RITA Intelligent Transportation Systems Joint Program Office

Atlanta
Congestion Reduction Demonstration

National Evaluation:
Tolling Data Test Plan

www.its.dot.gov/index.htm
Final – August 2, 2011
Publication Number FHWA-JPO-11-097

U.S. Department of Transportation
Research and Innovative Technology Administration

RITA Intelligent Transportation Systems Joint Program Office

ATLANTA
CONGESTION REDUCTION DEMONSTRATION

NATIONAL EVALUATION:
TOLLING DATA TEST PLAN

By

Battelle Memorial Institute
505 King Avenue
Columbus OH 43201

Prepared for

United States Department of Transportation
Federal Highway Administration (FHWA)
Office of Operations
1200 New Jersey Avenue, S.E.
Washington, DC 20590

Contract No. DTFH61-06-D-00007/ORDER 07-T-08002/WO BA07-041

FINAL
August 2, 2011

QUALITY ASSURANCE STATEMENT

The U.S. Department of Transportation provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. U.S. DOT periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-11-097		

4. Title and Subtitle	5. Report Date
Atlanta Congestion Reduction Demonstration: National Evaluation: Tolling Data Test Plan	August 2, 2011
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Ginger Goodin, Texas Transportation Institute	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Battelle 505 King Avenue Columbus, OH 43201	11. Contract or Grant No. DTFH61-06-D-00007/ORDER 07-T-08002/WO BA07-041
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Research and Innovative Technology Administration Federal Highway Administration Federal Transit Administration 1200 New Jersey Avenue, S.E. Washington, DC 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report presents the test plan for collecting and analyzing tolling data for the Atlanta Congestion Reduction Demonstration (CRD) under the United States Department of Transportation (U.S. DOT) Urban Partnership Agreement (UPA) and CRD Programs. The Atlanta CRD projects include the conversion of lanes for high occupancy vehicles (HOV) on approximately 16-miles of I-85 to high occupancy toll (HOT) lanes along with expansion and enhancement of transit service in that corridor, including new and expanded park-and-ride lots. The Tolling Data Test Plan is based on the Atlanta CRD National Evaluation Plan. This test plan describes the tolling data sources, data availability, and possible risks associated with the data. The methods for analyzing the tolling data are discussed. The schedule and responsibility for collecting, analyzing, and reporting the tolling data are presented.

17. Key Word	18. Distribution Statement
Urban Partnership Agreement, Congestion Reduction Demonstration, congestion pricing, HOT lane, Express Lanes, congestion reduction, evaluation	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		34	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

This page intentionally left blank

ACKNOWLEDGEMENTS

Many individuals from the Atlanta partnership were helpful during the development of this test plan. We acknowledge and appreciate the assistance of many individuals from Georgia Department of Transportation, Georgia Regional Transportation Authority, State Road and Tollway Authority, and that of other partner agencies including Atlanta Regional Commission, Georgia Department of Public Safety, Metropolitan Atlanta Rapid Transit Authority, Gwinnett County Government, Clean Air Campaign, and Georgia Institute of Technology.

This page intentionally left blank

TABLE OF CONTENTS

List of Appendices

List of Tables

List of Figures

LIST OF ABBREVIATIONS

4Ts	Tolling, Transit, Telecommuting, and Technology
AFV	Alternative fuel vehicle
ALPR	Automatic license plate reader
ARC	Atlanta Regional Commission
AVI	Automatic vehicle identification
CAC	Clean Air Campaign
CBA	Cost benefit analysis
CRD	Congestion Reduction Demonstration
CVO	Commercial vehicle operator
DPS	Department of Public Safety
FHWA	Federal Highway Administration
GDOT	Georgia Department of Transportation
Georgia Tech	Georgia Institute of Technology
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
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

1.0 INTRODUCTION

This report presents the test plan for collecting and analyzing tolling 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 tolling 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 Urban Partnership Agreement (UPA) evaluation questions shown in Table 1-1.

Table 1-1. U.S. DOT National Evaluation "Objective Questions"

Objective Question #1	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: • reductions in vehicle trips made during peak/congested periods; • reductions in travel times during peak/congested periods; • reductions in congestion delay during peak/congested periods; and • reductions in the duration of congested periods.
Objective Question #2	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: • increases in facility throughput during peak/congested periods; • increases in transit ridership during peak/congested periods; • modal shifts to transit and carpools/vanpools; • traveler behavior change (e.g., shifts in time of travel, mode, route, destination, or forgoing trips); • operational impacts on parallel systems/routes; • equity impacts; • environmental impacts; • impacts on goods movement; and • effects on businesses.
Objective Question #3	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?
Objective Question #4	What are the overall costs and benefits of the deployed set of strategies?

