2011

Evaluating Alternative Toll-Based Financing Approaches: A Case Study of the Boston Metropolitan Area

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EVALUATING ALTERNATIVE TOLL-BASED FINANCING APPROACHES:

A CASE STUDY OF THE BOSTON METROPOLITAN AREA

A Thesis Presented

by

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Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN CIVIL ENGINEERING

May 2011

Department of Civil and Environmental Engineering
Transportation Engineering

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ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincerest gratitude to my advisor and thesis committee chair Dr. John Collura for his continuous support throughout my Master's coursework and research, for his help, encouragement, motivation, and knowledge of the field. His guidance has helped me in researching and writing the thesis presented today. Without Dr. Collura the level and depth of research could not have been possible.

I would also like to express my appreciation of Dr. Song Gao, the other member of my thesis committee for her continual support and insight throughout the research process.

My sincere thanks also goes to Dr. Daiheng Ni and Dr. Michael Knodler for challenging me through interesting coursework and unique traffic projects.

I thank my fellow colleagues in the transportation engineering program for the stimulating discussions, the weekend study groups, and for all the fun we have had over the past year. I would also like to thank my friends and advisors from my life before UMass: Dr. Vinnie Ferraro, Dr. Giuliana Davidoff, Cuyler Mitchell, Emma Scarloss, Joanna Arcieri, Frazier Angell, Tara Kaleh, Sebastian Fischetti, Keith Fratus, Andy O'Donnell, Nick Colella, Nate Harman, Jessica McIver, and Tom Goldstein.

Last but certainly not least, I would like to thank my family: my parents, grandmother, uncle, and brother for their unconditional love and support throughout my 22 years of life.

ABSTRACT

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MAY 2011

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The current condition of the nation's transportation system is of great concern to State Departments of Transportation. Currently, funds in many state transportation budgets are depleting. Nowadays, State DOT officials together with researchers are exploring various transportation financing approaches and they are considering the utility, merits, challenges, and impacts of these approaches.

A major financing approach being considered relies on the collection of tolls on existing toll roads and on roads on which tolls are not presently collected. Recent technology advancements in Open Road Tolling and All-Electronic Tolling have provided State DOTs with the opportunity to consider expanding the use of toll revenue to finance transportation investments. These two types of tolling technologies appeal to motorists by allowing them to maintain their current highway speed while going through a toll plaza. In addition, many State DOT officials now view toll based approaches as viable "user fee" based strategies together with other alternative approaches such as the fuel tax and sales tax.

Central to this research is a case study of the Boston Metropolitan area. The case study includes the formulation and preliminary evaluation of toll based financing

approaches potentially suitable for consideration in Massachusetts. The approaches include increases to existing tolls and placing tolls on selected roadways not currently tolled. The evaluation includes estimates of changes in demand and anticipated revenues associated with these toll based approaches. It is expected that the results of this research will be of interest to State DOT officials in Massachusetts and other states.

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CHAPTER 1

INTRODUCTION

The current condition of the nation's transportation system is of great concern to State Departments of Transportation (DOT). Currently, funds in many state transportation budgets are depleting. At the present time, State DOT officials together with researchers are exploring various transportation financing approaches and they are considering the utility, merits, challenges, and impacts of these approaches.

A major financing approach being considered relies on the collection of tolls on existing toll roads and on roads on which tolls are not presently collected. Recent technology advancements in Open Road Tolling and All-Electronic Tolling have provided State DOTs with the opportunity to consider expanding the use of toll revenue to finance transportation investments. These two types of tolling technologies appeal to motorists by allowing them to maintain their current highway speed while going through a toll plaza. In addition, many State DOT officials now view toll based approaches as viable "user fee" based strategies together with other alternative approaches such as the fuel tax and sales tax.

CHAPTER 2

OBJECTIVES OF THE RESEARCH

The objectives of this research are as follows:

- **Review the experiences and lessons learned** with toll based financing approaches to provide revenue to finance toll road improvements and other transportation investments.
- **Identify the financing questions** of interest to State Departments of Transportation with an emphasis on the questions, issues, challenges, merits, and impacts associated with the evaluation and implementation toll based financing approaches as they compare to other alternative approaches. Examples of such questions are:
    - What are the major financing approaches available to State DOTs to support surface transportation investments?
    - Should tolls be considered as a major approach along with other approaches such as the fuel tax and/or a sales tax?
    - Should current toll levels be increased and should innovative pricing strategies be employed?
    - Should tolls be charged on existing roads where tolls are not currently collected such as state borders and at other locations?
    - What level of revenue can be expected from such toll based approaches and strategies as compared to other approaches and what analytical methods might be used to make these revenue estimates?

- What innovative technologies might be used to facilitate the collection of tolls and what are the expected capital and operating costs?

- **Contribute to the state of practice** by improving our understanding of the alternative financing approaches being considered by State DOTs and the relative levels of revenue that might be generated with such financing approaches. More specifically, the results of this research are expected to shed light on the contribution toll based approaches are able to make relative to the fuel tax and a sales tax. Finally, the results of the research are intended to illustrate the application of simplified analytical methods to estimate the level of revenues expected from toll based approaches.

CHAPTER 3

BACKGROUND AND RELATED WORK

As we dive deeper into the economic recession, our nation's roadways continue to deteriorate and transportation funds need to be replenished. In order to restore our nation's roadways to acceptable physical and operating conditions and allow for new transportation projects, various states have invested in researching and developing alternative finance approaches. Oregon, Iowa, Minnesota, New York, along with other states have focused on developing better toll payment systems and other user fee based approaches.

To date, tolls have been considered as appropriate sources of revenue. Initiatives in various forms of tolling have been explored nationally and internationally to fully reap their benefits. A number of states have been at the forefront when it comes to employing innovative toll policies and collection strategies including open-road tolling, cashless tolling, border privatization of toll roads, border tolling and other toll revenue and collection innovations.

What follows is an overview of common financing approaches being used by State DOTs; a more detail description of the innovative toll based approaches being implemented in the U.S.; and a discussion of the issues considered in the design of appropriate financing approaches; and a brief review of the capital and operating costs to implement these toll based approaches.

3.1 Alternative Financing Approaches

As shown in Figure 1, alternative financing approaches for transportation can be broken down into two groups: transportation and non-transportation related. (16)

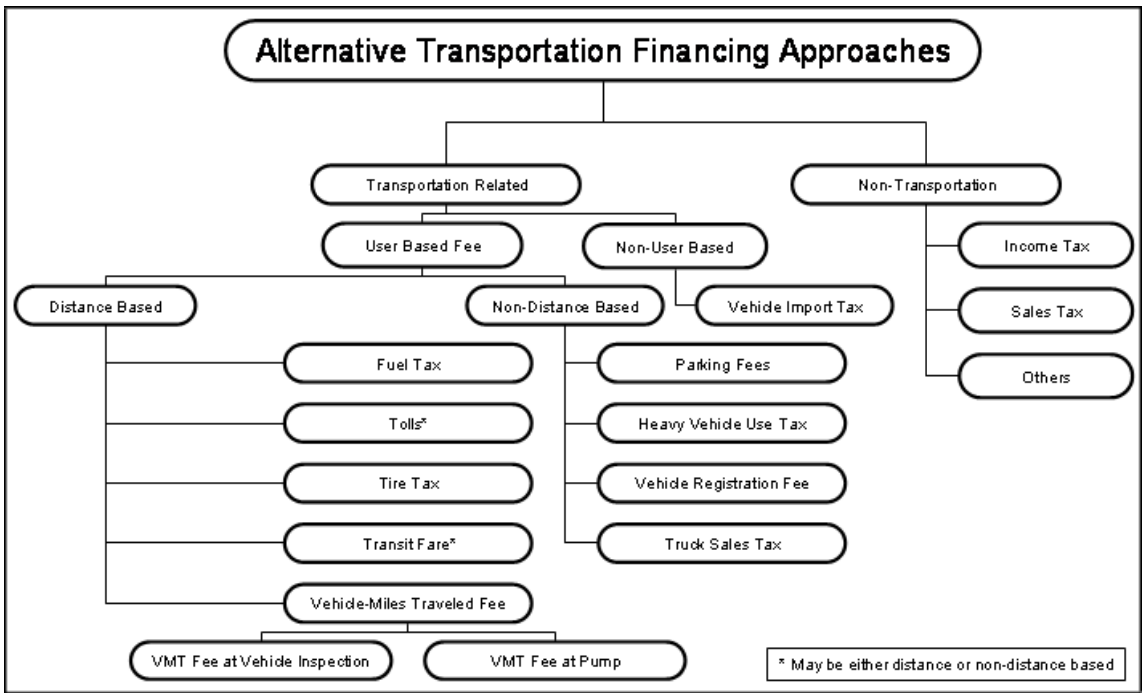
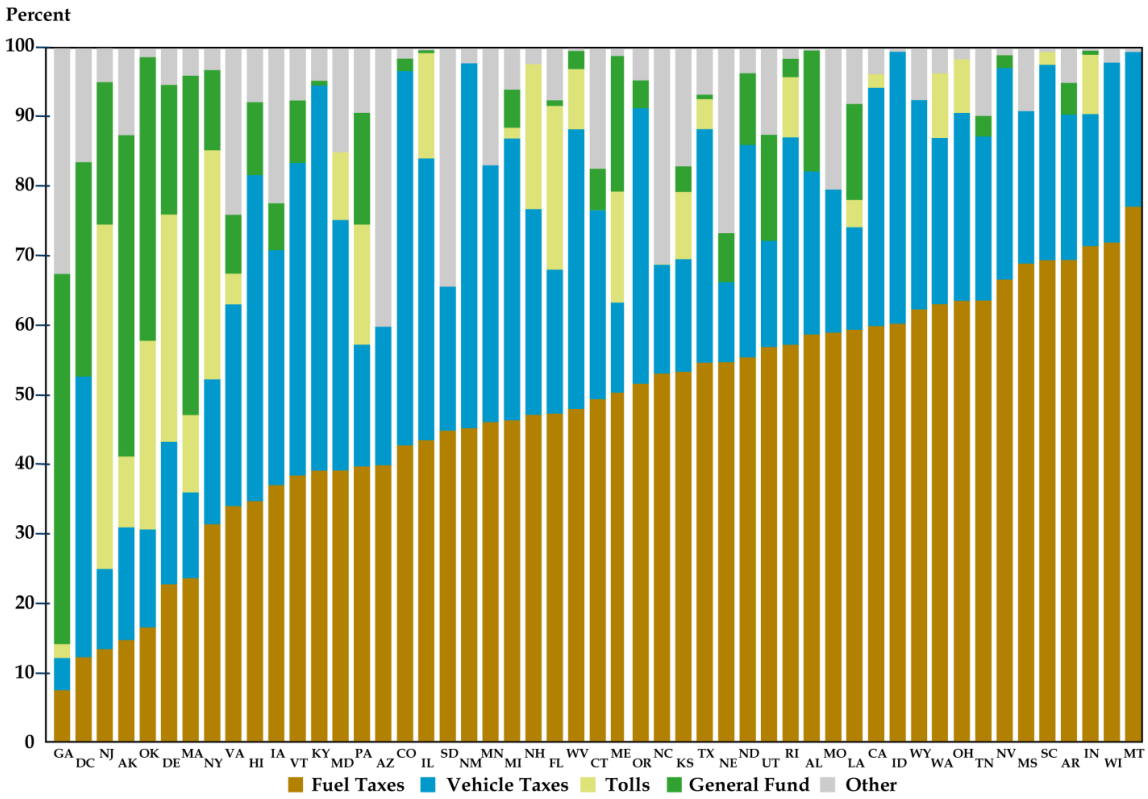


Figure 1. Alternative Transportation Financing Approaches

In the non-transportation group, states have the ability to use the income and sales taxes as a means to finance transportation. It is not uncommon for some states to use a portion of their sales tax to fund public transit. Within the transportation group, state officials will rely on fees including the fuel tax, tolls, tire tax, and in some cases a vehicle-miles traveled fee. Figure 2 shows by state the different financing approaches used in 2004. (15)



Source: 2004 Highway Statistics, Table SF-1

Figure 2. Transportation Revenue Sources, State by State, 2004.

Another financing approach being considered by State DOTs is the so-called vehicle-miles traveled (VMT) fee which could be paid at the pump or at an inspection station. The Oregon Department of Transportation ran a pilot program in 2006 showcasing the possibility of paying a VMT at the pump. (16)

More recently, initiatives in alternative financing approaches undergone by Texas DOT, the New York State Thruway Authority and the New York MTA indicate promise for technological advancement in toll collection throughout the country. These initiatives are reviewed below.

3.2 Toll Based Financing Approaches

3.2.1. ORT

At approximately 5am, Friday, May 14, 2010, the Highway Speed E-ZPass toll lanes at the Woodbury Toll Plaza opened on the New York State Thruway (NY Thruway). It is the first location on the Thruway that bolsters open-road tolling (ORT) for both passenger and commercial vehicles. (1) These lanes allow vehicles to pass through the intersection at the highway speed of 65mph. A similar initiative was undergone in 2007 at the Spring Valley Toll Plaza; however, the toll plaza only serves commercial vehicles. Four highway speed lanes have been added to the toll plaza two in each direction. (2) The $85 million project is envisioned to be successful. Although the Highway Speed E-ZPass lanes have been opened construction was scheduled to be completed in September 2010. (3) More than 42,000 vehicles pass through the toll plaza on an average day and that number rises to 62,000 per day during the summer and holiday weekends. (1, 5, 6) The NY Thruway Authority decided to proceed with the project in this location because of the heavy congestion seen daily at the toll plaza. (2) The new high speed lanes will reduce congestion in the entire toll plaza, increase capacity, and reduce the adverse effects on the environment. New York officials have been very excited about the project stating that it will help in New York's dedication to creating a greener State. (1)

3.2.2 AET

Announced in the Making Every Dollar Count report released by the Metropolitan transportation Authority (MTA) in January 2010, the Henry Hudson Bridge is the MTA's first test location for a non-stop all electronic toll collection site. (7) This is a two phase project. Phase 1 which introduces a gateless tolling scheme, where gates will be removed and cameras will be installed for enforcement barriers will remain intact is scheduled to be completed in mid-January 2011. Phase 2, which will eliminate cash collection completely and the entire toll plaza will turn to all-electronic toll collection, is scheduled to be completed by January 2012. (8) The project is expected to cost about $10 million with phase 1 costing about $4.6 million and phase 2 costing about $5.4 million. (8) The Henry Hudson Bridge toll plaza will be the first AET collection plaza in an urban and densely populated area. (9)

The Henry Hudson Bridge was chosen for the following reasons: there are no nearby entries and exits and thus there are potential savings from not proceeding with an otherwise necessary rebuild of the toll plaza; there is a high out-of-state component to the traffic (NJ, CT, PA drivers) so interstate collection can be tested; the Parkway serves cars-only so there are no vehicle classification complications; and the Parkway is a medium sized facility with 60,000 to 70,000 transactions/day. (8)

