li> </ul>
<p><b>Objective Question #2</b></p>	<p>What are the associated impacts of implementing the congestion reduction strategies? It is anticipated that impacts will vary by site and that the following measures may be used:</p> <ul style="list-style-type: none"> <li>• increases in facility throughput during peak/congested periods;</li> <li>• increases in transit ridership during peak/congested periods;</li> <li>• modal shifts to transit and carpools/vanpools;</li> <li>• traveler behavior change (e.g., shifts in time of travel, mode, route, destination, or forgoing trips);</li> <li>• operational impacts on parallel systems/routes;</li> <li>• equity impacts;</li> <li>• environmental impacts;</li> <li>• impacts on goods movement; and</li> <li>• effects on businesses.</li> </ul>
<p><b>Objective Question #3</b></p>	<p>What are the non-technical success factors with respect to the impacts of outreach, political and community support, and institutional arrangements implemented to manage and guide the implementation?</p>
<p><b>Objective Question #4</b></p>	<p>What are the overall costs and benefits of the deployed set of strategies?</p>

The questions shown in Table 1-1 will be addressed by carrying out the following 12 “evaluation analyses” described in the Atlanta CRD National Evaluation Plan: congestion, tolling, transit, travel demand management (TDM), technology, safety, equity, environmental, goods movement, business impacts, non-technical success factors, and cost benefit. Each of these 12 analyses relies upon various evaluation measures of effectiveness.

“Test plans” are the evaluation planning documents that describe how specific data will be collected and processed to yield the evaluation measures of effectiveness required for the various analyses. Whereas evaluation analyses are categorized according to related evaluation questions or types of impacts—for example all equity-related impacts are addressed in the equity analysis—test plans are categorized according to common data types or sources. For example, the “Traffic System Data Test Plan” collects and processes all of the traffic data required for the national evaluation. There is a total of ten test plans for the Atlanta CRD national evaluation. In addition to this Transit System Data Test Plan, there are test plans focusing on the following types of data: traffic, tolling, TDM, safety, surveys and interviews, environmental, content analysis, cost benefit, and exogenous factors.

The relationship between test plans and evaluation analyses is discussed in Section 1.2. In short, analyses describe the evaluation questions and hypotheses to be investigated and the test plans describe how the data and measures of effectiveness needed to support the evaluation will be collected and processed. Most test plans collect data and provide measures of effectiveness that will be used in multiple analyses and most analyses rely upon data and measures developed through several different test plans.

The remainder of this introduction chapter describes the Atlanta CRD deployments and elaborates on the relationship between test plans and evaluation analyses. The remainder of the report is divided into three sections. Chapter 2 presents the data sources, data availability, and risks associated with the data collected through this test plan. Chapter 3 discusses how all of the transit system data will be analyzed and used in the national evaluation. Chapter 4.0 presents the schedule and responsibilities for collecting and analyzing the transit system data.

## **1.1 The Atlanta CRD**

Atlanta was selected by the U.S. DOT to implement projects aimed at reducing congestion based on a combination of complementary strategies known as the 4Ts: Tolling, Transit, Telecommuting/TDM, and Technology. Under contract to the U.S. DOT, a national evaluation team led by Battelle is assessing the impacts of the projects in a comprehensive and systematic manner in Atlanta and other sites. The national evaluation will generate information and produce technology transfer materials to support deployment of the strategies in other metropolitan areas. The national evaluation will also generate findings for use in future Federal policy and program development related to mobility, congestion, and facility pricing.

The Atlanta CRD partnership is led by three public agencies—the Georgia Department of Transportation (GDOT), the Georgia Regional Transportation Authority (GRTA), and the State Road and Tollway Authority (SRTA). Other partners include Atlanta Regional Commission (ARC), Georgia Department of Public Safety, Metropolitan Atlanta Rapid Transit Authority

(MARTA), Gwinnett County Government, Clean Air Campaign (CAC), and Georgia Institute of Technology (Georgia Tech).

The Atlanta CRD partners have as a long-term regional goal an integrated system of congestion-priced lanes, enhanced transit service, and advanced technology on 49-miles of I-75, I-85, and I-20. The CRD will establish the first phase of that network on approximately 16 miles of I-85 from I-285 to Old Peachtree Road. The Atlanta CRD projects are described briefly below.

**High Occupancy Toll (HOT) Lanes on I-85.** As the first phase of a regional integrated system of congestion-priced lanes, the existing high occupancy vehicle (HOV) lanes will be converted to dynamically-priced HOT lanes, called Express Lanes, on approximately 16 miles of I-85 from Chamblee Tucker Road, just south of I-285, to just north of Old Peachtree Road in Gwinnett County. The Express Lanes are depicted in Figure 1-1. The occupancy requirement for using the Express Lanes toll-free will change from the two or more people on the current HOV lanes (HOV2+) to three or more people (HOT3+) and registration will also be required. Registered toll-exempt vehicles include vehicles with three or more people, motorcycles, alternative fuel vehicles (AFV) with GA AFV license plates (but not hybrids), transit, and emergency vehicles. Pre-registered vehicles with less than three occupants will be allowed on the Express Lanes by paying a toll. The lanes will operate with seven entry and exit points in the northbound direction and six in the southbound direction. Tolling will occur 24 hours a day and seven days a week in four southbound sections and five northbound sections. GDOT is responsible for the construction in the HOV to HOT conversion. SRTA will operate the tolling portion of the system.

**Transit Enhancements.** A total of 36 new buses will be added to the commuter bus fleet on the I-85 corridor, with 20 buses added in 2010 and 16 more in 2011. The expanded fleet will enable five new routes to operate on the corridor, the first of which began in August of 2010. GRTA will purchase the buses. GRTA is also responsible for the CRD-funded park-and-ride lot enhancements. These include three new lots—Mall of Georgia, Hamilton Mill, and Hebron Baptist Dacula—and one expanded lot at I-985/GA 20. The Mall of Georgia lot was the first to open in August of 2010 with 750 leased spaces until the permanent lot opens at that location. Opening in June 2011 are 400 new leased spaces at Hebron Baptist Dacula. Scheduled for July 2011 is the expansion of the I-985/GA 20 lot, which will add 384 spaces to the 347 that already exist today. The Hamilton Mill lot is scheduled to open in August 2011 with 918 spaces. In addition to the CRD-funded park and ride lots, the evaluation will include two other lots that are not funded by the CRD but could be impacted. These include the Discover Mills and Indian Trail Park and Ride Lots.