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 Tolling Data Test Plan, there are test plans focusing on the following types of data: traffic, transit, 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 tolling data will be analyzed and used in the national evaluation. Chapter 4 presents the schedule and responsibilities for collecting and analyzing the tolling 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.

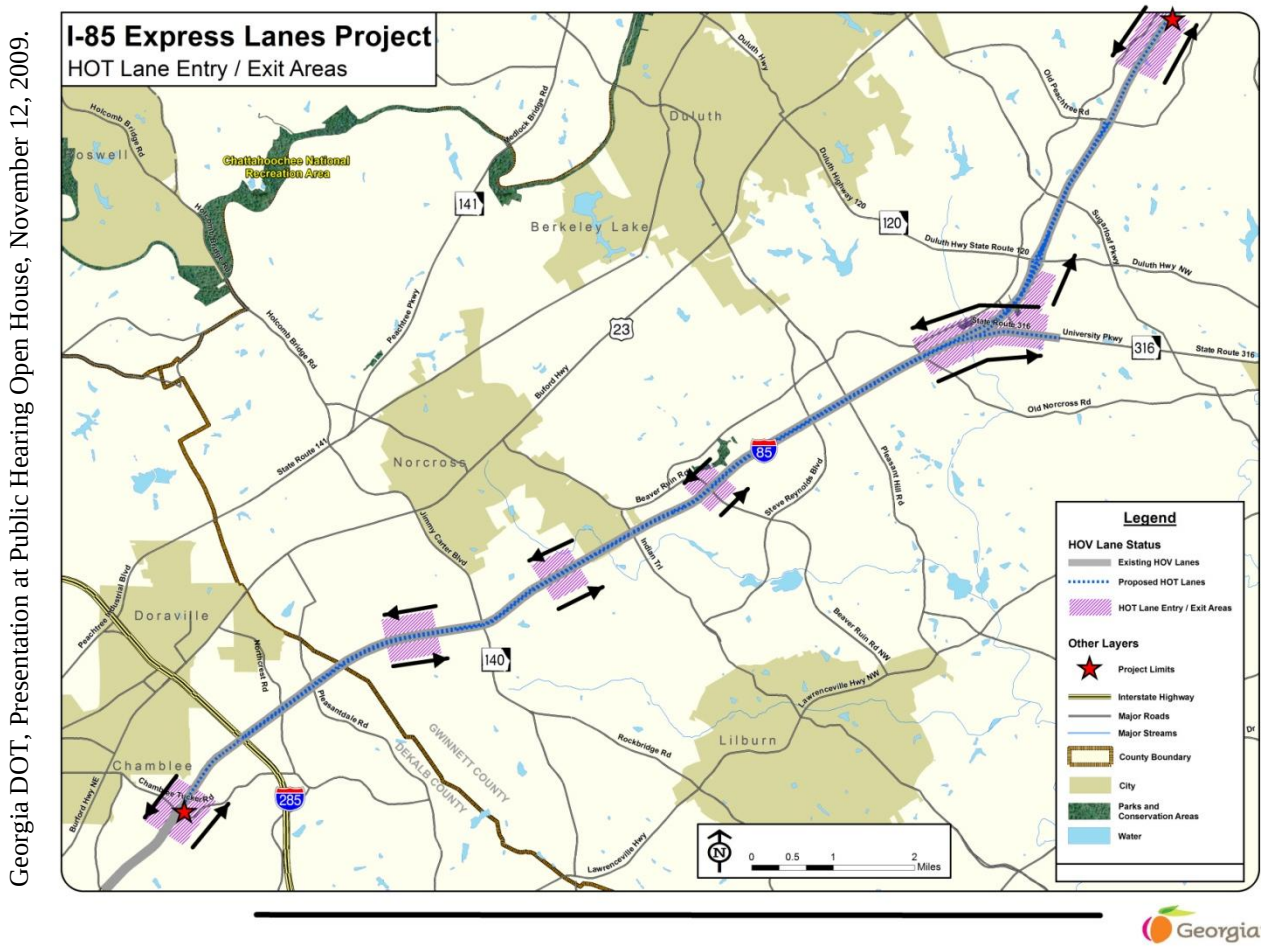

Figure 1-1. I-85 HOV to HOT Conversion Project

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.