During Phase 1 they plan to remove the gate and install cameras. Initially, the cameras will be used to identify violators and later (more likely in Phase 2) to do toll-by-plate of vehicles without a transponder. There is a proposed violation fee of $50 for those who do not have a transponder during Phase 1; however, the fee is anticipated to be revenue neutral the income from the fees are designed to offset the cost of collection and

inescapable toll revenues. (8) Phase 2 will begin around January 2012 when the plaza will go cashless. From this point on and conditions permitting, all traffic will go through the plaza and toll at highway speed. Payment will be accepted through various means: on-line, phone, mail, or payment agencies. (8) MTA Bridges and Tunnels President Jim Ferrara says the new traffic pattern leading into Manhattan will result in a smoother transition for drivers coming onto the Bridge from the two-lane Henry Hudson Parkway. (9)

3.2.3 Texas Tolling

The Central Texas Turnpike System (CTTS), in Texas, opened three turnpikes, SH130 tolls 1-4, SH45 North, and Loop 1 in 1998. Each roadway is equipped with Open Road Tolling (ORT), video tolling, and traditional cash tolling that are used concurrently as means of toll payment. In center lanes, highways are ORT is used in conjunction with video tolling. In order to use the system developed in Texas, users either sign up for a TxTag, a transponder placed inside the vehicle. The TxTag uses a system similar to that of the Fast Lane and EZ-Pass passes in which users create an account from which funds are drawn or to which charges are billed. If the user does not sign up for the TxTag, they are still able to use the highway speed toll lanes and are tolled by video tolling. In CTTS' case, video tolling has progressed beyond violation detection to general toll payment. Any vehicle that passes through the ORT facility that does not have a transponder has their license plate captured on video. This picture is then processed and the registered owner of the vehicle receives a bill in the mail, dubbed "Pay by Mail." Processing and late fees are applied if the bill is not paid on time. Additionally, CTTS has cash toll lanes

on these roadways to allow the user to pay in cash if they so choose. Since its inception, more turnpike sections have been developed. The North Texas Tollway Authority (NTTA) currently operates two toll roads with AET. These roads either use ORT and video tolling or just ORT. In instances where the roadway is only ORT, users have to have a transponder.

Over the two year period, from 2007 to 2008, the CTTS processed about 99 million toll transactions. More than half of these transactions used the ORT/video tolling. In 2009, CTTS had 73 million transactions, generating about $59 million from tolls. The total revenue for 2009 was $61,674,500. About 74% of vehicles used a transponder on the turnpikes. About 17% of the toll transactions used the video tolling system and 9.3% of the transactions used the old cash system. (12)

Since, video tolling costs more than using transponders due to image processing, CTTS charges 25% more for "Pay by Mail" than by transponder, plus a $1.00 processing fee. To encourage users to sign up for a transponder, each "Pay by Mail" bill comes with literature and an application for a transponder. There has been about 20% non-payment of video tolls. Texas does not use refusal of renewal of registration for unpaid tolls so they have to take violators to Justice of the Peace courts—this has made it difficult to for the state to collect toll payments. Unbillable tolls, from poor license plate reads are about 2% of total transactions, 11% of total plate reads. TxDot/CTTS outsources plate readings to a company that uses optical character recognition (OCR). Unbillable tolls were due to poor image quality, obscured plates, US Government plate, non-US plate or no license plate because no address could be found in the DMV vehicle registration database. (13) Factors that affect license plate identification/recognition (LPI/R) readings include, poor

image resolution, blurry images, poor lighting and contrast, obscured plates, out of state or vanity plates, and circumvention techniques.

3.2.4 NCHRP

In 2006, the National Cooperative Highway Research Program (NCHRP) released Synthesis 364: Estimating Toll Road Demand and Revenue. This synthesis gives a detailed analysis of toll road forecasting in terms of demand changes and revenue changes. Through the use of the four-step process NCHRP contributors affirm that changes in demand can be modeled and estimated.

"The demand for travel is a derived demand." (14) There are several factors that need to be considered when deriving demand: human activities, demographic location, socioeconomic issues, as well as land-use. In order to create a successful model, the four-step model is created using a three step process: input, process, and output. The "inputs" are defined to be factors such as zone definition, land-use inputs, transportation network, and observed travel characteristics. Secondly, the process is where the "four-step" process earns its name. The process is comprised of four steps which are trip generation, trip distribution, modal split, and trip assignment. The final part of the four-step process composition is the outputs. The outputs are "volumes by link and ridership numbers." (14) These numbers can be used to identify costs and revenues of a tolled facility.

As previously implied, there is a relationship between demand and revenue forecasts in that "revenue forecasts are **dependent** on travel demand forecasts and the assumptions on which the travel forecasts were based." It is not surprising that there is a proportional relationship between the uncertainty in revenue forecasts and the uncertainty

in travel demand forecasts. Moreover, revenue forecasts are dependent on the tolling technology, fare, and structure (schedule). Tolling schemes sometimes include discounts for electronic tolling, such as the FastLane pass, or multipass users, heavy vehicle fares, and variable tolling practices. "Increases in toll rates can also affect the demand, especially as some authorities have elected to increase toll rates more sharply than projected to quickly generate revenues in the short term." (14)

Calculating estimated toll revenues is similar to peeling an onion: as the tolling scheme becomes more complex, more layers of considerations are made. In general, travel demand forecasts are developed for a weekday peak hour or peak period. In order to apply generalized daily and yearly traffic volumes, conversion factors are used. Furthermore, revenue is then estimated by multiplying the forecast volume by the toll amount taking into account different toll rates, toll evasion, and discounts.

3.2.5 Implementation Costs

Within the context of this research, there are two sets of capital and operating costs that need to be considered: costs for the Massachusetts' Turnpike (an existing toll road) and costs for Interstate 93 (a road on which tolls are not currently collected). Since no construction or structural changes will be made to the Massachusetts' Turnpike estimating those capital and operating costs are relatively simple to determine; whereas with Interstate 93, the literature on Open-Road and video tolling needed to be reviewed to shed light on this project.

Capital cost estimates include items such as transponder costs, processing center, and telecommunication systems. Furthermore the cost of minor items is included in the

contingency component, which is usually about 10% of the total itemized capital costs. Operational cost estimates consider major items: maintenance and salary and benefits associated with toll road personnel.

In 2009, the operating expenses for the western portion of the Massachusetts' Turnpike were $66,696,000 for the fiscal year. (17) Repair and reconstruction costs for the western portion of the Massachusetts' Turnpike in 2007 were $8,000,000. Moreover, for the 2007 fiscal year the operations and policing costs for the Boston Extension was approximately $52,000,000. The repair and reconstruction costs for the Boston Extension were about $12,000,000 for the year 2007. (18) Since there would be no "new" construction for this project, the capital cost to increase the existing tolls on the Massachusetts' Turnpike portions is assumed to be $0.00.

In 2004, the New York State Thruway Authority estimated that they would spend between $30 and $50 million for each highway speed toll plaza installed on the Thruway – 6 years later the actual cost for the new toll plaza that opened in May 2010 was about $75 million. (2, 19) On the other hand, the All-Electronic Tolling project being done on the Henry Hudson toll plaza is contracted for about $10 million. The magnitude of the proposed project for Interstate 93 better aligns with the Henry Hudson toll plaza because each on ramp can be considered a "medium-sized" facility. Since the ownership of transponders for the Boston metropolitan area is unknown, it is assumed that the Commonwealth will spend approximately 10% of the capital costs on this equipment, about $1 million. Therefore, a preliminary order of magnitude estimate of the capital costs for the implementation of tolls on Interstate 93 is $111 million. The capital costs are projected to be $111 million because there are 11 exits that are being considered and it is

estimated that each exit will cost approximately $10 million. Since the Henry Hudson toll plaza is a two level plaza, it is not unreasonable to group the north and southbound exits in to one estimate.

In a side by side comparison of Interstate 93 and the Henry Hudson, it is shown that the average annual daily traffic (AADT) at each exit on Interstate 93 is lower than the Henry Hudson toll plaza. Furthermore, the $75 million used for the Woodbury toll plaza in Upstate New York was used for the construction of the toll plaza as well as additional repairs to the current toll booths and roadway.

The anticipated operating costs on I-93 would include personnel and repairs and maintenance. It was assumed that there would be about 30 personnel hired by MassDOT to manage the AET I-93 project. The average salary of personnel for the Massachusetts Turnpike was assumed to be $70,000 a year. Additionally, it is assumed that the maintenance cost of the Interstate 93 facilities will be about $200,000 annually or 15% of the equipment capital costs and 5% of the processing center costs.

3.3 Designing Appropriate Transportation Financing Approaches

The design of an appropriate financing approach is not a trivial task. As part of the design process, State DOT officials consider a number of questions including:

- What are the major financing approaches available to State DOTs to support surface transportation investments?
- Should tolls be considered as a major approach along with other approaches such as the fuel tax and/or a sales tax?

- Should current toll levels be increased and should innovative pricing strategies be employed?
- Should tolls be charged on existing roads where tolls are not currently collected such as state borders and at other locations?
- What level of revenue can be expected from such toll based approaches and strategies as compared to other approaches and what analytical methods might be used to make these revenue estimates?
- What innovative technologies might be used to facilitate the collection of tolls and what are the expected capital and operating costs?

Figure 3 presents a framework that suggests that there are four major elements that need to be considered in the design and evaluation of a transportation financing approach including establishing policy objectives; determining revenue sources; identifying short and long term implications; and assessing impacts. (16)

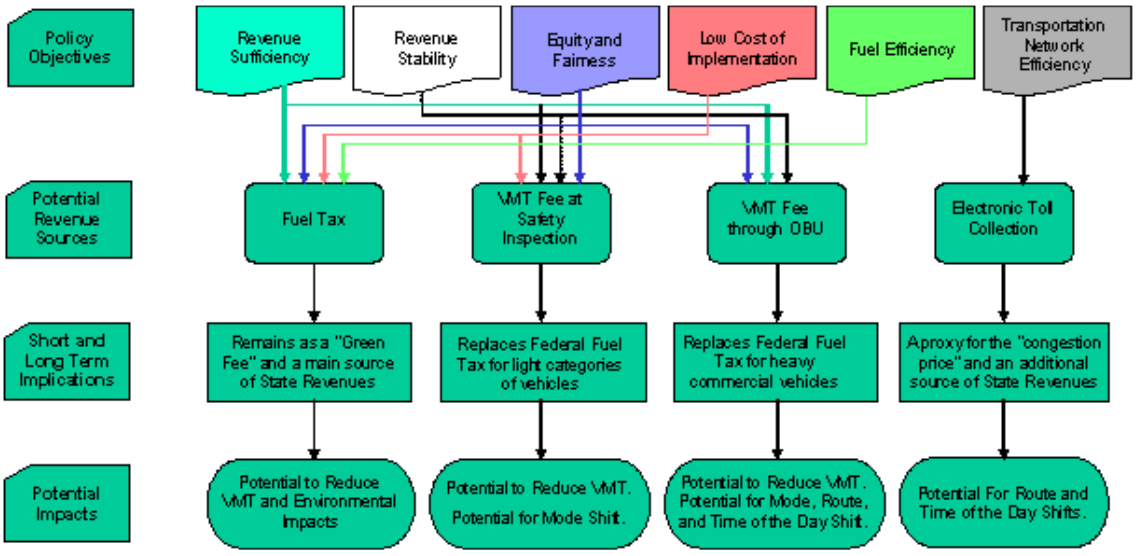


Figure 3. Alternative Finance Approaches Framework.

As depicted in Figure 3, the Fuel Tax, VMT Fee at Safety Inspection, and VMT through OBU (On-Board Unit), all have implications within revenue sufficiency, revenue

stability, equity, and low cost implications. It is important to note in light of the objectives of this research that all electronic toll (AET) collection has proven in certain cases to be successful in the collection of an adequate, stable, equitable, and fuel efficient source of revenue. Furthermore, in cases where the route is heavily traveled (such as Interstates 90 and 93) there is an expectation of revenue stability, because the demand for toll road service has been shown historically on existing toll roads to be inelastic with respect to changes in toll levels. Moreover, implementing tolls on roadways that are not currently tolled, as is the case with North South Interstate 93, has the potential to satisfy equity concerns vis a vis those who pay tolls on the East West Mass Turnpike. In addition, implementing a congestion pricing scheme on Interstate 93 may reduce travel time for those traveling during the peak hours.

CHAPTER IV

RESEARCH METHODOLOGY

4.1 Research Objectives

As presented in section 2, the research objectives are as follows:

- **Review the experiences and lessons learned** with toll based financing approaches to provide revenue to finance toll road improvements and other transportation investments.
- **Identify the financing questions** of interest to State Departments of Transportation with an emphasis on the questions, issues, challenges, merits, and impacts associated with the evaluation and implementation toll based financing approaches as compared to other alternative approaches. Examples of such questions are:
    - What are the major financing approaches available to State DOTs to support surface transportation investments?
    - Should tolls be considered as a major approach along with other approaches such as the fuel tax and/or a sales tax?
    - Should current toll levels be increased and should innovative pricing strategies be employed?
    - Should tolls be charged on existing roads where tolls are not currently collected such as state borders and at other locations?
    - What level of revenue can be expected from such toll based approaches and strategies as compared to other approaches and what analytical methods might be used to make these revenue estimates?

- What innovative technologies might be used to facilitate the collection of tolls and what are the expected capital and operating costs?

- **Contribute to the state of practice** by improving our understanding of the alternative financing approaches being considered by State DOTs and the relative levels of revenue that might be generated with such financing approaches. More specifically, the results of this research are expected to shed light on the contribution toll based approaches are able to make relative to the fuel tax and a sales tax. Finally, the results of the research will illustrate the application of simplified analytical methods to estimate the level of revenues expected from toll based approaches.

4.2 Tasks

In order to achieve the research objectives, the following tasks should be accomplished:

Task 1: Review literature signifying the importance of alternative finance approaches in transportation.

Task 2: Describe the toll approaches to be evaluated and their intended policy objectives.

Task 3: Conduct a case study by formulating toll based approaches and estimating changes in demand and expected revenues using elasticity methods.

A description of each task is provided below.

4.2.1 Task 1: Carry out Literature Review

Task 1 will consist of a literature review on the subject of transportation financing. Literature will be drawn from government reports, scholarly journal articles, university research reports, and other sources. An emphasis will be placed on reviewing

ongoing toll road projects in Texas, New York, and other states in which innovative toll strategies and technologies are being considered. In addition, widely used analytical methods for estimating toll revenues will be described. Finally, the issues, questions, and concerns of interest to State DOT officials as they consider alternative financing approaches regarding will also be discussed. These questions will be used as a basis in the in the formulation of the alternative financing approaches formulated in Task 2 and in conduct of the case study in Task 3.