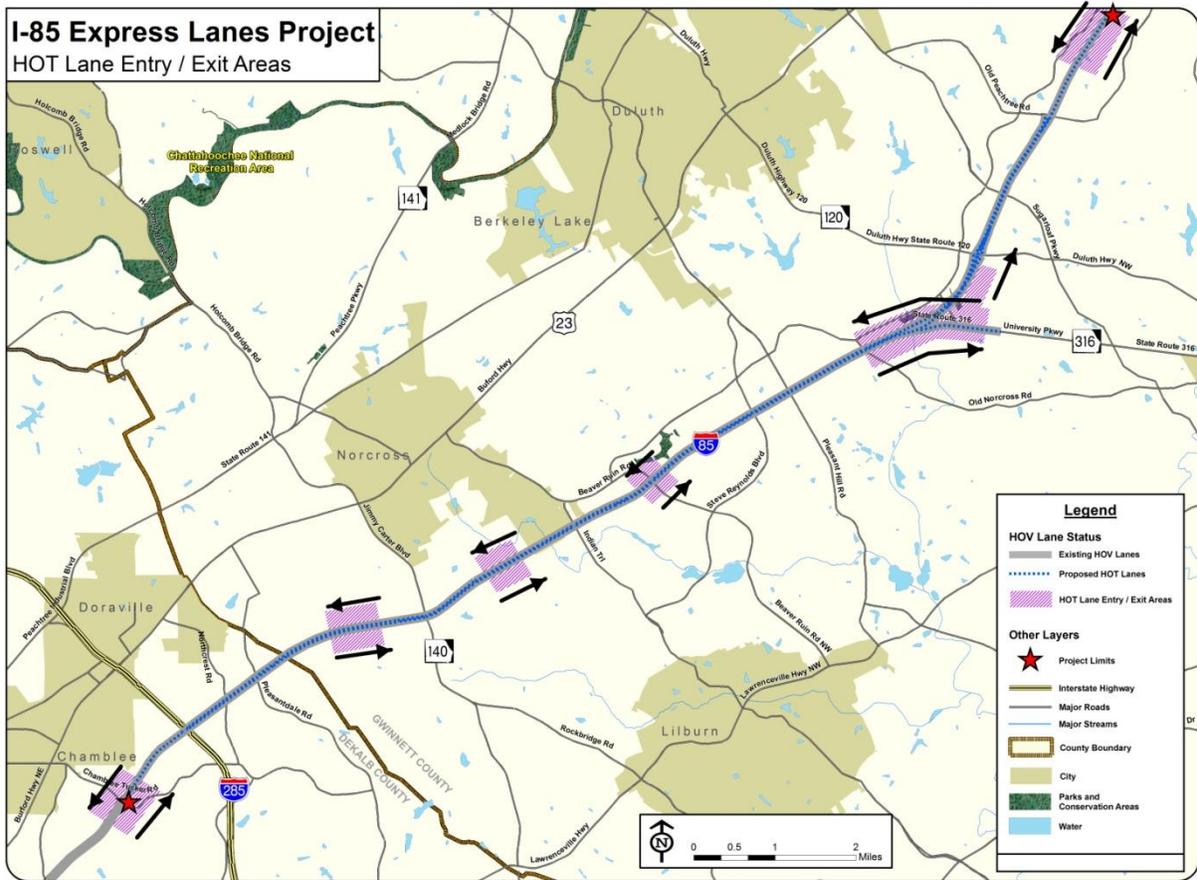


Figure 1-1. I-85 Express Lanes Project

**Automated Enforcement Systems.** A gantry-controlled access system for the Express Lanes will consist of approximately 35 overhead gantries or existing structures placed in the median. Readers equipped with radio frequency identification (RFID) will read transponders, and cameras will collect images of vehicle license plates. This information will be used to identify toll violators. Mobile automatic license plate readers (ALPR) camera systems installed in enforcement vehicles will aid police officers with visual occupancy verification of vehicles using the Express Lane. Enforcement officials will be provided with an audible or visual alert if a license plate matches the database of registered HOT3+ users to prompt a visual inspection for vehicle occupancy compliance. Officers will upload a list of occupancy violations written during a shift to the Express Lanes back-office system.

**Carpooling Outreach.** To support the CRD projects, the Clean Air Campaign will undertake public outreach to increase the number of 3 person carpools in the I-85 Express Lanes corridor. Their efforts will focus on converting existing 2-person to 3-person carpools and on creating 3-person carpools from single-occupant vehicle (SOV) drivers. CAC will use existing carpooler databases to identify and contact 2-person carpools. In conjunction with SRTA, CAC will identify SOV commuters who travel in the I-85 Express Lanes and encourage carpool

formation. SOV drivers will also be targeted through outreach to employers in the I-85 corridor and to employers outside the corridor who may have employees who use the I-85 corridor.

**Schedule for the Atlanta CRD Projects.** The projects to be evaluated go into operation between August 2010 and July 2012. Table 1-2 presents the dates at which each of the Atlanta CRD projects are expected to be in operation.

**Table 1-2. CRD Project Schedules**

Projects	Operational Date
Express Lanes on I-85	September 2011
5 New Bus Routes	August 2010 – July 2012
Park-and-Ride Lots	August 2010 – August 2011
Automated Enforcement	September 2011
Carpooling Outreach	Spring 2011 – Winter 2012

## 1.2 Atlanta National Evaluation Plan and the Use of Transit Data

Table 1-3 shows which of the various Atlanta CRD test plans will contribute data to each of the evaluation analyses. The “flow” between test plans is “one way” in the sense that test plans feed data and measures to the analyses rather than the reverse. The solid circles show where data from a given test plan constitutes a major input to an analysis; the open circles show where data from a given test plan constitutes a supporting input to an analysis. As shown in Table 1-3, the Transit System Data Test Plan provides major input to the transit analysis and supports the equity, environmental, and cost benefit analyses. Table 1-4 includes a summary of the transit data elements, the measures of effectiveness and the hypotheses/questions the transit system data will be used to evaluate.