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 carpoolers. 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 Tolling 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 Tolling Data Test Plan provides major input to the tolling and goods movement analyses and supports the equity and cost benefit analyses. Table 1-4 includes a summary of the tolling data elements, the measures of effectiveness and the hypotheses/questions the tolling 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. Tolling Test Plan Data Elements Used in Testing Evaluation Hypotheses/Questions

Atlanta Tolling Data Element	Atlanta CRD Measure of Effectiveness	Atlanta CRD Hypothesis/ Questions*
1. Number of Toll Accounts	• Account activity by month	AtlTolling-3
2. Number of Accounts by Type	• Account activity by month • Change in travel costs due to tolls paid, transit fares, and adaption costs by different user groups	AtlTolling-3 AtlEquity-1
3. Number of Transactions by Lane Group (GP or HOT)	• Change in vehicle throughput (number of vehicles) on I-85 Express Lanes • Change in the number of vehicles by user group on I-85 Express Lanes • Modal shift by current 2-person carpools in I-85 Express Lanes (to HOT3+, SOV, paying HOV2, transit) • Number of daily and monthly transactions by direction and time period • Frequency of use • Peak hour and peak period trips by toll status • Use of general purpose lanes by vehicles with transponders • Price elasticity of demand (change in transactions in response to change in toll charged) • Correlation of tolls paid by operators of light-duty trucks with travel time on Express Lanes	AtlTolling-1 AtlTolling-2 AtlTolling-3 AtlTolling-4 AtlCBA-1 AtlGoods-2
4. Number of Toll Transactions by Account Holder Zip Code	• Change in travel costs due to tolls paid, transit fares, and adaptation costs by different user groups	AtlEquity-1
5. Average and Highest Toll Price	• Price elasticity of demand (change in transactions in response to change in toll charged)	AtlTolling-4 AtlEquity-1
6. Toll Revenues (gross)	• Revenues from the I-85 toll system	AtlCBA-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.

This page intentionally left blank

2.0 DATA SOURCES, AVAILABILITY, AND RISKS

This chapter identifies the sources for the tolling data and discusses the availability of those data and any potential risks associated with collecting and processing them for use in the evaluation. Table 2-1 summarizes the data requirements for the tolling test plan. The details associated with source, timing and other particulars are discussed in the sections that follow.

2.1 Data Sources

The Tolling Data Test Plan focuses on data from the SRTA toll collection system for I-85. Data will be utilized in the tolling, technology, equity, goods movement, and cost benefit analyses. Key data elements that will be collected from the toll system database include the number of transponders purchased and activated, the home zip code of transponder purchasers, transaction data, revenue data, violation data, and other related system and user data. Individual transaction data will be provided on a monthly basis by SRTA that will detail the number and type of accounts, the number and type of transactions, and the number of violators. A separate dataset of transponder registration accounts will also be provided by SRTA, noting the zip codes of registration addresses.

SRTA has previously operated the GA 400 facility using the brand "Cruise Card" for all electronic tolling. The new toll system for the I-85 Express Lanes is being branded as the "PeachPass." Both the Cruise Card and Peach Pass transponder systems will be recognized on I-85 once the Express Lanes become operational. Cruise Card holders will only have to sign a new user agreement that details the differences between the GA 400 and I-85 tolling systems. SRTA intends to phase out the Cruise Card over time. The goal is for customers to have one transponder, one bill, and one account within a seamless system, using either transponder or video technologies with back office accommodations to provide interoperability between the two facilities.

SRTA has undertaken a dual procurement process to supply, install and maintain an all-electronic tolling solution that supports the tolling requirements for the I-85 Express Lanes. Federal Signal and TransCore were awarded contracts to supply the automatic vehicle identification (AVI) transponders and readers under an open protocol, non-proprietary solicitation. SRTA selected ISO18006-C RFID equipment to enable interoperability among multiple vendors' equipment and to ensure a simpler and more cost-effective path to future technology upgrades.

A second contract was awarded to ETC Corporation for toll system integration, which will include back office operations, customer service functions, hosting, lane equipment and maintenance. ETC will operate the toll system database from which much of the transaction files for the CRD evaluation will come on a monthly basis. The files will be provided in a Microsoft Access database or similar format.