4.2.2 Task 2: Formulate Alternative Financing Approaches

There are three toll based financing approaches that will be evaluated as part of this research. These three approaches are:

1. Increase tolls on Interstate 90 by 10% each year and impose no tolls on Interstate 93
2. Increase tolls on Interstate 90 for one year and impose a flat rate toll of $1.00 on Interstate 93
3. Increase tolls on Interstate 90 for one year and impose a $1.00 toll on Interstate-93 as well as a congestion toll of an additional $0.50 during the peak travel periods.

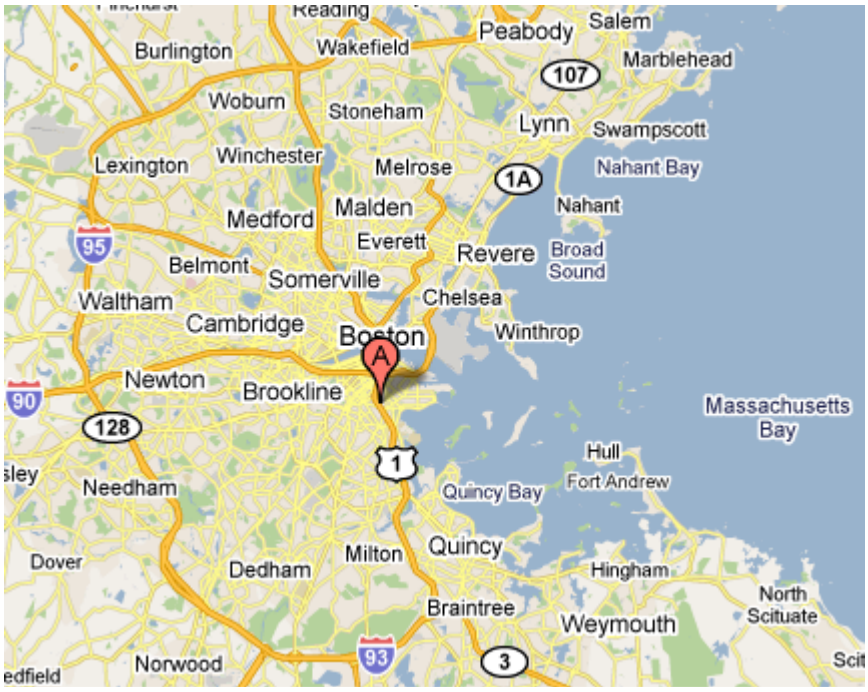


Figure 4. Boston Metropolitan Area Map

Figure 4 depicts the Boston metropolitan area. To the left of the "A" marker, lies Interstate 90 (also known as the Massachusetts Turnpike). North and south of the marker from Braintree to Woburn lies Interstate 93– the highway on which toll implementation is being considered.

The expectation is that raising tolls (including congestion pricing strategies) on the currently tolled Interstate 90 and imposing similar toll strategies on Interstate 93 will generate additional revenue for future transportation investments and possibly reduce peak period congestion.

4.2.3 Task 3

Based on current revenue and demand data and other information compiled by the Central Transportation Planning Staff (CTPS) and others on the East-West Interstate 90 (also referred to as the MassPike) and the North-South Interstate 93, changes in demand and expected revenue along both roadways will be examined for three proposed toll

based approaches using empirically derived toll elasticity values in conjunction with sensitivity analyses.

As stated in Task 2, there are three toll based financing approaches that will be evaluated. These three approaches are:

1. Increase tolls on Interstate-90 by 10% each year and impose no tolls on Interstate-93
2. Increase tolls on Interstate-90 for one year and impose a flat rate toll of $1.00 on Interstate-93
3. Increase tolls on Interstate-90 for one year, impose a $1.00 toll on Interstate-93 as well as a congestion toll of an additional $0.50 during the peak travel periods.

The data supplied by CTPS will allow for the generation of a model for the North-South roadways surrounding the Boston metropolitan area that are not tolled. Using the data, estimates will be developed that map the change in demand experienced when tolls are installed on these roadways on which tolls are not presently collected. This change in demand will then be used to estimate revenue for the new tolls. On Interstate 93 changes in demand and revenue for a $1 and $1.50 toll as well as a incorporating a congestion pricing scheme will be evaluated. For Interstate 93, open-road tolling technology as well as all-electronic payment technology would be the only toll collection option considered, in order to maintain the current flow of traffic.

CTPS data also will be used to further analyze changes in demand and revenue when the toll fares on Interstate 90 are increased. Using this data, changes in demand based on increased toll fares are estimated. Furthermore, after having calculated the demand change, the change in revenue can also be calculated.

CHAPTER V

RESEARCH ANALYSIS AND RESULTS

5.1 Demand and Revenues

Demand and revenue forecasting is never a simple task. Multiple variables need to be considered when approximating changes in demand. The sections below thoroughly outline and describe analytical methods used to estimate changes in demand on roadways when; a) tolls are increased on roadways that currently have tolls; b. tolls are implemented on roadways that are not currently tolled. Two methods of analysis were used: point elasticity and iterative arc elasticity.

5.1.1 Mass Turnpike: The Boston Extension

In January 2010, Cambridge Systematics (CS) prepared a report for the Massachusetts' Department of Transportation that focused on traffic and revenue in the Commonwealth of Massachusetts. This report details the toll transactions, toll revenues, and average toll on the Boston Extension of the Massachusetts' Turnpike. The Boston Extension includes exits 15 to 26 on the Massachusetts' Turnpike. Geographically users who travel on the Boston Extension can travel between Newton, Massachusetts and Logan International Airport. Using this data, an approximated yearly revenue was generated using an elasticity based method for a proposed 10% increase on all tolls on the Turnpike Extension. Furthermore, a sensitivity analysis was conducted to show the impacts of a various elasticity assumptions on revenues.

First and foremost, the data extracted from Table 1 supplied the "original" demand, revenue, and toll prices.

Table 2.8 2009 versus 2008 Toll Transactions and Toll Revenue by Month

	Toll Transactions			Toll Revenue			Average Toll		
Month	2008	2009	Percent Change	2008 (Dollars)	2009 (Dollars)	Percent Change	2008 (Dollars)	2009 (Dollars)	Percent Change
Boston Extension									
January	5,519,797	5,012,039	-9.2%	6,333,613	5,701,418	-10.0%	1.15	1.14	-0.9%
February	5,268,526	4,904,223	-6.9%	6,040,721	5,557,837	-8.0%	1.15	1.13	-1.2%
March	5,830,713	5,512,302	-5.5%	6,674,466	6,230,412	-6.7%	1.14	1.13	-1.3%
April	5,903,935	5,650,435	-4.3%	6,779,977	6,395,176	-5.7%	1.15	1.13	-1.4%
May	6,044,486	5,804,814	-4.0%	6,960,449	6,574,404	-5.5%	1.15	1.13	-1.6%
June	5,798,167	5,738,387	-1.0%	6,680,633	6,496,568	-2.8%	1.15	1.13	-1.7%
July	5,634,641	5,655,532	0.4%	6,512,707	6,417,071	-1.5%	1.16	1.13	-1.8%
August	5,550,527	5,553,963	0.1%	6,425,689	6,313,145	-1.8%	1.16	1.14	-1.8%
September	5,689,641	5,628,847	-1.1%	6,545,288	6,361,542	-2.8%	1.15	1.13	-1.8%
October	6,018,436	5,948,223	-1.2%	6,910,569	6,707,969	-2.9%	1.15	1.13	-1.8%
November	5,344,727	5,443,998	1.9%	6,100,426	6,120,794	0.3%	1.14	1.12	-1.5%
December	5,157,398	5,373,289	4.2%	5,875,509	6,042,163	2.8%	1.14	1.12	-1.3%
Total	**67,760,994**	**66,226,052**	**-2.3%**	**77,840,046**	**74,918,499**	**-3.8%**	**1.15**	**1.13**	**-1.5%**
Tunnels									
January	1,571,531	1,437,340	-8.5%	5,552,556	4,978,964	-10.3%	3.53	3.46	-2.0%
February	1,522,647	1,389,852	-8.7%	5,406,472	4,800,820	-11.2%	3.55	3.45	-2.7%
March	1,721,301	1,613,355	-6.3%	6,133,669	5,603,123	-8.6%	3.56	3.47	-2.5%
April	1,723,964	1,620,336	-6.0%	6,151,708	5,607,243	-8.9%	3.57	3.46	-3.0%
May	1,799,635	1,721,400	-4.3%	6,420,781	5,962,077	-7.1%	3.57	3.46	-2.9%
June	1,784,140	1,724,016	-3.4%	6,384,447	5,973,071	-6.4%	3.58	3.46	-3.2%
July	1,759,165	1,774,237	0.9%	6,233,407	6,129,171	-1.7%	3.54	3.45	-2.5%
August	1,757,576	1,775,579	1.0%	6,221,428	6,138,253	-1.3%	3.54	3.46	-2.3%
September	1,648,027	1,685,177	2.3%	5,857,393	5,861,652	0.1%	3.55	3.48	-2.1%
October	1,739,321	1,785,208	2.6%	6,177,475	6,245,454	1.1%	3.55	3.50	-1.5%
November	1,543,909	1,626,422	5.3%	5,401,681	5,630,699	4.2%	3.50	3.46	-1.0%
December	1,531,920	1,620,728	5.8%	5,324,455	5,543,142	4.1%	3.48	3.42	-1.6%
Total	**20,103,136**	**19,773,650**	**-1.6%**	**71,265,471**	**68,473,669**	**-3.9%**	**3.54**	**3.46**	**-2.3%**

Source: MassDOT.

Table 1. Toll Transactions and Toll Revenue by Month

More specifically, the 2008 data provided an original demand of 67,760,994 toll transactions, a base revenue of $77,840,046 for the year 2008, and an average toll of $1.15. Moreover, the new toll was set to be $1.27 or 10% higher than the 2008 average toll. It should be further noted that although the 2009 data was available, the data used for the I-93 analysis was from 2007 and it was used to maintain consistency.

Mathematically, the equation is: $\varepsilon = \frac{\frac{Old\ Demand - New\ Demand}{Old\ Demand}}{\frac{Old\ Price - New\ Price}{Old\ Price}}$. Substituting constant numbers, the equation is: $\varepsilon = \frac{\frac{67{,}760{,}994 - New\ Demand}{67{,}760{,}994}}{\frac{1.15-1.27}{1.15}}$. In order to demonstrate the impact of a varying elasticity, new demands were calculated for each elasticity value of -0.05 to -0.2 with increments of 0.05. Below are the calculated demands with the appropriate ε.

$\varepsilon = -0.05$

$$-0.05 = \frac{\frac{67{,}760{,}994 - New\ Demand}{67{,}760{,}994}}{\frac{1.15 - 1.27}{1.15}}$$

$$New\ Demand = 67{,}407{,}458\ toll\ transactions$$

$$New\ Revenue = \$1.27 * 67407458 = \$85{,}607{,}471/year$$

$\varepsilon = -0.10$

$$-0.10 = \frac{\frac{67{,}760{,}994 - New\ Demand}{67{,}760{,}994}}{\frac{1.15 - 1.27}{1.15}}$$

$$New\ Demand = 67{,}053{,}900\ toll\ transactions$$

$$New\ Revenue = \$1.27 * 67053900 = \$85{,}158{,}453/year$$

$\varepsilon = -0.15$

$$-0.15 = \frac{\frac{67{,}760{,}994 - New\ Demand}{67{,}760{,}994}}{\frac{1.15 - 1.27}{1.15}}$$

$$New\ Demand = 66{,}700{,}387\ toll\ transactions$$

$$New\ Revenue = \$1.27 * 66700387 = \$84{,}709{,}491/year$$

$\varepsilon = -0.20$

$$-0.20 = \frac{\frac{67{,}760{,}994 - New\ Demand}{67{,}760{,}994}}{\frac{1.15 - 1.27}{1.15}}$$

$$New\ Demand = 66{,}346{,}851\ toll\ transactions$$

$$New\ Revenue = \$1.27 * 66346851 = \$84{,}260{,}500/year$$

Given a varying elasticity from -0.05 to -0.2, the revenue fluctuates from approximately $85.6 million to $84.2 million. Since Cambridge Systematics calculated an elasticity of -0.06, it would be appropriate to consider the second elasticity of -0.1 in order to conservatively estimate revenue.

Elasticity	ε = -0.05		ε = -0.10	
	Base	Forecasted	Base	Forecasted
Demand	67,760,994	67,407,458	67,760,994	67,053,900
Revenue	$77,925,143	$85,607,471	$77,925,143	$85,158,453

Elasticity	ε = -0.15		ε = -0.20	
	Base	Forecasted	Base	Forecasted
Demand	67,760,994	66,700,387	67,760,994	66,346,851
Revenue	$77,925,143	$84,709,491	$77,925,143	$84,260,500

Table 2. Demand and Revenue for the Boston Extension

5.1.2 Mass Turnpike: Western Portion

The Central Transportation Planning Staff provided corridor counts for all major highways surrounding the Boston metropolitan area. These corridor counts include a portion of the tolled Massachusetts' Turnpike (Interstate 90 or I90) as well the untolled Interstate 93 (or I93). Since all the toll based approach alternatives examined include I90, our primary focus was to create an appropriate method to estimate revenues based on the data provided. Since I90's tolling scheme is based primarily on distance, Origin-Destination (O-D) tables were needed to generate accurate estimates of revenue; however, CTPS provided volume counts rather than the coveted O-D tables. In order to circumvent the lack of O-D tables, the toll level from exits 11 to 14 was used as an "average" toll. Therefore, the revenues estimated below for the Massachusetts' Turnpike (Eastbound), should be considered to be *very* conservative values.

In order to more accurately approximate revenues, the analysis of the Turnpike was split into the eastbound and westbound directions.

5.1.2.1 Eastbound Direction

First, the eastbound direction was considered. Since the volume on the Turnpike increased as motorists traveled towards Boston, the only exit volume data considered was at exit 14 (the last exit before the start of the Boston Extension, which was analyzed separately above). In this instance, it was assumed that the old price of the exit toll was \$1.10 and that a 10% increase in that price would be \$1.21. Furthermore, in order to showcase the impacts of a varying elasticity, several elasticity values were used in order to generate new demands as well as revenues. The average volume (per day) on I90 eastbound at exit 14 was 46,233 vehicles. The demand calculations for different elasticities are shown below.

In this analysis, epsilon, $\varepsilon = \frac{\frac{46233-x}{46233}}{\frac{1.10-1.21}{1.10}}$, where x represents the New Demand. Elasticity values of -0.05, -0.10, -0.15, and -0.20 were used to calculate different x's.