**Table 1-3. Relationships Among Test Plans and Evaluation Analyses**

Atlanta CRD Test Plans	Congestion Analysis	Tolling Analysis	Transit Analysis	TDM Analysis	Technology Analysis	Safety Analysis	Equity Analysis	Environmental Analysis	Goods Movement Analysis	Business Impact Analysis	Non-Technical Success Factors Analysis	Cost Benefit Analysis
Traffic System Data Test Plan	●	●		○	○	○		●	●			○
Tolling Data Test Plan		●					○		●			○
Transit System Data Test Plan			●				○	○				○
TDM Data Test Plan		○		●			○	○		○		○
Safety Data Test Plan					●	●						○
Surveys and Interviews Test Plan	○	○	●	●		○	●	○	○	○	●	○
Environmental Data Test Plan							○	●				○
Content Analysis Test Plan											●	
Cost Benefit Analysis Test Plan												●
Exogenous Factors Test Plan	○	○	○	○	○	○	○	○	○	○	○	○

● — Major Input

○ — Supporting Input

**Table 1-4. Transit Plan Data Elements Used in Testing Evaluation Hypotheses/Questions**

Atlanta CRD Transit Data Element	Atlanta CRD Measure of Effectiveness	Atlanta CRD Hypotheses/Questions*
Transit Ridership	<ul style="list-style-type: none"> <li>• Actual and percent change in average weekday ridership</li> <li>• Transit mode share</li> </ul>	AtITransit-2 AtITransit-3 AtIEnv-1 AtIEnv-2 AtICBA-1
Transit Service Quantity	<ul style="list-style-type: none"> <li>• Actual and percent change in number of revenue miles and hours</li> </ul>	AtITransit-1
Park-and-Ride Lot Capacity and Utilization	<ul style="list-style-type: none"> <li>• Actual and percent change in parking capacity (total number of spaces)</li> <li>• Actual percent change in park-and-ride lot occupied spaces</li> </ul>	AtITransit-1 AtITransit-2 AtITransit-3 AtITransit-4
Transit Travel Time	<ul style="list-style-type: none"> <li>• Actual and percent change in bus travel times</li> <li>• Observed changes in published schedule information</li> </ul>	AtITransit-1 AtITransit-4 AtIEquity-1 AtICBA-1
Transit Service Reliability	<ul style="list-style-type: none"> <li>• Actual and percent change in on-time performance</li> </ul>	AtITransit-1 AtITransit-4 AtIEquity-1

\*Listed are acronyms corresponding to hypotheses/questions to be addressed with data from this test plan. An explanation of these acronyms can be found in Appendix A, which contains a compilation of the hypotheses/questions for all the analysis areas from the Atlanta CRD National Evaluation Plan.

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## 2.0 GEOGRAPHIC FOCUS OF TRANSIT DATA COLLECTION

This chapter describes the geographic focus of the transit system data collection effort and the transit analysis in general. Although the CRD corridor is the Express Lanes on I-85 between I-285 in DeKalb County and Old Peachtree Road in Gwinnett County, the transit analysis will look at the performance of the express routes (branded as Xpress) for their entire length into downtown Atlanta as a reflection of the benefit to the overall trip experienced by the traveler and to facilitate data that will be recorded by bus drivers.

The CRD transit projects focus directly on adding bus service and park-and-ride lot capacity in the I-85 corridor. Prior to the CRD, there were five Xpress bus routes and three park and ride lots on I-85. The CRD is funding the purchase of 36 commuter coach buses for the creation of five new Xpress routes, the construction and/or lease of three new park-and-ride lots, and the expansion of one existing park-and-ride lot. The five Xpress routes will begin at staggered intervals as shown in Table 2-1. The park and ride lots will also open at staggered intervals as shown in Table 2-2.

**Table 2-1. CRD-Funded Transit Routes**

Route	Start Date
411 (Mall of Georgia to Midtown)	August 2010
413 (Hamilton Mill to Downtown)	August 2011
414 (Hamilton Mill to Midtown)	July 2012
416 (Dacula to Downtown)	July 2011
417 (Dacula to Midtown)	July 2012