Table 2-1. Summary of Data Needs for Atlanta UPA/CRD Tolling Test Plan

Data Element	Location	Data Granularity	Continuous Sampling (Automatic)	Data Collection Timing				Data Reporting Frequency	Responsible Agency (Data Source)
				Baseline[1]		Post-Deployment			
				Begin	End	Begin	End		
1. Number of Toll Accounts	I-85 Corridor	Monthly	X	NA	NA	Sept 2011	Aug 2012	Monthly	SRTA
2. Number of Accounts by Type	I-85 Corridor	Monthly	X	NA	NA	Sept 2011	Aug 2012	Monthly	SRTA
3. Number of Transactions by Lane Group (GP or HOT)	I-85 Corridor	Individual transactions with date/time stamp	X	Aug 2011	Aug 2011	Sept 2011	Aug 2012	Monthly	SRTA
4. Number of Toll Transactions by Account Holder Zip Code	I-85 Corridor	Individual transactions with date/time stamp	X	Aug 2011	Aug 2011	Sept 2011	Aug 2012	Monthly	SRTA
5. Average and Highest Toll Price	I-85 Corridor	AM Peak, PM Peak, Off-Peak, Daily	X	NA	NA	Sept 2011	Aug 2012	Monthly	SRTA
6. Toll Revenues (gross)	I-85 Corridor	N/A	X	NA	NA	Sept 2011	Aug 2012	Quarterly	SRTA

[1] Vehicles with current Cruise Card tags or early Peach Pass registrations will be observed during the one-month pre-deployment period. Information on the use of the existing HOV lane during that month may be gathered based on the recorded transponder reads of vehicles entering the lane.

There are several vehicle groups that qualify for non-revenue status (such as emergency vehicles) or toll exemptions, including motorcycles, alternative fuel vehicles, and vehicles with three or more occupants. In the SRTA Express Lanes business plan, the toll account type designations will be toll, register-by-plate, non-revenue, non-revenue emergency, and toll exempt. Motorists must choose their "primary mode" as toll or non-toll, and may change their status at least 15 minutes in advance of their trip on the Express Lanes. For example, a transponder-equipped vehicle that operates mostly as a 3-person carpool, and chooses "non-toll" as its primary mode, may operate as a single-occupant vehicle in the lanes by notifying the customer service center at least 15 minutes before the trip on the Express Lanes. By doing so, they are properly tolled for the trip.

Although casual carpooling, also known as "slugging," is not an official part of the CRD, the local partners and national evaluation team have agreed to make note of and report any occurrences of this phenomenon. The transit data test plan has outlined a process by which bus operators will make note of slugging. If casual carpooling activity is detected at park-and-ride facilities, the toll account database is the logical source of potential survey subjects (those using the facility in carpool status) to further assess the nature of HOT3+ casual carpooling related to the I-85 Express Lanes.

SRTA has also indicated that it is capable of detecting the presence of RFID-equipped vehicles on the non-tolled general purpose lanes with the AVI system. Depending upon the level of detail, this may offer a source of comparative data on usage of the HOT lanes by individual travelers over time and provide insight into price elasticity.

The tolling database will be able to provide data on the date, time, toll charge, and transponder identification numbers. For each toll transaction (with multiple transactions per trip), the following data are written by the system for transmission to the revenue and accounts management system:

- date and time of transaction;
- transponder identification number; and
- roadside toll collection identification number.

After the system receives the data, the transactions are processed to determine the full trip (with each transaction appended to one another to reflect a corridor trip), with tolls applied based upon the established rate at the point of entry. The individual's toll price will be set by the most congested downstream segment, with that per-mile rate applied to the total mileage. The account transaction reflects precise date, time, and toll charge for each toll segment, as well as the status of the account for that transaction, i.e., HOT3+ or single occupant vehicle (SOV).

The following provide examples of other data in addition to transaction data that will be obtained from the database for use in the tolling and other evaluation analyses:

- number of toll accounts;
- number of accounts by type;
- number of violations;
- number of toll transactions by zip code;
- average and highest toll rate; and
- revenues by time period.