$\varepsilon = -0.05$

$$-0.05 = \frac{\frac{46233 - x}{46233}}{\frac{1.10 - 1.21}{1.10}}$$

$$New\ Demand = 46002$$

$$Average\ Daily\ Revenue = \$55{,}662/day$$

$\varepsilon = -0.10$

$$-0.10 = \frac{\frac{46233 - x}{46233}}{\frac{1.10 - 1.21}{1.10}}$$

$$New\ Demand = 45771$$

$$Average\ Daily\ Revenue = \$55{,}383/day$$

$\varepsilon = -0.15$

$$-0.15 = \frac{\frac{46233 - x}{46233}}{\frac{1.10 - 1.21}{1.10}}$$

$$New\ Demand = 45540$$

$$Average\ Daily\ Revenue = \$55{,}103/day$$

$\varepsilon = -0.20$

$$-0.20 = \frac{\frac{46233 - x}{46233}}{\frac{1.10 - 1.21}{1.10}}$$

$$New\ Demand = 45308$$

$$Average\ Daily\ Revenue = \$54{,}823/day$$

To show that the above values were considered liberal, a link-by-link analysis of the eastbound segment was done. In a link-by-link analysis, it was considered that each segment of roadway has a toll level – in this case the toll is the original toll that is charged if a motorist were to enter and exit the turnpike at each entry and exit point (respectively). Tables 3 through 6 summarize this analysis.

Exit 11 to Exit 11a:

Original Demand: 33219
Original Price: $0.45
New Price: $0.50

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	33035	32850	32665	32481
Estimated Revenue/ day	$16352	$16261	$16169	$16078

Table 3. Demand and Revenue Values for I-90E Exit 11 to 11a

Exit 11a to Exit 12:

Original Demand: 36027
Original Price: $0.25
New Price: $0.28

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	35811	35595	35379	35162
Estimated Revenue/ day	$9848	$9789	$9729	$9670

Table 4. Demand and Revenue Values for I-90E Exit 11a to 12

Exit 12 to Exit 13:

Original Demand: 40000
Original Price: $0.30
New Price: $0.33

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	39800	39600	39400	39200
Estimated Revenue/ day	$13134	$13068	$13002	$12936

Table 5. Demand and Revenue Values for I-90E Exit 12 to 13

Exit 13 to Exit 14:

Original Demand: 46233
Original Price: $0.30
New Price: $0.33

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	46002	45771	45540	45308
Estimated Revenue/ day	$15181	$15104	$15028	$14952

Table 6. Demand and Revenue Values for I-90E Exit 13 to 14

It can then be assumed that the average daily revenue for this portion of the Massachusetts' Turnpike using a link-by-link analysis would be $54,515 for an elasticity value of -0.05, $54,222 for an elasticity value of -0.1, $53,929 for an elasticity value of -

0.15, and $53,635 for an elasticity value of -0.2. In the link-by-link analysis, the average daily revenue was smaller than the aggregate data used above. Table 7 summarizes this analysis.

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
Aggregate Revenue	$55,662	$55,383	$55,103	$54,823
Link-by-link Revenue	$54,515	$54,222	$53,929	$53,635

Table 7. Side by Side Revenue Analysis

In order to make a comparison between the current toll prices and the proposed toll prices, current revenues for Exit 11 to Exit 14 were approximated. In order to estimate these toll revenues, the link volume was multiplied by the toll price. Table 8 gives a summary of the original revenue values.

Original Values - I90E			
Eastbound	Volume	Toll Price	Revenue
Exit 11 to 11a	33219	$0.45	14949
Exit 11a to 12	36027	$0.25	9007
Exit 12 to 13	40000	$0.30	12000
Exit 13 to 14	46233	$0.30	13870
Total Revenue			$49,825

Table 8. Original Revenue I-90E

As shown in the analysis, the proposed increase in tolls would result in an increase of $4,000 per day or approximately $1 million per year for eastbound weekday toll transactions.

5.1.2.2 Westbound Direction

On the Massachusetts' Turnpike Westbound, the similar calculations were done. In this case, as motorists headed west towards the New York state border, they exited the turnpike, which allowed for a higher understanding of the data. Below is the general formula of the calculations done for a portion of the Massachusetts' Turnpike westbound.

Like the analysis done for the eastbound direction of the turnpike and the Boston Extension, several elasticity values were used to calculate approximates for the New Demand. As before, epsilon, ε, was set equal to the percent change in demand over the percent change in price. The equation was written as $\varepsilon = \frac{\frac{Old\ Demand - New\ Demand}{Old\ Demand}}{\frac{Old\ Price - New\ Price}{Old\ Price}}$. From there, constant values were substituted which yielded a more condensed equation. The revenues calculated below provide a conservative estimate of potential revenue if the toll price along the turnpike were to increase by 10%.

Below, Tables 9 through 12 summarize the estimated revenues and new demand for each exit.

Exit 14 to Exit 13:
Original Demand: 48356
Original Price: $0.30
New Price: $0.33

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	48114	47872	47631	47389
Estimated Revenue/ day	$15878	$15798	$15718	$15638

Table 9. Demand and Revenue Values for I-90W Exit 14 to 13

Exit 13 to Exit 12:
Original Demand: 41027
Original Price: $0.30
New Price: $0.33

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	40822	40617	40412	40207

Estimated Revenue/ day	$13471	$13404	$13336	$13268

Table 10. Demand and Revenue Values for I-90W Exit 13 to 12

Exit 12 to Exit 11:
Original Demand: 35822
Original Price: $0.25
New Price: $0.28

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	35607	35392	35177	34962
Estimated Revenue/ day	$9792	$9733	$9674	$9615

Table 11. Demand and Revenue Values for I-90W Exit 12 to 11

Exit 11 to Exit 11A:
Original Demand: 33219
Original Price: $0.45
New Price: $0.50

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
New Demand	33035	32850	32665	32481
Estimated Revenue/ day	$16352	$16261	$16169	$16078

Table 12. Demand and Revenue Values for I-90W Exit 11 to 11a

It can then be assumed that the average daily revenue for this portion of the Massachusetts' Turnpike would be $55,493 for an elasticity value of -0.05, $55,195 for an elasticity value of -0.1, $54,897 for an elasticity value of -0.15, and $54,599 for an elasticity value of -0.2. Table 13 summarizes these findings.

Elasticity Value	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
Estimated Revenue/ day	$55,493	$55,195	$54,897	$54,599

Table 13. Total (Western Portion) Estimated Revenue for I-90W

As before, in order to effectively analyze the positive outcome of increasing the tolls on the Massachusetts' Turnpike by 10%, the original revenue needed to be

calculated. Table 14 provides a summary of the link revenues as well as the total estimated revenue for Exit 11 through Exit 14.

Original Values – I90W			
Westbound	Volume	Toll Price	Revenue
Exit 11 to 11a	33219	$0.45	14949
Exit 11a to 12	35822	$0.25	8956
Exit 12 to 13	41027	$0.30	12308
Exit 13 to 14	48356	$0.30	14507
Total Revenue			$50,719

Table 14. Current Volume and Revenues for I-90W

As shown in the analysis, the proposed increase in tolls would result in an increase of $4,000 per day or approximately $1 million per year for westbound weekday toll transactions.

5.1.2.3 Comparison

The revenues and volumes presented above can be converted into daily averages or yearly averages, without becoming too uncertain. The yearly estimates are more accurate because they were converted by Cambridge Systematics, a company which has access to better and more accurate data. Converting daily averages to yearly averages would be a little more complex because it cannot be assumed that the roadway volume on a weekday is comparable to the roadway volume on a weekend or holiday.

The Westbound and Eastbound average revenues appear to be comparable. The average daily revenue for each direction falls between $54,000 and $56,000 per day. On March 29, 2010, the Massachusetts' Turnpike Authority released, "Western Turnpike

Revenue Bonds" which is a document that reported the annual revenue generated by the Massachusetts' Turnpike for the fiscal year that ended on June 30, 2009. The report stated that for Exit 1 to Exit 15 on the Turnpike about $110,773,000 was generated in 2008-2009. The gap between the revenues estimated in this research and the revenues reported by the Turnpike cannot be directly compared because the revenues reported by the Turnpike account for Exit 1 through Exit 15, whereas this research only considers Exit 11 through Exit 14.

5.1.3 Interstate 93

In order to estimate the anticipated revenues on Interstate 93, a freeway that runs North/South through the Boston Metropolitan area, the adjusted 2007 corridor counts provided by the Central Transportation Planning Staff (CTPS) were used. Since the data from CTPS was based on a 250 day year (including only "work" days), the data needed to be adjusted to include 365 days (a full non-leap year). In order to appropriately adjust the data, the individual corridor count sections were multiplied (i.e. North of route 129, North of Exit 16, etc.) by 250 and then divided that number by 365. More explicitly, the equation below was used:

$$\frac{y_i \times 250}{365}$$

Where y_i is the corridor count on section of road under consideration. Moreover, due to the fact that it is being suggested that collection ramps be installed at each exit north of Route 3 and south of Route 28, the exit ramp demand was calculated using the adjusted CTPS data. More specifically, if traffic was moving Northbound towards Route 28, the calculations started with the corridor count from the Braintree Split and subtracted

the following exit from the previous exit (i.e. The corridor count of exit 15 was subtracted from exit 14), in most cases this yielded a positive number. A positive number indicated an increase in volume; a negative number indicated a decrease in volume. It should be noted that negative numbers were discarded and not used in any revenue summations.

Using the adjusted corridor counts provided by CTPS and approximated elasticities, the demand changes on Interstate 93 were estimated for when a toll is collected. Since Interstate 93 is not currently tolled, an arc elasticity was used rather than a standard elasticity calculation. In using an arc elasticity, the nontrivial issue of dividing by 0 was circumvented. The equations for a standard elasticity (the one used for the Massachusetts' Turnpike analysis) and an arc elasticity are shown below:

$$\varepsilon_{standard} = \frac{\frac{Old\ Demand - New\ Demand}{Old\ Demand}}{\frac{Old\ Price - New\ Price}{Old\ Price}}$$

$$\varepsilon_{arc_{i+1}} = \frac{\frac{(New\ Demand)_{i+1} - (Old\ Demand)_i}{(New\ Demand)_{i+1}}}{\frac{(New\ Price)_{i+1} - (Old\ Price)_i}{(New\ Price)_{i+1}}}$$

As you can see from $\varepsilon_{standard}$ the "Old Price" divides the difference of the "New Price" but in this situation the "Old Price" is zero. In order to best approximate the change in demand an iterative method was needed.

Statement of Method:

Step 1: Let $i = 0$

Step 2: Find $ND_i = f(OP_i, NP_i, OD_i)$

Step 3: $OD_{i+1} = ND_i$

Step 4: $i = i + 1$

Step 5 (if necessary): Go to Step 1

To better illustrate this approach, an epsilon, $\varepsilon = -0.05$ and the values in Table 15 were considered.

i	OP_i Old Price	NP_i New Price	OD_i Old Demand	ND_i New Demand
0	\$0.00	\$0.01	10000	ND_0 $(= OD_1)$
1	\$0.01	\$0.02	OD_1	ND_1

Table 15. Calculation Analysis, Step 1

Solve for ND_0:

$$-0.05 = \frac{\frac{ND_0 - 10000}{ND_0}}{\frac{\$0.01 - \$0.00}{\$0.01}}$$

Therefore:

$$ND_0 \approx 9524$$

It then follows that Table 15 (now Table 16) can be filled in as such:

i	Old Price	New Price	Old Demand	New Demand
0	\$0.00	\$0.01	10000	9524
1	\$0.01	\$0.02	9524	ND_1

Table 16. Calculation Analysis, Step 2

Solve for

$$-0.05 = \frac{\frac{ND_1 - 9524}{ND_1}}{\frac{\$0.02 - \$0.01}{\$0.02}}$$

Like before, it can be seen:

$$ND_1 \approx 9292$$

From there the calculations are completed and compiled into Table 17:

i	Old Price	New Price	Old Demand	New Demand
0	$0.00	$0.01	10000	9524
1	$0.01	$0.02	9524	9292

Table 17. Calculation Analysis, Final

Prior to the research, it was expected that implementing tolls on Interstate 93 would significantly reduce demand – the analysis supports our original hypothesis. The manner in which the data was originally presented was disjoint. CTPS looked at link volumes for Interstate 93 (in the north and south direction) north and south of Boston. Since it was proposed that users entering or leaving Boston would have to pay a $1.00 toll, which means that for each Table 18 through 25 a user is expected to pay the toll, regardless if they were already counted in a previous table in which the roadway was going the same direction. Additionally, unlike the analysis done for the Massachusetts' Turnpike, after the first link, the difference in volume (among the following) was only considered, to avoid double counting.

The same method of analysis (as shown above) was applied to the Interstate 93 data for multiple elasticity values and exits. The appendix includes a detailed summary of the iterative analysis done for Interstate 93. Additionally in Tables 21 through 25, the effects of congestion pricing during the AM Peak hour was analyzed. A summary of all the data analysis for I-93 is presented in Tables 18 through 25. It should be noted that all values are considered to be daily estimates.

First, Interstate 93 Northbound, both north and south of Boston were analyzed. Then, Interstate 93 Southbound, both north and south of Boston were analyzed. After that analysis was done, the morning peak volumes were analyzed to measure the effects of congestion pricing during that peak period. The original demand for each link is in parenthesis next to the link location. It was found that there was a huge reduction in

demand as the absolute value of the elasticity increased. In the calculations, to avoid double and triple counting vehicles, it was necessary to use the link volume from the first link and subtracted it from the total volume on the second link – this method was continued until the last link in the chain was reached. Therefore, in the revenue analysis negative demand values were not considered because it meant that more vehicles were exiting the facility than entering them and unfortunately there was no way to extract that information from the data provided.