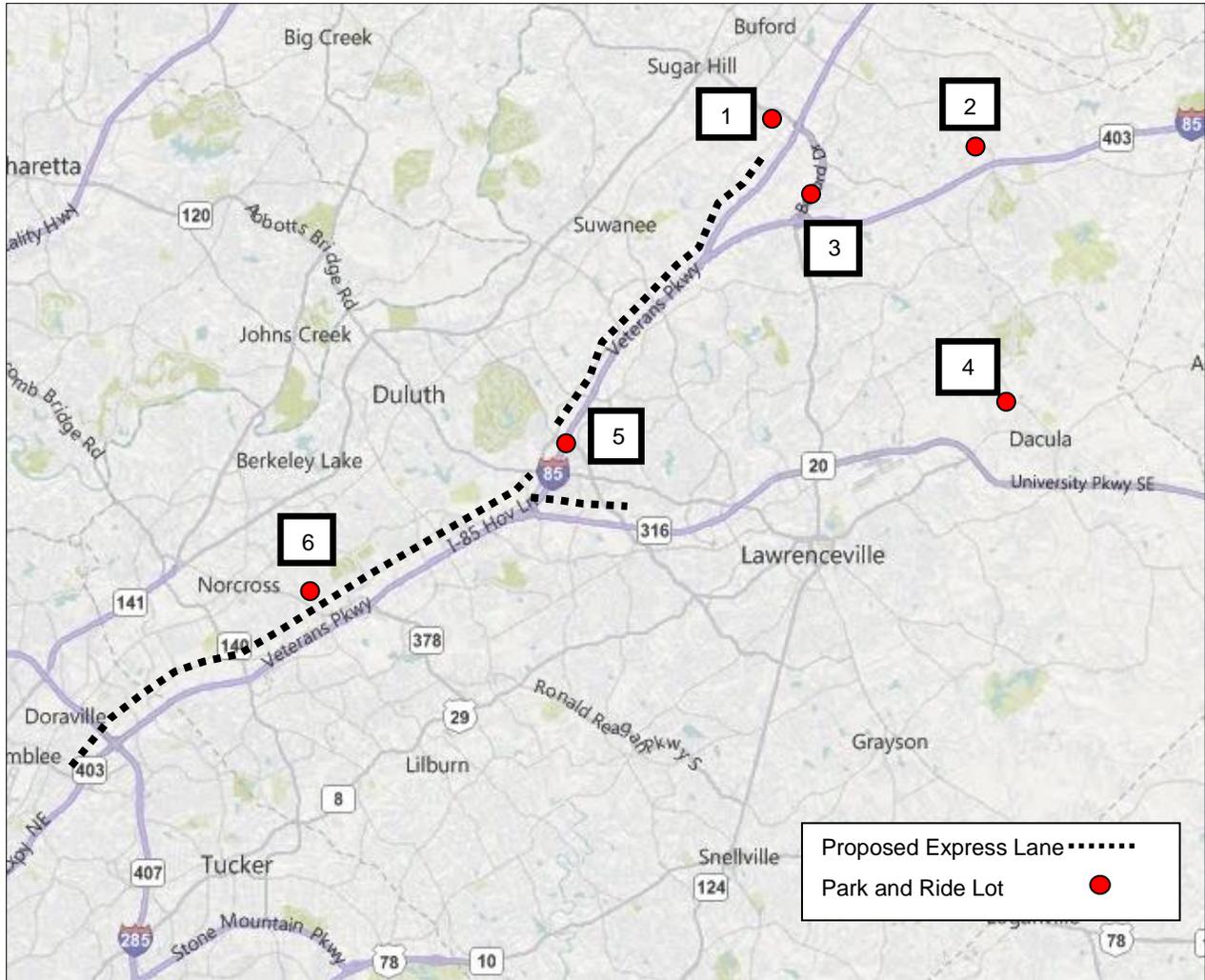
**Table 2-2. CRD-Funded Park and Ride Lots**

Location	Opening Date
Mall of Georgia (new)	August 2010
Hebron Baptist Dacula (lease)	June 2011
I-985/GA-20 (expansion)	July 2011
Hamilton Mill (new)	August 2011

In addition to the routes and park-and-ride lots listed above, the transit analysis will also include some routes and park-and-ride lots that, though not funded by the CRD, are likely to be impacted by the Express Lanes. Table 2-3 shows the complete list of routes and lots that will be included in the evaluation and whether they are CRD funded. Figure 2-1 shows the locations of the park-and-ride lots and the routes that they serve; additional details are provided in the legend below the map.

**Table 2-3. Xpress Routes and Lots to be Evaluated**

<b>Route</b>	<b>CRD Funded</b>
101 – Buford to Downtown	No
102 – Indian Trail to Downtown	No
103 – Discover Mills to Downtown	No
410 – Discover Mills to Lindberg	No
411 – Mall of Georgia to Midtown	Yes
412 – Discover Mills to Midtown	No
413 – Hamilton Mill to Downtown	Yes
414 – Hamilton Mill to Midtown	Yes
416 – Dacula to Downtown	Yes
417 – Dacula to Midtown	Yes
<b>Park and Ride Lot</b>	<b>CRD Funded</b>
Mall of Georgia (new)	Yes
I-985/GA-20 (expansion)	Yes
Hamilton Mill (new)	Yes
Hebron Baptist (lease)	Yes
Discover Mills	No
Indian Trail	No



ID No.	Park-and-Ride Lot	Routes Served	Route Start Date
1	I-985/GA 20	101 (Buford to Downtown)	Current
2	Hamilton Mill	413 (Hamilton Mill to Downtown)	Aug-11
		414 (Hamilton Mill to Midtown)	Jul-12
3	Mall of Georgia	411 (Mall of Georgia to Midtown)	Aug-10
4	Hebron Baptist	416 (Dacula to Downtown)	Jul-11
		417 (Dacula to Midtown)	Jul-12
5	Discover Mills	103 (Discover Mills to Downtown)	Current
		410 (Discover Mills to Lindberg)	Current
		412 (Discover Mills to Midtown)	Current
6	Indian Trail	102 (Indian Trail to Downtown)	Current

**Figure 2-1. Park and Ride Lot Locations and Routes Served**

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### 3.0 DATA SOURCES, AVAILABILITY, AND RISKS

This chapter discusses each of the data elements identified in Table 1-1 in Chapter 1.0, defining the required data format, source, timing, and other essential characteristics. Also discussed is the availability of those data and any potential risks associated with collecting and processing them for use in the evaluation. Table 3-2 summarizes the data requirements for the transit system data test plan.

#### 3.1 Data Sources

**I-85 Xpress Weekday Transit Ridership.** I-85 Xpress buses are not equipped with automatic passenger counters. GRTA collects daily ridership data two ways. One is through passenger counts recorded by the bus driver. The other is through a reconciliation of smart card data (i.e., Breeze Card) and the revenue collected by the General Fares Industry (GFI) farebox. GRTA will report to the national evaluation team the monthly average weekday ridership figure for each I-85 Xpress route shown in Table 2-3 for the a.m. peak period (6:00 to 10:00 a.m.) and the p.m. peak period (3:00 to 7:00 p.m.). This data should be provided quarterly to the national evaluation team. An illustrative example of the ridership data needed for the evaluation is shown in Table 3-1. The ridership data will be used by the national evaluation team to calculate transit person throughput and transit mode share. Transit person throughput will be used in the congestion analysis in conjunction with person throughput data for other modes to calculate total person throughput. The calculation of overall mode shares will be done within the transit analysis, utilizing transit ridership data collected through this test plan and person-trip data for non-transit modes collected through the Traffic System Data Test Plan.