2.2 Data Availability

The post-deployment data for the analysis will be obtained from SRTA. One month of transaction data from the equipment test period before the tolling starts may be available from SRTA. If the test period data is available, the national evaluation team will be able to assess the shift in Express Lanes usage during implementation by comparing about one month of pre-deployment transaction data from active transponders with post-deployment observations. Although potentially informative, the test period data is not essential for the evaluation. Vehicles with current Cruise Card tags or early Peach Pass registrations will be observed during the one-month pre-deployment period. Information on the use of the existing HOV lane during that month may be gathered based on the recorded transponder reads of vehicles entering the lane. Collection of all recorded transactions will be initiated after tolling begins in September 2011. It is anticipated that daily toll system data and a separate transponder account dataset will be batched and transmitted to the national evaluator on a monthly basis. Information on new accounts will be provided on a monthly basis to the national evaluation team. SRTA will also provide transaction data that includes the zip codes of account holders and frequency of use on a monthly basis.

2.3 Potential Risks

There do not appear to be any significant risks associated with obtaining the I-85 toll data from SRTA. The accuracy of toll transaction data is not expected to be a problem. Radio-frequency identification technology used for tolling purposes is typically 99%+ accurate, unlike other forms of fixed-point sensors used for traffic data collection. Although there are no significant risks anticipated, there are a few, more minor risks associated with tolling data as identified in Table 2-2.

Table 2-2. Potential Risks and Mitigation for Tolling Data Collection

Risk	Mitigation
Potential inaccuracy of GDOT loop detector data, associating toll prices with traffic volumes	SRTA toll transaction data will be used as a surrogate.
Pre-tolling transaction data quality, possibly incomplete or inaccurate data records during the time period to test the gantry system before the start date	If the data quality is questionable, then no information collected during the pre-deployment phase will be used in the final assessment.
Potential atypical conditions, exogenous factors	A multivariate analysis will be used to control for infrequent events, school and holiday schedules, weather, major regional economic changes, construction activity
Use of zip codes to infer demographic characteristics of users may lead to inaccurate conclusions	Comparison with household survey results

3.0 DATA ANALYSIS

This chapter discusses the approach for analyzing the tolling data. The tolling data generated by SRTA's tolling system are expected to be highly accurate. Nevertheless, as a first step in the data analysis, the national evaluation team will conduct a visual inspection of the data and will use automated range checks to identify any outliers or suspect data. Any data concerns identified will be checked with SRTA representatives. The potential to use one month of pre-deployment test data with post-deployment information may be considered in the analysis. The one month of data would enable a comparison of the geographic distribution of HOV users with post-deployment Express Lanes users by investigating the zip codes of account holder transactions before and after the start of tolling.

Using data collected through the Exogenous Factors Test Plan, in combination with toll data from I-75 as a control facility, the analysis will take into consideration a number of factors un-related to I-85 that may influence travel in the corridor. Among the items to be reviewed are non-typical travel condition data (incidents, construction, adverse weather), transportation system changes not on I-85 (such as major roadway improvements), and regional economic conditions, including employment and gas prices. It is anticipated that toll data impacted by exogenous influences will not be eliminated from the analysis, but rather will be examined to understand the influence of those factors on toll usage in the I-85 corridor.

A variety of analytic techniques will be used. Descriptive analytic tools, such as histograms and graphs, will be produced to identify patterns in the data. Standard statistical measures, such as t-tests, F-tests, and Chi-Square tests, will help identify statistically significant variations in the data. Multivariate techniques, such as regression analysis, will be the primary technique for incorporating exogenous factors into assessing the tolling data.

The data obtained from the toll system database will be used to examine measures of effectiveness needed for the tolling, technology, environmental, equity, business impacts, goods movement, and cost benefit analyses. Examples of the data analysis conducted using the tolling data are discussed below:

- **Toll transactions on the I-85 Express Lanes.** Examining toll transactions in the I-85 Express Lanes provides a basic indication of use levels. Examples of how the toll transaction data will be analyzed are highlighted below.
    - Toll transaction by time-of-day and by segment will analyze use of the Express Lanes during different times of day, different directions of travel, and to identify those segments with high levels of use and those with lower levels of use. The traffic conditions in the adjacent general-purpose freeway lanes will be examined based on data from the Traffic System Data Test Plan to explore possible correlations between traffic congestion in the general-purpose freeway lanes and the use of Express Lanes (AtlCong-1).
    - Volume data from I-85 and the I-75 control corridor will be used, based on the Traffic System Data Test Plan, to measure changes in throughput by vehicle type during the analysis period (AtlTolling-1).