I93N (South of Boston)				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
SE Expwy @ Braintree Split (67041)	51854	40260	31370	24525
north of Route 28 (4158)	3216	2497	1946	1521
SE Expwy n. of Exit 14 (719)	556	432	336	263
SE Expwy n. of Exit 15 (6603)	5107	3965	3090	2416
SE Expwy n. of Exit 16 (-5233)	-4048	-3143	-2449	-1914
Total	$60733	$47154	$36742	$28725

Table 18. New Demand for I-93N (South of Boston)

I93N (North of Boston)				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
South of Exit 30 (53236)	41176	31970	24911	19475
South of Exit 32 (11428)	8839	6863	5347	4181
South of Exit 33 (979)	757	588	458	358
Stoneham TL (1295)	1002	778	606	474
South of Exit 36 (3134)	2424	1882	1466	1146
South of Rt 129 (-10284)	-7954	-6176	-4812	-3762
Total	$54198	$42081	$32788	$25634

Table 19. New Demand for I-93N (North of Boston)

I93S (South of Boston)				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
SE Expwy n. of Exit 16 (63014)	48739	37842	29486	23052
SE Expwy n. of Exit 15 (15315)	11846	9197	7166	5603
SE Expwy n. of Exit 14 (-2291)	-1772	-1376	-1072	-838
north of Route 28 (-4435)	-3430	-2663	-2075	-1622
SE Expwy @ Braintree Split (-740)	-572	-444	-346	-271
Total	$60585	$47039	$36652	$28655

Table 20. New Demand for I-93S (South of Boston)

I93S (North of Boston)				
Location	**elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
South of Rt 129 (60801)	47027	36513	28450	22242
South of Exit 36 (9312)	7203	5592	4357	3407
Stoneham TL (-3216)	-2487	-1931	-1505	-1176
South of Exit 33 (-1476)	-1142	-886	-691	-540
South of Exit 32 (-3366)	-2603	-2021	-1575	-1231
South of Exit 30 (-9353)	-7234	-5617	-4377	-3422
Total	$54230	$42105	$32807	$25649

Table 21. New Demand for I-93S (North of Boston)

I93S (North of Boston) – Congestion				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
South of Rt 129 (15305)	11599	8825	6738	5161
South of Exit 36 (-1747)	-1324	-1007	-769	-589
Stoneham TL (-935)	-709	-539	-412	-315
South of Exit 33 (226)	171	130	99	76
South of Exit 32 (-630)	-477	-363	-277	-212
South of Exit 30	-1171	-891	-680	-521

(-1545)				
I93S (North of Boston) – Congestion				
Location	**Revenues (in dollars)**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
South of Rt 129	17399	13237	10106	7742
South of Exit 36	-1986	-1511	-1154	-884
Stoneham TL	-1063	-809	-617	-473
South of Exit 33	257	195	149	114
South of Exit 32	-716	-545	-416	-319
South of Exit 30	-1756	-1336	-1020	-782
Total	17656	13432	10256	7856

Table 22. New Demand and Revenue during the AM Peak for I-93S (North of Boston)

I93N (North of Boston) -- Congestion				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
South of Rt 129 (7171)	-1988	-1512	-1155	-885
South of Exit 36 (2507)	1168	889	678	520
Stoneham TL (247)	1015	772	589	452
South of Exit 33 (1339)	187	142	109	83
South of Exit 32 (1541)	1900	1445	1104	845
South of Exit 30 (-2623)	5435	4135	3157	2418
I93N (North of Boston) -- Congestion				
Location	**Revenues (in dollars)**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
South of Rt 129	-2982	-2269	-1732	-1327
South of Exit 36	1752	1333	1018	780
Stoneham TL	1522	1158	884	677
South of Exit 33	281	214	163	125
South of Exit 32	2850	2168	1655	1268
South of Exit 30	8152	6202	4735	3627
Total	14557	11075	8456	6477

Table 23. New Demand and Revenue during the AM Peak for I-93N (North of Boston)

I93S (South of Boston) -- Congestion				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
SE Expwy @ Braintree Split (9589)	7267	5529	4221	3234

north of Route 28 (1969)	1492	1135	867	664
SE Expwy n. of Exit 14 (-1120)	-849	-646	-493	-378
SE Expwy n. of Exit 15 (2853)	2162	1645	1256	962
SE Expwy n. of Exit 16 (-3103)	-2352	-1789	-1366	-1046
I93S (South of Boston) -- Congestion				
Location	**Revenues (in dollars)**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
SE Expwy @ Braintree Split	10901	8293	6332	4851
north of Route 28	2238	1703	1300	996
SE Expwy n. of Exit 14	-1273	-969	-740	-567
SE Expwy n. of Exit 15	3243	2467	1884	1443
SE Expwy n. of Exit 16	-3528	-2684	-2049	-1570
Total	16383	12464	9516	7290

Table 24. New Demand and Revenue during the AM Peak for I-93S (South of Boston)

I93N (South of Boston) -- Congestion				
Location	**Elasticity value**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
SE Expwy @ Braintree Split (13483)	10219	7774	5936	4547
north of Route 28 (634)	480	366	279	214
SE Expwy n. of Exit 14 (589)	446	340	259	199
SE Expwy n. of Exit 15 (1373)	1041	792	604	463
SE Expwy n. of Exit 16 (-17)	-13	-10	-7	-6
I93N (South of Boston) -- Congestion				
Location	**Revenues (in dollars)**			
	-0.05	**-0.1**	**-0.15**	**-0.2**
SE Expwy @ Braintree Split	15328	548	419	321
north of Route 28	721	548	419	321
SE Expwy n. of Exit 14	670	509	389	298
SE Expwy n. of Exit 15	1561	1187	907	695
SE Expwy n. of Exit 16	-19	-15	-11	-9
Total	18279	2794	2133	1634

Table 25. New Demand and Revenue during the AM Peak for I-93N (South of Boston)

5.1.4 Turnpike Application

In order to test the veracity of the method proposed above, the same iterative method was applied to an exit on the Massachusetts' Turnpike. For the analysis, Exit 11

to 11a on the Massachusetts' Turnpike (in the eastbound direction) was used. All parameters and base numbers used previously were once again used.

As depicted in Table 26, below, the new and original methods were compared. The new method yielded a higher value for new demand for all values of ε; however, the percent difference between the two methods at its highest is only 1.5% — relatively small when other factors are taken into consideration. This comparison supports the notion that the iterative calculations using the arc elasticity and the corresponding results may be considered to be reasonable.

It should be noted that one of the main differences between the analysis for this exit on the Massachusetts' Turnpike and the analysis done for Interstate 93 is that the first "Old Price" in the iterative method was \$0.45, rather than \$0.00 (the value that had been used for Interstate 93). If the "Old Price" had been set to \$0.00, as it was in previous calculations, the demand decrease would have been significant. Furthermore, since the original and new methods yield almost the same demand values, using \$0.45 as the original "Old Price" it can be concluded that the calculations in both cases for Interstate 90 and 93 were done in a reasonable manner and that the higher decrease in demand estimated for Interstate 93 may be reasonable.

Exit 11 to Exit 11a:

Original Demand: 33219
Original Price: \$0.45
New Price: \$0.50

	Elasticity Value			
	ε = -0.05	ε = -0.10	ε = -0.15	ε = -0.20
Original Method	33035	32850	32665	32481
New Method	33079	33046	33012	32979

Difference	44	196	347	498
Percent Diff.	0.13%	0.59%	1.07%	1.53%

Table 26. Side by Side Comparison of the Two Methods

5.2 Contributions of the Research

The results of the research will better serve state DOT officials in understanding how tolls can be used as a tool in transportation finance. Toll roads have been used as a source of transportation finance for more than 50 years, but still there are states in the continental U.S. that do not have any tolled roadways. Literature shows that in locations where tolls are currently used, users are looking for better technology and faster collection. In locations where toll roads are non-existent, high speed toll roads and all electronic toll payment systems are being considered as an alternative transportation finance approach.

It should be noted that installing toll roads on roadways that are not currently tolled can have mixed effects. For example, in some instances the roadway users will accept that they need to pay the toll and demand will not change. On the other hand, many roadways users may switch to other roadways where tolls are not charged and demand on these other roads may decrease significantly. Furthermore, as roadway users switch to an alternate route, the roadways in which they choose to relocate are usually not designed to handle increased demand. What may happen is that users would initially switch routes, but the increase in travel time as well as inconvenience would direct them back to the newly tolled highway. As such, demand on the newly tolled highway may not significantly decrease as time went on. It goes without saying that revenue will increase because there was no generated revenue in the first place.

More specifically, on Interstate 93, it was believed that users will use alternative routes to reach their destination. As such, their new route choice could be examined to see if: a) they are in fact switching routes; b) choosing to commute at off-peak times (in the case where congestion pricing is implemented); and finally c) carpooling with co-workers and acquaintances to reduce traveling expenses. Gathering political support and public acceptance to implement tolls on a roadway such as Interstate 93 is expected to be a challenge for State DOT officials because the notion of installing tolls on roads that are not currently tolled may raise a lot of questions.

In raising toll prices on Interstate 90, revenue would also be expected to increase. As shown in the literature, the roads that typically demonstrate a severe decrease in demand when tolls are raised are roads that were not previously tolled. Although demand may fluctuate on Interstate 90, revenue on the roadway is expected to increase which is supported with CTPS data for the MassPike. Moreover, many users who choose to utilize a different facility in response to the toll increase on the MassPike may revert back to the MassPike due to convenience and faster travel times.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The current economic climate serves as an open forum to consider alternative financing approaches for surface transportation. As discussed in the literature, tolling is a major finance approach available to State DOTs to support surface transportation investments. Present trends indicate that toll roads are sustainable financing approaches. Although not referenced in this paper, a vehicle-miles traveled fee or a VMT fee has been suggested as a viable substitute to the gas tax. The current gas tax has been recognized by many researchers and economists as a financing method that is losing its purchasing power -- as the number of hybrid cars increases, the gas tax becomes more ineffective. Another alternative used to support surface transportation investments has been the sales tax (in some states). Using the sales tax to fund surface transportation investments is a complicated issue because people want their taxes to be used in investments that relate to them – not everyone drives. Additionally, other sources imply that a financing approach including many different innovative financing schemes should be considered.

Not only should current toll levels be increased, to remain on par with inflation, but innovative pricing strategies should be employed to reduce congestion during peak hours as well as create a greener transportation system. In employing effective and innovative pricing strategies, congestion on roadways such as Interstate 93, previously discussed, would create a more enjoyable travel experience for the user, generate revenue for the state, and reduce idle time for users (i.e. reducing CO2 emissions).

In employing innovative technologies, toll collection strategies needed to be considered. In this day and age, the literature suggests and later proves that all-electronic

tolling and "cashless" tolling are strategies being considered by many toll road agencies. Roadway users have two goals: they want to get to their destination without incident and they want to do that quickly -- all-electronic tolling better allows users to achieve their goals.

Massachusetts, like most states, is in the middle of an economic decline – especially when it comes to financing transportation while at the same time the State DOT is looking for ways to generate additional revenue for transportation investments. Increasing the tolls on the Massachusetts' Turnpike and implementing tolls on Interstate 93 are viable alternatives to pave way for improvements and new development to transportation infrastructure in the commonwealth. In a place where snow falls can accumulate to more than 40 inches in one month, there needs to money to offset the damaging effects of the weather – implementing the alternatives proposed above can help remedy these hardships. The analysis done on Interstate 93 will allow state department of transportation officials a foundation in which they can use to seek clarity when deciding to implement tolls on a roadway that is not currently tolled. Using an iterative arc elasticity, rather than the standard arc elasticity is believed to yield a more accurate approximation when it comes to forecasting new demand on roadways that were not previously tolled. Furthermore, state officials should know that using the point elasticity method (such as the one used for the Massachusetts' Turnpike) is not a viable option because it leaves the researcher to divide by zero – undefined in mathematics. Furthermore, reflecting on the project demand decrease on Interstate 93, it is expected that a route shift will occur; however, due to the limitations of the data, the alternative routes chosen could not be determined.

Since, the Massachusetts' Turnpike already has tolls and transportation demand is relatively inelastic, increasing the tolls on this roadway, as shown above, would minimally reduce demand while at the same time increase revenue. Most users expect that as inflation increases the cost of living increases as well – they see it everywhere. With the rising cost of oil, produce, taxes, and rent, it is only natural to expect a rise in transportation costs. Looking at the analysis of the Boston Extension, just by increasing the average toll price by 10%, revenues are projected to increase by at least $6 million for the year AND there will be a reduction in congestion on the heavily traveled Boston Extension. Furthermore, looking at the western/central portion of the Turnpike, revenues are projected to increase as well.

Unlike the Boston Extension, current revenue data for the western portion of Turnpike was not made available so it had to be estimated in a manner similar to that of the analysis. For both the eastbound and westbound directions of the Massachusetts' Turnpike, increasing tolls by 10% could yield at least an increase of approximately $8,000 per weekday in revenues or approximately $2,000,000 annually for weekday traffic. If Origin-Destination (OD) tables were available for the entire Western portion of the Turnpike, a more accurate analysis could have been performed. With OD tables, the exact toll price for users would be known and as such be able to better calculate projected revenues.

APPENDIX

93 DATA ANALYSIS

		I93S (south of boston)																			
		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**			
OP	NP	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**
0.0	0.0	6301	6301	6301	6301	1531	1531	1531	1531	-	-	-	-	-	-	-	-		-		-
0	1	4	4	4	4	5	5	5	5	2291	2291	2291	2291	4435	4435	4435	4435	-740	740	-740	740
0.0	**0.0**	6001	5728	5479	5251	1458	1392	1331	1276	-	-	-	-	-	-	-	-		-		-
1	**2**	3	5	5	2	6	3	7	3	2182	2083	1992	1909	4224	4032	3857	3696	-705	673	-643	617
0.0	0.0	5855	5455	5097	4773	1423	1326	1238	1160	-	-	-	-	-	-	-	-		-		-
2	3	0	8	2	8	0	0	8	2	2129	1984	1853	1736	4121	3840	3587	3360	-688	641	-599	561
0.0	0.0	5759	5279	4854	4475	1399	1283	1179	1087	-	-	-	-	-	-	-	-		-		-
3	4	0	8	5	4	7	2	8	7	2094	1920	1765	1627	4053	3716	3417	3150	-676	620	-570	526
0.0	**0.0**	5687	5151	4679	4262	1382	1251	1137	1035	-	-	-	-	-	-	-	-		-		-
4	**5**	9	0	0	3	4	9	2	9	2068	1873	1701	1550	4003	3625	3293	3000	-668	605	-549	501
0.0	0.0	5631	5050	4542	4098	1368	1227	1104		-	-	-	-	-	-	-	-		-		-
5	6	6	0	7	4	7	4	1	9961	2047	1836	1652	1490	3964	3554	3197	2884	-661	593	-533	481
0.0	0.0	5585	4967	4431	3966	1357	1207	1077		-	-	-	-	-	-	-	-		-		-
6	7	0	2	9	2	4	2	1	9639	2031	1806	1611	1442	3931	3496	3119	2791	-656	583	-520	466
0.0	**0.0**	5545	4897	4338	3856	1347	1190	1054		-	-	-	-	-	-	-	-		-		-
7	**8**	4	2	9	0	8	2	5	9372	2016	1780	1578	1402	3903	3447	3054	2714	-651	575	-510	453
0.0	0.0	5511	4836	4259	3761	1339	1175	1035		-	-	-	-	-	-	-	-		-		-
8	9	0	8	1	9	4	5	1	9143	2004	1759	1548	1368	3879	3404	2998	2648	-647	568	-500	442
0.0	0.1	5480	4783	4189	3680	1332	1162	1018		-	-	-	-	-	-	-	-		-		-
9	0	5	6	3	2	0	6	2	8944	1993	1739	1523	1338	3857	3367	2948	2590	-644	562	-492	432
0.1	**0.1**	5453	4736	4127	3608	1325	1151	1003		-	-	-	-	-	-	-	-		-		-
0	**1**	3	3	4	0	4	1	1	8769	1983	1722	1501	1312	3838	3333	2905	2539	-640	556	-485	424
0.1	0.1	5428	4693	4071	3543	1319	1140			-	-	-	-	-	-	-	-		-		-
1	2	6	6	8	6	4	7	9896	8612	1974	1706	1480	1288	3821	3303	2866	2494	-638	551	-478	416
0.1	0.1	5406	4654	4021	3485	1313	1131			-	-	-	-	-	-	-	-		-		-
2	3	1	8	6	5	9	3	9774	8471	1965	1692	1462	1267	3805	3276	2830	2453	-635	547	-472	409
0.1	**0.1**	5385	4619	3975	3432	1308	1122			-	-	-	-	-	-	-	-		-		-
3	**4**	3	3	7	7	9	7	9663	8343	1958	1679	1445	1248	3790	3251	2798	2416	-632	542	-467	403
0.1	0.1	5366	4586	3933	3384	1304	1114			-	-	-	-	-	-	-	-		-		-
4	5	2	5	5	3	2	7	9560	8225	1951	1668	1430	1230	3777	3228	2768	2382	-630	539	-462	397
0.1	0.1	5348	4556	3894	3339	1299	1107			-	-	-	-	-	-	-	-		-		-
5	6	3	1	6	8	9	3	9465	8117	1944	1656	1416	1214	3764	3207	2741	2351	-628	535	-457	392
0.1	**0.1**	5331	4527	3858	3298	1295	1100			-	-	-	-	-	-	-	-		-		-
6	**7**	7	8	4	6	8	5	9378	8017	1938	1646	1403	1199	3753	3187	2716	2322	-626	532	-453	387
0.1	0.1	5316	4501	3824	3260	1292	1094			-	-	-	-	-	-	-	-		-		-
7	8	1	4	7	2	0	0	9296	7924	1933	1637	1391	1185	3741	3168	2692	2295	-624	529	-449	383
0.1	0.1	5301	4476	3793	3224	1288	1088			-	-	-	-	-	-	-	-		-		-
8	9	3	5	1	4	4	0	9219	7837	1927	1628	1379	1172	3731	3151	2670	2269	-623	526	-445	379
0.1	**0.2**	5287	4453	3763	3190	1285	1082			-	-	-	-	-	-	-	-		-		-
9	**0**	4	1	4	8	1	3	9147	7755	1922	1619	1368	1160	3721	3134	2649	2246	-621	523	-442	375