**Table 3-1. Illustrative Sample of Average Weekday Transit Ridership Data**

	A.M. Peak Period (6:00 to 10:00 a.m.)			
	Aug-09	Sep-09	Oct-09	Nov-09
101 – Buford to Downtown	298	303	293	282
102 – Indian Trail to Downtown	109	114	118	116
103 – Discover Mills to Downtown	551	544	531	519
410 – Discover Mills to Lindberg	114	111	120	123
411 – Mall of GA to Midtown	not yet in service			
412 – Discover Mills to Midtown	209	216	217	202
413 – Hamilton Mill to Downtown	not yet in service			
414 – Hamilton Mill to Midtown	not yet in service			
416 – Dacula to Downtown	not yet in service			
417 – Dacula to Midtown	not yet in service			
<b>Total</b>	<b>1281.0</b>	<b>1288.0</b>	<b>1279.0</b>	<b>1242.0</b>

**I-85 Xpress Monthly Transit Ridership.** The monthly total requested here are distinct and separate from the average weekday ridership figures requested in the previous paragraph. The I-85 Xpress transit ridership for each month for all I-85 routes combined will be compared with the Xpress transit ridership in other parts of the Atlanta region as described in the following paragraph.

**Systemwide Xpress Monthly Transit Ridership.** System-wide Xpress route ridership—ridership on Xpress buses throughout the rest of the GRTA service area (excluding the I-85 Xpress Routes) will be used as a control group in the evaluation. This will help to determine whether changes in ridership on the I-85 Xpress buses are due to the CRD projects. For example, if ridership on the I-85 Xpress bus routes shows the same trend as ridership on the Xpress bus service system-wide, this would be a likely indicator that the observed change was due to an exogenous factor(s) instead of the CRD project. For this component of the evaluation, GRTA will provide the national evaluation team the monthly ridership total for Xpress bus system-wide (not including the I-85 routes) and the monthly ridership total for just the I-85 routes. Because GRTA's express buses do not have automated passenger counting systems, the intent here is to keep the comparison between regional ridership and ridership in the I-85 corridor as simple as possible. Therefore, through this data element, the national evaluation will receive simply the monthly total ridership for Xpress bus system-wide (minus the I-85 routes). The system-wide total excluding the I-85 routes will eliminate any influence of I-85 ridership on the system-wide totals. This data should be reported quarterly to the national evaluation team.

**I-85 Xpress Historical Annual Transit Ridership.** Historical ridership figures for the Xpress buses in the I-85 corridor will help provide context to any changes observed during the evaluation. GRTA will provide historical annual ridership figures for the Xpress bus in the I-85 corridor and for the region as a whole going back to 2005 if possible. (Example: 2005 annual ridership for all I-85 Xpress Bus Routes was 608,000; 2006 Annual Ridership was 600,000, etc.). This data set is a one-time submittal to the national evaluation team.

**Transit Service Quantity.** GRTA will report the number of revenue miles and revenue hours operated each month for each route in Table 2-3. This information will be used to calculate average boardings per revenue mile and boardings per revenue. This data should be provided quarterly to the national evaluation team.

**Park-and-Ride Lot Capacity and Utilization.** GRTA, or its contracted vendor, will conduct park-and-ride lot counts at all the lots listed in Table 2-3 in Oct. 2010, April 2011, Oct. 2011, and April 2012. The counts will be done on the second week of those months. Each count will be done for one day. The count should be done at mid-week (Tuesday, Wednesday, Thursday), preferably on a Wednesday, because some transit riders may be working compressed work weeks and be off either Friday or Monday. The count should be done in the morning preferably after 9 a.m. to maximize the count. The count will include all vehicles in the lot (including those that are illegally parked). New data should be submitted to the national evaluation team as soon as possible after each subsequent count. A copy of the tracking sheet to be used for the park and ride lot counts is included in Appendix B. It shows the capacity of each lot and, where appropriate, the new capacity after expansion.

**Transit Travel Time and Service Reliability.** It is anticipated that the HOV to HOT conversion on I-85 lanes will result in reduced travel times and better on-time performance. Since the express buses in the I-85 corridor are not equipped with an automatic vehicle location (AVL) system, to support the evaluation GRTA has designed a “travel time report card” to be used by the bus drivers to record departure and arrival times. From the report card data, it will be possible to derive average bus running times and on-time performance percentages. An example of the travel time report card used for the Route 410 is shown in Figure 3-1, and an illustrative sample of the data that will be derived from this report card is shown in Table 3-3. For the purpose of this evaluation, on-time is defined as arriving 5 minutes or less past the scheduled arrival time. A bus is considered late if it arrives greater than 5 minutes past the scheduled arrival time. Early arrivals will not be considered as the express routes are “released” to get downtown as quickly as possible once they depart the park and ride lot. In the a.m. period, the evaluation will compare the scheduled to actual arrival time at the first bus stop in downtown Atlanta. In the p.m. period, the evaluation will compare the actual to scheduled arrival time at the park and ride lot. All of the routes listed in Table 2-3 will be surveyed on the second week of each month for one full work week (i.e., Monday – Friday) for both the morning and evening peak periods. Each month, GRTA will mail the completed cards to the national evaluation team for data entry.

**Casual Carpool Formation.** Although casual carpooling (also known as slugging) is not an official part of the CRD, the local partners agreed to make note of and report any occurrences of this phenomenon. The best chance to capture this data would be when the bus drivers are filling in their travel time report cards on the second week of each month. The national evaluation team will work with GRTA staff on adding space to the travel time report card for recording any observations made of casual carpooling. If any casual carpooling is observed during the evaluation, the national evaluation team will report it to the CRD partners and discuss potential approaches for evaluating casual carpooling.