- Toll transaction data will be used in combination with data from the Traffic System Data Test Plan to assess the influence of changes in toll rates on the operation of the Express Lanes, including managing toward travel speed targets (AtlCong-3).
- Toll transaction data will be used in combination with the sensor data from the Traffic System Data Test Plan and the number of buses from the Transit System Data Test Plan to estimate the vehicle mix (tolled vehicles, carpools, and buses) using the Express Lanes. The analysis will compare historical and pre-deployment field occupancy counts referenced in the Traffic System Data Test Plan with post-deployment carpool use from the toll transaction dataset. The term user group will be defined as vehicle occupancy for SOV, HOV2, and HOT3+ (AtlTolling-2).
- Price elasticities will be examined to assess the effectiveness of pricing for managing vehicular throughput on the I-85 Express Lanes. The combination of toll transaction data, traffic volumes from the Traffic System Data Test Plan, and toll price by time of day will be used to assess demand elasticities in the Express Lanes. An additional econometric analysis may be made possible by having the ability to read transponders from vehicles not utilizing the Express Lanes on particular trips. Since SRTA has indicated that it is possible to read transponders in the general purpose lanes, it may be useful to review toll records to find patterns within individual tagholders for lane choice versus toll rate, travel speeds, and account status. The assessment may provide additional insight into evaluating price elasticites of specific users (AtlTolling-4).

- **Potential Equity Concerns.** For the equity analysis, the geographic distribution of the Express Lanes users will be examined by zip codes with the median household incomes associated with those areas. The zip codes will be aggregated as closely as possible to census tracts in the corridor without compromising any privacy concerns. Census data on income, automobiles per household, households without an automobile available, race and ethnicity, and age will be examined to characterize Peach Pass users and identify potential equity concerns. Frequency of use by zip code zone of transponder holders will also be examined to the extent possible. This analysis will explore potential differences in frequency of use by individuals residing in areas with different socio-economic characteristics (AtlEquity-1).
- **Change in Violation Rates in the I-85 Express Lanes.** Information from citations issued by Georgia DPS (identified in the Safety Data Test Plan) will be used to assess changes in vehicle-occupancy violation rates on the I-85 Express Lanes before and after deployment (AtlTolling-2). Citation data will also be used in the technology analysis to assess whether the advanced gantry system will enhance enforcement capabilities on the corridor compared to historical and pre-deployment data from Georgia DPS (AtlTech-1).
- **Light Duty Truck Drivers Utilizing the Express Lanes.** The transactions of light-duty trucks will be assessed for correlations in tolls and the travel times on the I-85 Express Lanes. It is expected that faster travel on the Express Lanes will benefit commercial interests such as business services and construction trades and, therefore, usage of the Express Lanes by light-duty trucks will increase as travel times decrease once tolling is implemented (AtlGoods-2).

- **Toll Revenue Data.** Data on the average tolls; the average toll by time period, and direction; and the highest toll by time period and direction will be examined to assess the price elasticity of demand, or the change in the number of transactions in response to amount of toll charged (AtlTolling-4). The quarterly toll revenue reports will be used as an input for the cost-benefit analysis to assess the net benefits of the project (AtlCBA-1).

This page intentionally left blank

4.0 SCHEDULE AND RESPONSIBILITY

Tolling data collection will begin after opening of the I-85 toll system in September 2011. Data collection will continue for one full year of post-deployment operation. There is a possibility of obtaining transaction data collected during the pre-tolling test period when the tolling system is in place but not yet charging tolls. The test-period data would offer opportunities to determine how individual travelers change their behavior with the initiation of tolls (e.g., shift in time of travel).

SRTA will be responsible for providing the tolling data in an electronic format on a regular basis. The national evaluation team will be responsible for working with the local partners to specify data formats and collection protocols and analyzing the data for the various measures of effectiveness and reporting on the findings.

This page intentionally left blank

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 incidents related to violations for crossing the double white line
	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?

This page intentionally left blank

U.S. Department of Transportation
ITS Joint Program Office-HOIT
1200 New Jersey Avenue, SE
Washington, DC 20590

Toll-Free “Help Line” 866-367-7487
www.its.dot.gov

FHWA-JPO-11-097

U.S. Department of Transportation

Research and Innovative Technology Administration