	0.2	5274	4430	3735	3159	1281	1076			-	-	-	-	-	-	-	-	-	-	-	-
0.2	1	2	9	3	2	9	9	9078	7678	1918	1611	1358	1149	3712	3119	2629	2223	-619	520	-439	371
0.2	0.2	5261	4409	3708	3129	1278	1071			-	-	-	-	-	-	-	-	-	-	-	-
1	2	7	9	9	4	8	8	9014	7606	1913	1603	1348	1138	3703	3104	2610	2203	-618	518	-436	367
0.2	**0.2**	5249	4389	3683	3101	1275	1066			-	-	-	-	-	-	-	-	-	-	-	-
2	**3**	8	9	7	2	9	9	8953	7537	1909	1596	1339	1128	3695	3090	2593	2183	-617	516	-433	364
0.2	0.2	5238	4370	3659	3074	1273	1062			-	-	-	-	-	-	-	-	-	-	-	-
3	4	4	9	9	5	1	3	8895	7472	1905	1589	1331	1118	3687	3076	2576	2164	-615	513	-430	361
0.2	0.2	5227	4352	3637	3049	1270	1057			-	-	-	-	-	-	-	-	-	-	-	-
4	5	5	8	1	1	5	9	8840	7410	1901	1583	1322	1109	3679	3064	2560	2146	-614	511	-427	358
0.2	**0.2**	5217	4335	3615	3024	1268	1053			-	-	-	-	-	-	-	-	-	-	-	-
5	**6**	1	5	4	9	0	7	8787	7352	1897	1576	1314	1100	3672	3051	2545	2129	-613	509	-425	355
0.2	0.2	5207	4318	3594	3001	1265	1049			-	-	-	-	-	-	-	-	-	-	-	-
6	7	0	9	7	8	5	7	8737	7296	1893	1570	1307	1091	3665	3040	2530	2113	-611	507	-422	353
0.2	0.2	5197	4302	3574	2979	1263	1045			-	-	-	-	-	-	-	-	-	-	-	-
7	8	4	9	8	7	2	8	8688	7242	1890	1564	1300	1083	3658	3028	2516	2097	-610	505	-420	350
0.2	**0.2**	5188	4287	3555	2958	1260	1042			-	-	-	-	-	-	-	-	-	-	-	-
8	**9**	1	6	8	6	9	1	8642	7191	1886	1559	1293	1076	3651	3018	2503	2082	-609	504	-418	347
0.2		5179	4272	3537	2938	1258	1038			-	-	-	-	-	-	-	-	-	-	-	-
9	0.3	2	9	5	3	8	5	8598	7141	1883	1553	1286	1068	3645	3007	2490	2068	-608	502	-415	345
0.3	0.3	5170	4258	3519	2918	1256	1035			-	-	-	-	-	-	-	-	-	-	-	-
0	1	6	7	9	8	7	0	8555	7094	1880	1548	1280	1061	3639	2997	2477	2054	-607	500	-413	343
0.3	**0.3**	5162	4245	3502	2900	1254	1031			-	-	-	-	-	-	-	-	-	-	-	-
1	**2**	3	0	9	1	6	7	8514	7049	1877	1543	1274	1054	3633	2988	2465	2041	-606	499	-411	341
0.3	0.3	5154	4231	3486	2882	1252	1028			-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	8	6	1	7	5	8474	7005	1874	1539	1268	1048	3628	2978	2454	2028	-605	497	-409	338
0.3	0.3	5146	4219	3470	2864	1250	1025			-	-	-	-	-	-	-	-	-	-	-	-
3	4	4	0	8	8	8	4	8436	6963	1871	1534	1262	1042	3622	2969	2443	2016	-604	495	-408	336
0.3	**0.3**	5138	4206	3455	2848	1249	1022			-	-	-	-	-	-	-	-	-	-	-	-
4	**5**	9	6	6	0	0	4	8398	6922	1868	1529	1256	1035	3617	2961	2432	2004	-603	494	-406	334
0.3	0.3	5131	4194	3440	2831	1247	1019			-	-	-	-	-	-	-	-	-	-	-	-
5	6	5	6	8	8	2	5	8363	6883	1866	1525	1251	1030	3612	2952	2422	1993	-603	493	-404	333
0.3	0.3	5124	4183	3426	2816	1245	1016			-	-	-	-	-	-	-	-	-	-	-	-
6	7	4	0	6	2	4	6	8328	6844	1863	1521	1246	1024	3607	2944	2412	1982	-602	491	-402	331
0.3	**0.3**	5117	4171	3412	2801	1243	1013			-	-	-	-	-	-	-	-	-	-	-	-
7	**8**	5	7	7	0	8	9	8294	6808	1861	1517	1241	1018	3602	2936	2402	1971	-601	490	-401	329
0.3	0.3	5110	4160	3399	2786	1242	1011			-	-	-	-	-	-	-	-	-	-	-	-
8	9	8	8	3	4	1	2	8262	6772	1858	1513	1236	1013	3597	2928	2392	1961	-600	489	-399	327
0.3	0.4	5104	4150	3386	2772	1240	1008			-	-	-	-	-	-	-	-	-	-	-	-
9	0	2	1	3	2	5	7	8230	6737	1856	1509	1231	1008	3592	2921	2383	1951	-599	487	-398	326
0.4	**0.4**	5097	4139	3373	2758	1239	1006			-	-	-	-	-	-	-	-	-	-	-	-
0	**1**	9	8	6	4	0	1	8199	6704	1853	1505	1227	1003	3588	2914	2374	1941	-599	486	-396	324
0.4	0.4	5091	4129	3361	2745	1237	1003			-	-	-	-	-	-	-	-	-	-	-	-
1	2	7	7	3	0	5	7	8169	6671	1851	1501	1222	-998	3584	2907	2366	1932	-598	485	-395	322
0.4	0.4	5085	4119	3349	2732	1236	1001			-	-	-	-	-	-	-	-	-	-	-	-
2	3	6	9	4	0	0	3	8140	6640	1849	1498	1218	-993	3579	2900	2357	1923	-597	484	-393	321
0.4	**0.4**	5079	4110	3337	2719	1234				-	-	-	-	-	-	-	-	-	-	-	-
3	**4**	7	3	7	3	6	9990	8112	6609	1847	1494	1213	-989	3575	2893	2349	1914	-597	483	-392	319
0.4	0.4	5073	4101	3326	2707	1233				-	-	-	-	-	-	-	-	-	-	-	-
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7	**8**	9	9	6	6	8	9216	7188	5625	1774	1379	1075	-842	3434	2669	2082	1629	-573	445	-347	272
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I93N (south of Boston)

		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**			
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I93N (north of Boston)

		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**				**ND (6)**			
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6	**7**	44	52	97	67	9	2	8	2		3		2	6	1		8	2	52	9	41	8701	7390	6297	5383
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2	**3**	51	88	21	00	1	1	1	4	816	2	572	2	9	2	757	7	1	83	2	42	8568	7164	6012	5061
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5	**6**	75	27	44	55	1	3	7	6	811	4	562	0	2	1	743	2	5	56	8	04	8514	7076	5900	4937
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8	**9**	31	23	40	95	9	6	9	6	806	6	552	0	6	1	731	8	0	32	8	71	8467	6997	5803	4828
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4	**5**	15	39	94	61	0	9	7	5	798	4	537	2	6	4	710	5	6	92	9	16	8387	6865	5640	4648
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7	**8**	34	44	32	64	1	6	9	0	795	8	530	5	2	7	701	6	5	75	7	93	8352	6808	5570	4571
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0	**1**	68	74	01	03	5	8	8	2	792	3	524	9	8	1	693	7	5	59	8	72	8320	6756	5506	4502
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3	**4**	15	25	98	74	2	4	3	2	789	9	519	2	4	5	686	9	6	44	0	52	8290	6708	5447	4438
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6	**7**	72	95	18	70	2	5	3	6	787	4	513	7	0	9	679	1	8	31	4	35	8263	6664	5393	4379
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2	**3**	13	79	15	27	6	6	5	0	782	7	504	7	4	9	667	8	3	06	4	03	8213	6583	5296	4275
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5	**6**	90	58	83	74	6	8	0	9	763	7	469	9	9	0	620	8	2	11	0	82	8015	6270	4923	3878
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8	**9**	18	46	52	36	1	4	2	0	762	5	466	7	8	7	617	5	8	04	2	74	8001	6249	4897	3851
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0.9	**0.9**	412	321	251	196	886	689	538	422		59		36	100	78		47	243	18	147	11	-	-	-	-
4	**5**	82	35	04	77	2	8	9	4	759	1	462	2	4	2	611	9	0	92	8	58	7975	6208	4849	3801
0.9	0.9	412	321	250	196	885	689	538	421		59		36	100	78		47	242	18	147	11	-	-	-	-
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0.9	0.9	412	320	250	195	885	688	537	420		59		36	100	78		47	242	18	147	11	-	-	-	-
6	7	39	68	25	94	3	4	2	6	758	0	460	0	3	0	609	7	8	88	3	54	7967	6195	4834	3785
0.9	**0.9**	412	320	249	195	884	687	536	419		58		36	100	77		47	242	18	147	11	-	-	-	-
7	**8**	18	35	86	54	8	7	4	8	758	9	459	0	3	9	608	6	7	86	1	51	7962	6188	4827	3777
0.9	0.9	411	320	249	195	884	687	535	418		58		35	100	77		47	242	18	146	11	-	-	-	-
8	9	97	02	48	14	4	0	6	9	758	9	459	9	2	8	607	5	5	84	9	49	7958	6182	4819	3770
0.9	1.0	**411**	**319**	**249**	**194**	**883**	**686**	**534**	**418**		**58**		**35**	**100**	**77**		**47**	**242**	**18**	**146**	**11**	**-**	**-**	**-**	**-**
9	0	**76**	**70**	**11**	**75**	**9**	**3**	**7**	**1**	**757**	**8**	**458**	**8**	**2**	**8**	**606**	**4**	**4**	**82**	**6**	**46**	**7954**	**6176**	**4812**	**3762**

I93S (north of Boston)

		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**				**ND (6)**			
O P	N P	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**
0. 00	0.0 1	608 01	608 01	608 01	608 01	93 12	93 12	93 12	93 12	321 6	321 6	321 6	321 6	147 6	147 6	147 6	147 6	336 6	336 6	336 6	336 6	935 3	935 3	935 3	935 3
0. 01	**0.0 2**	579 06	552 74	528 70	506 68	88 69	84 65	80 97	77 60	306 3	292 4	279 7	268 0	140 6	134 2	128 3	123 0	320 6	306 0	292 7	280 5	890 8	850 3	813 3	779 4
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0. 04	**0.0 5**	548 81	497 01	451 47	411 26	84 05	76 12	69 14	62 99	290 3	262 9	238 8	217 5	133 2	120 7	109 6	- 998	303 8	275 1	249 9	227 7	844 2	764 5	694 5	632 6
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0.08	0.09	531 74	466 69	410 95	362 98	81 44	71 48	62 94	55 59	281 3	246 9	217 4	192 0	129 1	113 3	- 998	- 881	294 4	258 4	227 5	201 0	818 0	717 9	632 2	558 4
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24	5	39	99	94	20	25	32	75	06	2668	2222	1856	1556	1224	1020	852	714	2792	2325	1943	1629	7759	6461	5399	4526
0.25	**0.26**	50338	41832	34885	29186	7710	6407	5343	4470	-2663	-2213	-1845	-1544	-1222	-1016	-847	-709	-2787	-2316	-1931	-1616	-7744	-6435	-5366	-4490
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0.34	**0.35**	49584	40589	33342	27480	7594	6216	5107	4209	-2623	-2147	-1764	-1454	-1204	-985	-809	-667	-2745	-2247	-1846	-1521	-7627	-6244	-5129	-4227
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0.37	**0.38**	49378	40252	32929	27027	7562	6165	5043	4139	-2612	-2129	-1742	-1430	-1199	-977	-799	-656	-2734	-2228	-1823	-1496	-7596	-6192	-5065	-4158
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0.43	**0.44**	49013	39660	32205	26238	7507	6074	4932	4019	-2592	-2098	-1703	-1388	-1190	-963	-782	-637	-2713	-2196	-1783	-1453	-7540	-6101	-4954	-4036
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0.49	**0.50**	48698	39151	31588	25570	7458	5996	4838	3916	-2576	-2071	-1671	-1353	-1182	-950	-767	-621	-2696	-2167	-1749	-1416	-7491	-6023	-4859	-3933
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0.58	**0.59**	482 93	385 03	308 07	247 32	73 96	58 97	47 18	37 88	255 4	203 7	163 0	130 8	117 2	- 935	- 748	- 600	267 4	213 2	170 6	136 9	742 9	592 3	473 9	380 4
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0.59	0.6	482 52	384 38	307 29	246 48	73 90	58 87	47 06	37 75	255 2	203 3	162 5	130 4	117 1	- 933	- 746	- 598	267 1	212 8	170 1	136 5	742 3	591 3	472 7	379 2
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0.68	0.69	479 13	379 01	300 87	239 64	73 38	58 05	46 08	36 70	253 4	200 5	159 1	126 8	116 3	- 920	- 730	- 582	265 3	209 8	166 6	132 7	737 0	583 0	462 8	368 6
										-	-	-	-	-				-	-	-	-	-	-	-	-
0.69	0.70	478 79	378 46	300 22	238 95	73 33	57 96	45 98	36 60	253 2	200 2	158 8	126 4	116 2	- 919	- 729	- 580	265 1	209 5	166 2	132 3	736 5	582 2	461 8	367 6
										-	-	-	-	-				-	-	-	-	-	-	-	-
0.70	**0.71**	478 44	377 92	299 58	238 27	73 28	57 88	45 88	36 49	253 1	199 9	158 5	126 0	116 1	- 917	- 727	- 578	264 9	209 2	165 9	131 9	736 0	581 4	460 8	366 5
										-	-	-	-	-				-	-	-	-	-	-	-	-
0.71	0.72	478 11	377 39	298 95	237 60	73 22	57 80	45 79	36 39	252 9	199 6	158 1	125 7	116 1	- 916	- 726	- 577	264 7	208 9	165 5	131 5	735 5	580 5	459 9	365 5
										-	-	-	-	-				-	-	-	-	-	-	-	-
0.72	0.73	477 78	376 87	298 33	236 94	73 17	57 72	45 69	36 29	252 7	199 3	157 8	125 3	116 0	- 915	- 724	- 575	264 5	208 6	165 2	131 2	735 0	579 7	458 9	364 5
										-	-	-	-	-				-	-	-	-	-	-	-	-
0.73	**0.74**	477 45	376 35	297 72	236 30	73 12	57 64	45 60	36 19	252 5	199 1	157 5	125 0	115 9	- 914	- 723	- 574	264 3	208 4	164 8	130 8	734 5	578 9	458 0	363 5
0.	0.7	477	375	297	235	73	57	45	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