**Table 3-2. Summary of Transit Data Needs**

Data Element	Data Sub-Element	Sampling Locations	Time Period / Direction Segmentation	Data Collection Frequency	Data Collection Period		Data Reporting Freq.
					Begin	End	
1. I-85 Xpress Weekly Transit Ridership	Average weekday ridership	See Table 2-3	– 6-10 a.m., 3-7 p.m. – Peak direction	Monthly	8/09	7/12	Quarterly
2. I-85 Xpress Monthly Transit Ridership	Monthly ridership	All routes in Table 2-3 combined	– Not applicable to monthly totals	Monthly	8/09	7/12	Quarterly
3. I-85 Xpress Historical Annual Transit Ridership	Annual ridership	All routes in the corridor combined	– Not applicable to annual totals	Once	1/05	7/09	Once
4. Systemwide Xpress Monthly Transit Ridership	Monthly ridership	System-wide without I-85 routes	– Not applicable to monthly totals	Monthly	8/09	7/12	Quarterly
5. Transit Service Quantity	Revenue miles Revenue hours	See Table 2-3	– 6-10 a.m., 3-7 p.m. – Peak direction	Monthly	8/09	7/12	Quarterly
6. Park-and-Ride Lot Capacity and Utilization	Lot capacity % utilization	See Table 2-3	– Count to be done in a.m. – One day counts mid-week	Oct. 2010 April 2011 Oct. 2011 April 2012	N/A	N/A	After each Count
7. Transit Travel Time	Average end to end travel time by route	See Table 2-3	– 6-10 a.m., 3-7 p.m. – Peak direction	2 <sup>nd</sup> week of each month	6/10	7/12	Monthly
8. Transit Service Reliability	On-time performance percentage	See Table 2-3	– 6-10 a.m., 3-7 p.m. – Peak direction	2 <sup>nd</sup> week of each month	6/10	7/12	Monthly
9. Casual Carpool Formation	Potential casual carpooling at park and ride lots	Lots in Table 2-3	– 6-10 a.m., Peak direction	2 <sup>nd</sup> week of each month	8/11	7/12	Monthly

### Travel Time Report Card — Route 410, Morning

Thank you for completing this Travel Time Report Card. Your responses are important. Please take the time to answer every question. The results help us understand how to provide better service and help direct our future improvements.

1. Date \_\_\_\_\_
  2. Block number \_\_\_\_\_
  3. Leave Discover Mills Park-and-Ride lot \_\_\_\_\_ : \_\_\_\_\_
  4. Arrive at Lindbergh MARTA Station \_\_\_\_\_ : \_\_\_\_\_
  5. Traffic conditions
    - Normal, no delay
    - Heavy traffic, no accident
    - Accident in the general purpose lane
    - Accident in the HOV lane
    - Other \_\_\_\_\_
  6. Weather
    - Clear
    - Rain
    - Severe (ice, snow)
  7. Number of passengers \_\_\_\_\_
- Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Figure 3-1. Example of Travel Time Report Card (Route 410)**



**Table 3-4. Transit System Test Plan Data Sources and Availability**

Data Source	Available?
1. I-85 Xpress Weekday Transit Ridership Data	Yes
2. I-85 Xpress Monthly Transit Ridership Data	Yes
3. I-85 Express Historical Annual Ridership Data	Yes
4. Systemwide Xpress Monthly Transit Ridership	Yes
5. Transit Service Quantity Data	Yes
6. Park-and-Ride Lot Utilization Data	Yes, but no Historical
7. Transit Travel Time Data	Yes
8. Transit Reliability Data	Yes
9. Casual Carpool Formation	Yes

GRTA will forward the various data sets to the national evaluation team via email if the data sets are sufficiently small. If too large for email transfer, the files will be transferred using a file transfer protocol (FTP) site, or by placing on compact discs and posting in the mail. GRTA will use this template in Appendix B for submitting the ridership and park-and-ride lot data. For the bus travel time data, GRTA will mail the travel time report cards to the national evaluation team on a monthly basis for data entry.

### **3.3 Potential Risks**

There appears to be only one risk associated with the data. The accuracy of the bus travel times and on-time performance figures that will be derived from the on-time report cards depend on the drivers entering their departure and arrival times accurately. Using a report card prepared for the evaluation the bus drivers will be self-reporting their departure and arrival times, and, thus, there is a risk that they will enter times that make the bus appear to be on time when in fact the bus was late to its destination. This may occur if there is a fear by the driver that he/she will be punished for late time performance. The national evaluation team will examine the results closely for outliers, and, if irregularities are observed, discuss with GRTA on how to mitigate the problem. One approach is for GRTA to make it clear to the operators and drivers at the beginning of the data collection period that accuracy is important and no one will be punished for truthfully reporting.

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## 4.0 DATA ANALYSIS

This chapter summarizes how data collected through this test plan and other related data will be used to analyze CRD transit impacts. The temporal aspect of the analysis is described, followed by a discussion of the specific hypothesis testing that will be performed and the approach for considering the role of exogenous factors.

### 4.1 Data Analysis Phases

The CRD funded project elements are being phased in over more than a year. The first of the new CRD funded transit service began in August 2010. Tolling on I-85 is scheduled to begin in September 2011. The last of the new CRD funded transit service will begin in January 2012. To account for this extended deployment period, the transit evaluation data will be partitioned into three phases, as shown Table 4-1 below.

The pre-deployment data collection period goes from August 2009 to July 2010. It is intended to address the one-year time period prior to any CRD funded transit service. The intermediate deployment data collection period goes from August 2010 to August 2011. It is intended to address as much of the CRD funded transit service as possible prior to the initiation of tolls on I-85. The post-deployment data collection period goes from September 2011 to August 2012. It is intended to address the time period after tolls begin on I-85.

**Table 4-1. Data Analysis Phases**

Phase	Description	Time Period
I	Pre-Deployment Data Collection	8/09 – 7/10
II	Intermediate Deployment Data Collection	8/10 – 8/11
III	Post-Deployment Data Collection	9/11 – 8/12

The core of the evaluation, as specified in the National Evaluation Strategy document, is to compare the pre-deployment situation with the post-deployment situation. Thus, a comparison of Phase I data and Phase III data is the primary requirement of the data analysis stage. However, Phase II data is also important because it is during this phase that most of the additional CRD transit service on I-85 will begin. Thus, Phase II will provide an opportunity to see what impacts, if any, the new transit service has on ridership in the corridor prior to the start of tolling in September 2011.

### 4.2 Data Analysis Approach

The analysis of transit system data will focus primarily on testing the four hypotheses of the transit analysis. The results of the data analysis will also be used in the equity, environmental and cost benefit analyses. This section describes the data analysis approach.

The data analysis will begin with a quality check of the data received from GRTA to determine its completeness and identify any inconsistencies or outliers. Any problems with the data will be resolved in consultation with GRTA. Descriptive techniques such as histograms and graphical trends will be used to characterize the patterns in the data. Standard statistical techniques will be used to assess the significance of observed variations, such as t-tests, F-tests, and chi-square. Where warranted, more sophisticated multivariate techniques such as regression analysis may be applied.

While testing the four transit hypotheses will be the primary focus of the data analysis, some of the same measures used in the transit analysis will also be used in other analyses as noted below. Moreover, since the transit CRD projects do not occur in isolation, the analysis must take into consideration the effect of influences external to the CRD in the observed transit data. These exogenous factors include unemployment rates, gasoline prices, atypical travel conditions (weather, incidents, construction), and non-CRD transportation system changes (e.g., roadway improvements or transit fare changes). Thus, this data analysis section includes a discussion of potential exogenous factors and how they will be incorporated in the transit data analysis.

- **AtlTransit-1:** *Atlanta CRD projects will enhance transit performance in the I-85 corridor.* This hypothesis is focused on determining how the CRD project impacts transit performance within the evaluation corridor. Transit capacity measures like aggregate corridor revenue miles and park-and-ride lot capacity will be used to monitor the service capacity provided, while average travel time and on-time performance will be used to assess how the CRD project impacts transit service performance. These different performance measures will be measured over the length of the evaluation corridor. Any transit travel time or reliability changes that result from the CRD-funded transit improvements will also be noted in the equity analysis, which looks to assess the social impacts of the CRD project.
- **AtlTransit-2:** *Atlanta CRD projects will increase ridership and facilitate a mode shift to transit within the I-85 corridor.* The second hypothesis relates to the impact of the CRD projects on ridership and transit mode share. Monthly average weekday ridership will be tracked. In addition, the transit analysis will use the ridership data to calculate the total person throughput and mode share. To do that, the transit ridership data will be combined with non-transit person trip data taken from the average vehicle occupancy counts in the Traffic System Data Test Plan to derive total person throughput and mode share (i.e., the percentage of person-trips made by each mode). Transit mode share in the CRD corridor may increase through people switching to transit who previously travelled by private auto, by increased transit usage among existing transit users, or by a reduction in non-transit person throughout. Data from the Survey and Interview Test Plan will play a key role in linking any observed changes in ridership to subsequent transit mode shift that is attributable to the CRD. This data includes transit on-board surveys and, where possible, the Volpe household travel surveys. If surveys reveal a large percentage of new transit riders who indicated saving money as their primary reason for switching to transit, then it could be suggested that the CRD project had a direct impact on transit ridership. Likewise, survey data showing the reasons for any transit usage will help differentiate changes related to the CRD from changes related to exogenous factors.

- **AtlTransit-3:** *Increased ridership/mode shift to transit will contribute to congestion mitigation within the I-85 corridor.* The third hypothesis relates to whether any observed changes in transit ridership and transit mode share have any subsequent impact on traffic congestion within the corridor. This will require coordination with the Congestion Analysis section of the evaluation. As each transit element of the CRD project is implemented, the Measures of Effectiveness specified in the congestion analysis will be monitored to assess any related impact on congestion. Survey data will also be used to isolate the impact of transit on congestion and assess causality.
- **AtlTransit-4:** *What was the relative contribution of each Atlanta CRD project element to increased ridership and/or mode shift to transit within the I-85 corridor?* The last hypothesis relates to the relative contribution of each of the CRD project elements to transit mode shift and subsequent congestion reduction. There are a number of CRD-related factors contributing to possible mode shift, including increased vehicle travel cost (the I-85 toll), decreased transit travel time, increased transit reliability, improved transit infrastructure, increased service quantity, as well as exogenous factors such as high gasoline prices. If mode shift to transit does occur, it is important to be able to understand why and, to the extent possible, to relate the resultant mode shift to specific project elements. Survey data will be used to identify the reasons behind any change in transit usage among travelers.

In the preceding discussion, several references are made to understanding the influence of exogenous factors through the use of survey data. Additional methods to isolate exogenous influences, including use of data from the Transit System Data Test Plan and from the Exogenous Factors Data Test Plan, consist of the following:

- **Control Group.** For the transit evaluation, the control data will be system-wide Xpress bus data. “System-wide” is defined as the entire service area covered by Xpress bus but excluding the I-85 Xpress bus routes. GRTA will provide the national evaluation team monthly ridership figures for Xpress bus system-wide (excluding the I-85 routes) and monthly ridership figures for just the I-85 routes so that comparisons can be made. Comparison of Xpress bus service for the region with that of the I-85 corridor will help explain system-wide factors such as economic conditions (e.g., unemployment and gas prices) and regional fare changes should they occur.
- **Isolation of Non-Typical Travel Conditions.** Using data collected in the Exogenous Factors Test Plan, the evaluation will identify specific time periods and locations within the evaluation area where construction, traffic incidents, special events and/or adverse weather conditions may have significantly influenced travel in the evaluation corridor. The analysis can calculate the measures of effectiveness (MOEs) with and without data points that reflect such time periods and locations to determine the influence of non-typical travel conditions on transit.

- **Non-CRD Transportation System Changes.** The evaluation will document non-CRD related transportation projects or policies. For example, should transit service in the region suffer significant cutbacks for economic reasons, as has happened in many other parts of the country, the evaluation would need to take that into consideration.
- **Historic Transit Patterns.** The evaluation will document the long-term transit trends going back 3 to 5 years (2005 to 2007) within the CRD impact area. This longer term perspective (in addition to the one-year baseline and post-deployment evaluation periods) may suggest transit usage patterns that preceded the CRD transit deployments and that need to be considered in drawing conclusions from the evaluation data. The historic transit data will be collected as part of the Transit System Data Test Plan.

In addition to the transit analysis, transit data will support the equity, environmental, and cost benefit analyses. The equity analysis will assess the socio-economic and geographic distribution of changes in transit ridership and travel time before and after the operation of the Express Lanes. In the environmental analysis transit data will be used to assess the impact of changes in transit mode share and its impact on emissions and energy consumption. The cost benefit analysis will use transit travel time and ridership data for calibration of the transportation model to be used in 10-year forecasts of the impact of the CRD projects.