74	5	13	84	11	66	07	56	50	09	252	198	157	124	115	912	721	572	264	208	164	130	734	578	457	362
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0.	0.7	476	375	296	235	73	57	45	36	252	198	156	124	115	-	-	-	264	207	164	130	733	577	456	361
75	6	81	34	52	03	03	49	41	00	2	5	8	3	7	911	720	571	0	8	2	1	5	4	1	6
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0.	**0.7**	476	374	295	234	72	57	45	35	252	198	156	124	115	-	-	-	263	207	163	129	733	576	455	360
76	**7**	49	85	94	42	98	41	32	90	0	3	5	0	7	910	718	569	8	5	8	8	0	6	2	6
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0.	0.7	476	374	295	233	72	57	45	35	251	198	156	123	115	-	-	-	263	207	163	129	732	575	454	359
77	8	19	36	36	81	93	34	24	81	9	0	2	7	6	909	717	568	6	3	5	4	5	9	4	7
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78	9	88	88	79	21	88	26	15	72	7	8	9	4	5	908	716	566	5	0	2	1	0	1	5	7
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0.	**0.8**	475	373	294	232	72	57	45	35	251	197	155	123	115	-	-	-	263	206	162	128	731	574	452	357
79	**0**	58	41	24	62	84	19	06	63	6	5	6	0	5	906	714	565	3	7	9	8	6	4	6	8
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81	2	99	48	14	47	75	05	90	45	2	0	1	4	3	904	712	562	0	2	3	1	7	0	9	1
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0.	**0.8**	474	372	292	230	72	56	44	35	251	196	154	122	115	-	-	-	262	206	162	127	730	572	450	355
82	**3**	70	03	61	91	70	98	81	36	1	8	8	1	2	903	710	561	8	0	0	8	2	3	1	2
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83	4	41	58	08	35	66	91	73	28	9	5	5	8	2	902	709	559	6	7	7	5	8	6	3	3
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0.	0.8	474	371	291	229	72	56	44	35	250	196	154	121	115	-	-	-	262	205	161	127	729	570	448	353
84	5	13	14	56	80	62	84	65	20	8	3	2	6	1	901	708	558	5	5	4	2	4	9	5	5
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0.	**0.8**	473	370	291	229	72	56	44	35	250	196	153	121	115	-	-	-	262	205	161	126	728	570	447	352
85	**6**	85	71	04	27	57	78	57	11	6	1	9	3	0	900	707	557	3	2	1	9	9	3	7	7
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86	7	58	28	54	73	53	71	50	03	5	9	7	0	0	899	705	555	2	0	8	6	5	6	9	9
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87	8	31	85	04	21	49	64	42	95	3	6	4	7	9	898	704	554	0	8	6	3	1	9	2	1
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0.	**0.8**	473	369	289	227	72	56	44	34	250	195	153	120	114	-	-	-	261	204	160	126	727	568	445	350
88	**9**	04	43	54	69	45	58	35	87	2	4	2	4	8	897	703	553	9	5	3	1	7	3	4	3
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89	0.9	77	02	06	18	41	52	27	79	1	2	9	2	8	896	702	552	7	3	0	8	3	7	7	5
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0.	0.9	472	368	288	226	72	56	44	34	249	195	152	119	114	-	-	-	261	204	159	125	726	567	443	348
90	1	51	61	58	68	37	45	20	72	9	0	6	9	7	895	701	550	6	1	8	5	9	0	9	7

0.91	**0.92**	472 25	368 20	288 10	226 18	72 33	56 39	44 12	34 64	-249 8	-194 8	-152 4	-119 6	114 6	- 894	- 699	- 549	-261 4	-203 8	-159 5	-125 2	-726 5	-566 4	-443 2	-347 9
0.92	0.93	471 99	367 80	287 63	225 69	72 29	56 33	44 05	34 57	-249 7	-194 5	-152 1	-119 4	114 6	- 893	- 698	- 548	-261 3	-203 6	-159 2	-124 9	-726 1	-565 8	-442 5	-347 2
0.93	0.94	471 74	367 41	287 17	225 20	72 25	56 27	43 98	34 49	-249 5	-194 3	-151 9	-119 1	114 5	- 892	- 697	- 547	-261 2	-203 4	-159 0	-124 7	-725 7	-565 2	-441 8	-346 4
0.94	**0.95**	471 49	367 02	286 71	224 73	72 21	56 21	43 91	34 42	-249 4	-194 1	-151 7	-118 9	114 5	- 891	- 696	- 546	-261 0	-203 2	-158 7	-124 4	-725 3	-564 6	-441 0	-345 7
0.95	0.96	471 24	366 63	286 26	224 25	72 17	56 15	43 84	34 35	-249 3	-193 9	-151 4	-118 6	114 4	- 890	- 695	- 544	-260 9	-203 0	-158 5	-124 1	-724 9	-564 0	-440 4	-345 0
0.96	0.97	471 00	366 25	285 81	223 79	72 14	56 09	43 77	34 27	-249 1	-193 7	-151 2	-118 4	114 3	- 889	- 694	- 543	-260 7	-202 8	-158 2	-123 9	-724 5	-563 4	-439 7	-344 3
0.97	**0.98**	470 75	365 87	285 37	223 33	72 10	56 04	43 71	34 20	-249 0	-193 5	-150 9	-118 1	114 3	- 888	- 693	- 542	-260 6	-202 5	-158 0	-123 6	-724 2	-562 8	-439 0	-343 5
0.98	0.99	470 51	365 50	284 94	222 87	72 06	55 98	43 64	34 13	-248 9	-193 3	-150 7	-117 9	114 2	- 887	- 692	- 541	-260 5	-202 3	-157 7	-123 4	-723 8	-562 2	-438 3	-342 8
0.99	**1.00**	**470 27**	**365 13**	**284 50**	**222 42**	**72 03**	**55 92**	**43 57**	**34 07**	**-248 7**	**-193 1**	**-150 5**	**-117 6**	**114 2**	**- 886**	**- 691**	**- 540**	**-260 3**	**-202 1**	**-157 5**	**-123 1**	**-723 4**	**-561 7**	**-437 7**	**-342 2**

I93S (North of Boston) -- Congestion

		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**				**ND (6)**			
OP	NP	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**0.05**	**-0.1**	**-0.15**	**-0.2**	**0.05**	**0.1**	**0.15**	**0.2**	**0.05**	**0.1**	**0.15**	**0.2**	**0.05**	**0.1**	**0.15**	**0.2**	**0.05**	**-0.1**	**-0.15**	**-0.2**
0.00	0.01	153 05	1530 5	1530 5	1530 5	-1747	174 7	-174 7	-174 7	-935	93 5	-935	93 5	226	22 6	226	22 6	-630	63 0	-630	63 0	154 5	154 5	154 5	154 5
0.01	**0.02**	145 76	1391 4	1330 9	1275 4	-1664	158 8	-151 9	-145 6	-890	85 0	-813	77 9	215	20 5	197	18 8	-600	57 3	-548	52 5	147 1	140 5	134 3	128 8
0.02	0.03	142 21	1325 1	1238 0	1159 5	-1623	151 3	-141 3	-132 3	-869	81 0	-756	70 8	210	19 6	183	17 1	-585	54 5	-510	47 7	143 6	133 8	125 0	117 0
0.03	0.04	139 88	1282 4	1179 1	1087 0	-1597	146 4	-134 6	-124 1	-855	78 3	-720	66 4	207	18 9	174	16 1	-576	52 8	-485	44 7	141 2	129 5	119 0	109 7
0.04	**0.05**	138 15	1251 1	1136 4	1035 2	-1577	142 8	-129 7	-118 2	-844	76 4	-694	63 2	204	18 5	168	15 3	-569	51 5	-468	42 6	139 5	126 3	114 7	104 5

0.05	0.06	136,078	1226,6	1103,3	9954	-1561	-140,0	125,9	113,6	-836	-74,9	-674	-60,8	202	18,1	163	14,7	-563	-50,5	-454	-41,0	138,1	123,8	111,4	100,5
0.06	0.07	135,065	1206,4	1076,4	9633	-1548	-137,7	122,9	110,0	-829	-73,7	-658	-58,8	200	17,8	159	14,2	-558	-49,7	-443	-39,7	136,9	121,8	108,7	-972
0.07	**0.08**	134,069	1189,5	1053,9	9366	-1537	-135,8	120,3	106,9	-823	-72,7	-644	-57,2	199	17,6	156	13,8	-554	-49,0	-434	-38,6	136,0	120,1	106,4	-945
0.08	0.09	133,085	1174,8	1034,5	9137	-1528	-134,1	118,1	104,3	-818	-71,8	-632	-55,8	198	17,3	153	13,5	-551	-48,4	-426	-37,6	135,1	118,6	104,4	-922
0.09	0.10	133,011	1161,9	1017,5	8938	-1519	-132,6	116,1	102,0	-813	-71,0	-622	-54,6	197	17,2	150	13,2	-548	-47,8	-419	-36,8	134,4	117,3	102,7	-902
0.10	**0.11**	132,045	1150,4	1002,5	8763	-1512	-131,3	114,4	100,0	-809	-70,3	-612	-53,5	196	17,0	148	12,9	-545	-47,4	-413	-36,1	133,7	116,1	101,2	-885
0.11	0.12	131,085	1140,0	9890	8607	-1505	-130,1	112,9	-982	-805	-69,6	-604	-52,6	195	16,8	146	12,7	-543	-46,9	-407	-35,4	133,1	115,1	998	-869
0.12	0.13	131,030	1130,6	9768	8466	-1499	-129,0	111,5	-966	-802	-69,1	-597	-51,7	194	16,7	144	12,5	-540	-46,5	-402	-34,8	132,5	114,1	986	-855
0.13	**0.14**	130,080	1121,9	9656	8337	-1493	-128,1	110,2	-952	-799	-68,5	-590	-50,9	193	16,6	143	12,3	-538	-46,2	-397	-34,3	132,0	113,3	975	-842
0.14	0.15	130,034	1114,0	9554	8220	-1488	-127,2	109,1	-938	-796	-68,1	-584	-50,2	192	16,4	141	12,1	-536	-45,9	-393	-33,8	131,6	112,5	964	-830
0.15	0.16	129,090	1106,6	9459	8112	-1483	-126,3	108,0	-926	-794	-67,6	-578	-49,6	192	16,3	140	12,0	-535	-45,6	-389	-33,4	131,1	111,7	955	-819
0.16	**0.17**	129,050	1099,7	9371	8012	-1478	-125,5	107,0	-914	-791	-67,2	-573	-48,9	191	16,2	138	11,8	-533	-45,3	-386	-33,0	130,7	111,0	946	-809
0.17	0.18	129,012	1093,3	9289	7918	-1474	-124,8	106,0	-904	-789	-66,8	-568	-48,4	191	16,1	137	11,7	-531	-45,0	-382	-32,6	130,3	110,4	938	-799
0.18	0.19	128,076	1087,3	9213	7831	-1470	-124,1	105,2	-894	-787	-66,4	-563	-47,8	190	16,1	136	11,6	-530	-44,8	-379	-32,2	130,0	109,8	930	-791
0.19	**0.20**	128,042	1081,6	9141	7750	-1466	-123,5	104,3	-885	-785	-66,1	-558	-47,3	190	16,0	135	11,4	-529	-44,5	-376	-31,9	129,6	109,2	923	-782
0.20	0.21	128,010	1076,2	9072	7673	-1462	-122,8	103,6	-876	-783	-65,7	-554	-46,9	189	15,9	134	11,3	-527	-44,3	-373	-31,6	129,3	108,6	916	-775
0.21	0.22	127,080	1071,1	9008	7601	-1459	-122,1	102,8	-868	-781	-65,5	-550	-46,2	189	15,8	133	11,2	-526	-44,2	-371	-31,4	129,1	108,9	909	-767