## **5.0 SCHEDULE AND RESPONSIBILITY**

GRTA is responsible for all transit data collection and transmittal of the data to the national evaluation team. The schedule for GRTA's data collection and reporting frequency are presented in Table 3-1 in Chapter 3. The national evaluation team is responsible for analyzing the transit data and reporting on the findings.

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## APPENDIX A – COMPILATION OF HYPOTHESIS/QUESTIONS FROM ATLANTA CRD NATIONAL EVALUATION PLAN

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Congestion	AtlCong-1	Converting the I-85 HOV lanes to HOT operations will improve travel time and average travel speeds on both the general purpose and high occupancy lanes on I-85
	AtlCong-2	Converting the I-85 HOV lanes to HOT operations will improve travel time reliability and reduce variability on both the general purpose and high occupancy lanes on I-85
	AtlCong-3	Deploying the CRD improvements will result in more vehicles and persons being served on I-85
	AtlCong-4	Implementing the CRD improvements in the I-85 corridor will reduce the spatial and temporal extent of congestion
	AtlCong-5	As a result of the CRD improvements, the perception of travelers is that congestion has been reduced in the I-85 corridor
Pricing	AtlTolling-1	Tolling will increase vehicular throughput on I-85 Express Lanes and improve travel reliability
	AtlTolling-2	What changes in usage will occur as a result of the conversion of the HOV2+ lanes to HOT3+ lanes?
	AtlTolling-3	How much will travelers utilize the I-85 Express Lanes system?
	AtlTolling-4	Variable pricing on the I-85 Express Lanes will regulate vehicular access so as to improve the operation of the lanes
Transit	AtlTransit-1	Atlanta CRD project will enhance transit performance in the I-85 corridor
	AtlTransit-2	Atlanta CRD project will increase ridership and facilitate a mode shift to transit within the I-85 corridor
	AtlTransit-3	Increased ridership / mode shift to transit will contribute to congestion mitigation within the I-85 corridor
	AtlTransit-4	What was the relative contribution of each Atlanta CRD project element to increased ridership and/or mode shift to transit within the I-85 corridor?

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
TDM	AtlTDM-1	Promotion of commute alternatives removes trips and vehicle miles traveled (VMT) from I-85
	AtlTDM-2	CAC incentives support formation of 3+ carpools and vanpools on I-85
	AtlTDM-3	What was the relative contribution of the Atlanta CRD TDM initiatives on reducing I-85 vehicle trips/VMT?
Technology	AtlTech-1	Using advanced technology to enhance enforcement will reduce the rate and type of violators in the corridor
Safety	AtlSafety-1	The collective impacts of CRD improvements will be safety neutral or safety positive
	AtlSafety-2	Gantry-controlled access technology will reduce buffer-related incidents and buffer violations
	AtlSafety-3	Tolling strategies that entail unfamiliar signage will not adversely affect highway safety
Equity	AtlEquity-1	What are the direct social effects (travel times, tolls, and adaptation costs) for various transportation system user groups from tolling and other CRD strategies?
	AtlEquity-2	What is the spatial distribution of aggregate out-of-pocket and inconvenience costs, and travel-time and mobility benefits?
	AtlEquity-3	Are there any differential environmental impacts on certain socio-economic groups?
	AtlEquity-4	How does reinvestment of toll revenues impact various transportation system users?
Environmental	AtlEnv-1	What are the impacts of the Express Lanes project in the I-85 corridor on air quality?
	AtlEnv-2	What are the impacts on energy consumption?
Goods Movement	AtlGoods-1	Commercial vehicle operators (CVOs) will experience reduced travel time by reduced congestion on general purpose lanes
	AtlGoods-2	Operators with light-duty trucks will prefer to use Express Lanes to general purpose lanes for faster travel times
	AtlGoods-3	Operators delivering goods will perceive the net benefit of tolling strategies (e.g., benefits such as faster service and greater customer satisfaction outweigh higher operating costs due to tolls)
	AtlGoods-4	Operators report changing operational decisions due to use of Express Lanes (e.g., changing delivery times)

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Business	AtlBusiness-1	What is the impact of the strategies on employers? e.g., employee satisfaction with commute and increased employment-shed to downtown/mid-town Atlanta
	AtlBusiness-2	What is the impact of the strategies on businesses that rely on customers accessing their stores, such as retail and similar establishments?
	AtlBusiness-3	How are businesses that are particularly impacted by transportation costs affected (e.g., taxis, couriers, distributors, tradesmen)?
Non-Technical	AtlNonTech-1	What role did factors related to “people” play in the success of the deployment? People (sponsors, champions, policy entrepreneurs, neutral conveners)
	AtlNonTech-2	What role did factors related to “process” play in the success of the deployment? Process (forums including stakeholder outreach, meetings, alignment of policy ideas with favorable politics, and agreement on nature of the problem)
	AtlNonTech-3	What role did factors related to “structures” play in the success of the deployment? Structures (networks, connections and partnerships, concentration of power and decision-making authority, conflict-management mechanisms, communications strategies, supportive rules and procedures)
	AtlNonTech-4	What role did factors related to “media” play in the success of the deployment? Media (media coverage, public education)
	AtlNonTech-5	What role did factors related to “competencies” play in the success of the deployment? Competencies (cutting across the preceding areas: persuasion, getting grants, doing research, technical/technological competencies; ability to be policy entrepreneurs; knowing how to use markets)
	AtlNonTech-6	Does the public support the UPA/CRD strategies as effective and appropriate ways to reduce congestion?
Cost Benefit	AtlCBA-1	What is the net benefit (benefits minus costs) of the Atlanta CRD projects?

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## APPENDIX B – PARK AND RIDE LOT TRACKING SHEET

	June 2010 Capacity	New Capacity	Occupancy			
			Oct-10	Apr-11	Oct-11	Apr-12
Mall of Georgia (Open August 2010)	0	750				
I-985/GA 20 (Open / 2000 Expanded July 2011)	347	747				
Hamilton Mill (Open August 2011)	0	900				
Hebron Baptist (Open June 2011)	0	850				
Discover Mills GCT (Opened 2003 – Expanded 2010)	500	500				
Discover Mills GRTA (Opened 2006)	750	750				
Indian Trail (Opened mid 1990s)	506	506				

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