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0.2	**0.2**	127	1066			-	121	102	-	-	65	-	46		15		11	-	43	-	31	128	107	-	-
2	**3**	51	2	8947	7532	1455	7	1	860	779	1	547	0	188	7	132	1	525	9	368	0	7	6	903	760
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0.2	0.2	127	1061			-	121	101	-	-	64	-	45		15		11	-	43	-	30	128	107	-	-
3	4	23	6	8889	7467	1452	2	5	852	777	9	543	6	188	7	131	0	524	7	366	7	4	2	897	754
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0.2	0.2	126	1057			-	120	100	-	-	64	-	45		15		10	-	43	-	30	128	106	-	-
4	5	97	2	8834	7406	1449	7	8	845	776	6	540	2	187	6	130	9	523	5	364	5	2	7	892	748
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0.2	**0.2**	126	1053			-	120	100	-	-	64	-	44		15		10	-	43	-	30	127	106	-	-
5	**6**	71	0	8781	7347	1446	2	2	839	774	3	536	9	187	5	130	8	522	3	361	2	9	3	886	742
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0.2	0.2	126	1049			-	119	-	-	-	64	-	44		15		10	-	43	-	30	127	105	-	-
6	7	47	0	8731	7291	1444	7	997	832	773	1	533	5	187	5	129	8	521	2	359	0	7	9	881	736
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0.2	0.2	126	1045			-	119	-	-	-	63	-	44		15		10	-	43	-	29	127	105	-	-
7	8	24	1	8683	7237	1441	3	991	826	771	8	530	2	186	4	128	7	520	0	357	8	4	5	876	731
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0.2	**0.2**	126	1041			-	118	-	-	-	63	-	43		15		10	-	42	-	29	127	105	-	-
8	**9**	01	4	8636	7186	1438	9	986	820	770	6	528	9	186	4	128	6	519	9	356	6	2	1	872	725
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0.2		125	1037			-	118	-	-	-	63	-	43		15		10	-	42	-	29	127	104	-	-
9	0.3	79	8	8592	7137	1436	5	981	815	768	4	525	6	186	3	127	5	518	7	354	4	0	8	867	720
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	0.3	125	1034			-	118	-	-	-	63	-	43		15		10	-	42	-	29	126	104	-	-
0.3	1	58	4	8549	7089	1433	1	976	809	767	2	522	3	185	3	126	5	517	6	352	2	8	4	863	716
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0.3	**0.3**	125	1031			-	117	-	-	-	63	-	43		15		10	-	42	-	29	126	104	-	-
1	**2**	38	0	8508	7044	1431	7	971	804	766	0	520	0	185	2	126	4	516	4	350	0	6	1	859	711
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0.3	0.3	125	1027			-	117	-	-	-	62	-	42		15		10	-	42	-	28	126	103	-	-
2	3	19	8	8468	7000	1429	3	967	799	765	8	517	8	185	2	125	3	515	3	349	8	4	8	855	707
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0.3	0.3	125	1024			-	117	-	-	-	62	-	42		15		10	-	42	-	28	126	103	-	-
3	4	00	7	8430	6958	1427	0	962	794	764	6	515	5	185	1	124	3	515	2	347	6	2	4	851	702
							-	-			-		-						-		-	-	-		
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1.1	1.1	117				-	-103	-	-	-	-55	-	-33		13			-	-37	-	-22	118	-	-	-
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7	8	40	9040	6985	5416	1340	2	797	618	717	2	427	1	173	3	103	80	483	2	288	3	5	913	705	547
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8	9	44				1329	101 5 -	778	598	711	54 3 -	416	32 0 -		1			479	36 6 -	281	21 6 -	117 5 -	898	688	529
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1.4 9	**1.5**	**115 99**	**8825**	**6738**	**5161**	**- 1324**	**100 7**	**- 769**	**- 589**	**- 709**	**53 9**	**- 412**	**31 5**	**171**	**13 0**	**99**	**76**	**- 477**	**36 3**	**- 277**	**21 2**	**117 1**	**- 891**	**- 680**	**- 521**

I93N (North of Boston) -- Congestion

		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**				**ND (6)**			
OP	NP	**- 0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**- 0.15**	**- 0.2**		**- 0.05**	**- 0.1**	**- 0.15**	**- 0.2**	**- 0.05**	**- 0.1**	**- 0.15**	**- 0.2**	**- 0.05**	**- 0.1**	**- 0.15**	**- 0.2**	**- 0.05**	**- 0.1**	**- 0.15**	**- 0.2**
0.0 0	0.0 1	717 1	7171	7171	7171	2507	25 07	250 7	25 07	247	24 7	247	24 7	133 9	13 39	133 9	13 39	154 1	15 41	154 1	15 41	262 3	262 3	262 3	262 3
0.0 1	**0.0 2**	683 0	6519	6236	5976	2388	22 79	218 0	20 89	235	22 5	215	20 6	127 5	12 17	116 4	11 16	146 8	14 01	134 0	12 84	249 8	238 5	228 1	218 6
0.0	0.0	666	6209	5801	5433	2329	21	202	18	230	21	200	18	124	11	108	10	143	13	124	11	-	-	-	-

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0.03	**0.04**	6554	6008	5524	5093	2291	2101	1931	1781	226	207	190	175	1224	1122	1032	951	1408	1291	1187	1094	2397	2198	2021	1863
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0.47	**0.48**	5755	4637	3749	3041	2012	1621	1311	1063	198	160	129	105	1075	866	700	568	1237	996	806	653	210-5	169-6	137-1	111-2
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0.49	**0.50**	5743	4618	3726	3016	2008	1614	1302	1054	198	159	128	104	1072	862	696	563	1234	992	801	648	210-1	168-9	136-3	110-3
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0.53	**0.54**	5721	4582	3682	2969	2000	1602	7	38	197	8	127	2	8	6	688	54	9	5	791	8	2093	1676	1347	1086
0.54	0.55	5716	4573	3672	2958	1998	1599	4	34	197	8	126	2	7	4	686	52	8	3	789	6	2091	1673	1343	1082
0.55	**0.56**	5711	4565	3662	2948	1996	1596	0	31	197	7	126	2	6	2	684	50	7	1	787	3	2089	1670	1340	1078
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0.57	**0.58**	5701	4549	3643	2927	1993	1590	4	23	196	7	125	1	4	9	680	47	5	8	783	9	2085	1664	1332	1071
0.58	0.59	5696	4541	3633	2917	1991	1588	0	20	196	6	125	0	4	8	678	45	4	6	781	7	2083	1661	1329	1067
0.59	**0.60**	5691	4533	3624	2907	1990	1585	7	16	196	6	125	0	3	7	677	43	3	4	779	5	2082	1658	1326	1063
0.60	0.61	5686	4526	3615	2897	1988	1582	4	13	196	6	125	0	2	5	675	41	2	3	777	3	2080	1655	1325	1060
0.61	**0.62**	5682	4519	3606	2888	1986	1580	1	10	196	6	124	99	1	4	673	39	1	1	775	1	2078	1653	1319	1056
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0.63	**0.64**	5672	4504	3589	2870	1983	1575	5	03	195	5	124	99	9	1	670	36	9	8	771	7	2075	1648	1313	1050
0.64	0.65	5668	4497	3581	2861	1982	1572	2	00	195	5	123	99	8	0	669	34	8	6	769	5	2073	1645	1310	1046
0.65	**0.66**	5664	4490	3572	2852	1980	1570	9	7	195	5	123	98	8	8	667	33	7	5	768	3	2072	1642	1307	1043
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0.67	**0.68**	5655	4477	3556	2835	1977	1565	3	1	195	4	122	98	6	6	664	29	5	2	764	9	2069	1637	1301	1037
0.68	0.69	5651	4470	3549	2826	1976	1563	1	8	195	4	122	97	5	5	663	28	4	1	763	7	2067	1635	1298	1034

0.69	**0.70**	5647	4464	3541	2818	1974	1561	1238	985	195	154	122	97	1054	833	661	526	1213	959	761	606	-2066	-1633	-1295	-1031
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0.71	**0.72**	5639	4451	3526	2802	1971	1556	1233	980	194	153	121	97	1053	831	658	523	1212	956	758	602	-2063	-1628	-1290	-1025
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0.73	**0.74**	5631	4439	3511	2787	1969	1552	1228	974	194	153	121	96	1051	829	656	520	1210	954	755	599	-2060	-1624	-1285	-1019
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0.77	**0.78**	5616	4415	3484	2758	1963	1544	1218	964	193	152	120	95	1049	824	650	515	1207	949	749	593	-2054	-1615	-1274	-1009
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0.79	**0.80**	5609	4404	3470	2744	1961	1540	1213	959	193	152	120	95	1047	822	648	512	1205	946	746	590	-2052	-1611	-1269	-1004
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0.85	**0.86**	5589	4372	3433	2704	1954	1529	1200	945	192	151	118	93	1044	816	641	505	1201	940	738	581	-2045	-1599	-1255	-989

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1.09	**1.10**	5520	4265	3308	2574	1930	1491	116	900	190	147	114	89	1031	796	618	481	1186	917	711	553	2019	1560	1210	-941
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1.15	**1.16**	5505	4243	3281	2546	1925	1483	114	890	190	146	113	88	1028	792	613	475	1183	912	705	547	2014	1552	1200	-931
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1.27	**1.28**	5478	4201	3233	2497	1915	1469	1130	873	189	145	111	86	1023	784	604	466	1177	903	695	536	-2004	-1537	-1183	-913
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1.29	**1.30**	5474	4194	3226	2489	1914	1466	1128	870	189	144	111	86	1022	783	602	465	1176	901	693	535	-2002	-1534	-1180	-910
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1.36	1.37	5460	4172	3200	2463	1909	1459	1119	861	188	144	110	85	1019	779	598	460	1173	897	688	529	1997	1526	1171	-901
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1.43	**1.44**	5446	4152	3176	2438	1904	1451	1110	852	188	143	109	84	1017	775	593	455	1170	892	683	524	1992	1519	1162	-892
1.44	1.45	5444	4149	3173	2435	1903	1450	1109	851	188	143	109	84	1017	775	592	455	1170	891	682	523	1991	1518	1161	-891
1.45	**1.46**	5442	4146	3170	2431	1903	1449	1108	850	187	143	109	84	1016	774	592	454	1169	891	681	523	1991	1518	1159	-889
1.46	1.47	5440	4143	3166	2428	1902	1448	1107	849	187	143	109	84	1016	774	591	453	1169	890	680	522	1990	1517	1158	-888
1.47	**1.48**	5438	4140	3163	2425	1901	1447	1106	848	187	143	109	84	1015	773	591	453	1169	890	680	521	1989	1516	1157	-887
1.48	1.49	5437	4137	3160	2422	1901	1446	1105	847	187	143	109	83	1015	773	590	452	1168	889	679	520	1989	1516	1156	-886
1.49	**1.50**	**5435**	**4135**	**3157**	**2418**	**1900**	**1445**	**1104**	**845**	**187**	**142**	**109**	**83**	**1015**	**772**	**589**	**452**	**1168**	**889**	**678**	**520**	**1988**	**1512**	**1155**	**-885**

		I93N (South of Boston) -- Congestion																			
		ND (1)				ND (2)				ND (3)				ND (4)				ND (5)			
OP	NP	-0.05	-0.1	-0.15	-0.2	-0.05	-0.1	-0.15	-0.2	-0.05	-0.1	-0.15	-0.2	-0.05	-0.1	-0.15	-0.2	-0.05	-0.1	-0.15	-0.2

0.0	0.0	958	958					196	196	-	-	-	-	285	285	285	285	-	-	-	-		
0	1	9	9	9589	9589	1969	1969	9	9	1120	1120	1120	1120	3	3	3	3	3103	3103	3103	3103		
0.0	**0.0**	913	871					171	164	-	-			271	259	248	237	-	-	-	-		
1	**2**	2	7	8338	7991	1875	1790	2	1	1067	1018	-974	-933	7	4	1	8	2955	2821	2698	2586		
0.0	0.0	891	830					159	149	-				265	247	230	216	-	-	-	-		
2	3	0	2	7757	7264	1830	1705	3	2	1041	-970	-906	-848	1	0	8	1	2883	2687	2510	2351		
0.0	**0.0**	876	803					151	139	-				260	239	219	202	-	-	-	-		
3	**4**	4	4	7387	6810	1800	1650	7	8	1024	-938	-863	-795	7	0	8	6	2836	2600	2390	2204		
0.0	0.0	865	783					146	133	-				257	233	211	193	-	-	-	-		
4	5	5	8	7120	6486	1777	1610	2	2	1011	-916	-832	-758	5	2	8	0	2801	2537	2304	2099		
0.0	**0.0**	857	768					141	128	-				255	228	205	185	-	-	-	-		
5	**6**	0	5	6913	6237	1760	1578	9	1	1001	-898	-807	-728	0	6	7	6	2773	2487	2237	2018		
0.0	0.0	849	755					138	123					252	224	200	179	-	-	-	-		
6	7	9	9	6744	6035	1745	1552	5	9	-993	-883	-788	-705	9	9	7	6	2750	2446	2182	1953		
0.0	0.0	843	745					135	120					251	221	196	174	-	-	-	-		
7	8	9	2	6603	5868	1733	1530	6	5	-986	-870	-771	-685	1	7	4	6	2731	2412	2137	1899		
0.0	**0.0**	838	736					133	117					249	219	192	170	-	-	-	-		
8	**9**	6	0	6481	5725	1722	1511	1	5	-980	-860	-757	-669	5	0	8	3	2714	2382	2097	1852		
0.0	0.1	834	727					130	115					248	216	189	166	-	-	-	-		
9	0	0	9	6375	5600	1712	1495	9	0	-974	-850	-745	-654	1	6	7	6	2699	2356	2063	1812		
0.1	**0.1**	829	720					129	112					246	214	186	163	-	-	-	-		
0	**1**	8	7	6281	5490	1704	1480	0	7	-969	-842	-734	-641	9	4	9	4	2685	2332	2032	1777		
0.1	0.1	826	714					127	110					245	212	184	160	-	-	-	-		
1	2	1	2	6196	5392	1696	1467	2	7	-965	-834	-724	-630	8	5	4	4	2673	2311	2005	1745		
0.1	**0.1**	822	708					125	108					244	210	182	157	-	-	-	-		
2	**3**	7	3	6120	5304	1689	1454	7	9	-961	-827	-715	-620	8	7	1	8	2662	2292	1980	1716		
0.1	0.1	819	702					124	107					243	209	180	155	-	-	-	-		
3	4	5	9	6050	5224	1683	1443	2	3	-957	-821	-707	-610	8	1	0	4	2652	2275	1958	1690		
0.1	0.1	816	697					122	105					243	207	178	153	-	-	-	-		
4	5	6	9	5986	5150	1677	1433	9	8	-954	-815	-699	-602	0	7	1	2	2642	2259	1937	1667		
0.1	**0.1**	813	693					121	104					242	206	176	151	-	-	-	-		
5	**6**	9	3	5927	5082	1671	1424	7	4	-951	-810	-692	-594	1	3	3	2	2634	2244	1918	1645		
0.1	0.1	811	689					120	103					241	205	174	149	-	-	-	-		
6	7	3	0	5871	5020	1666	1415	6	1	-948	-805	-686	-586	4	0	7	3	2625	2230	1900	1624		
0.1	**0.1**	809	685					119	101					240	203	173	147	-	-	-	-		
7	**8**	0	0	5820	4961	1661	1407	5	9	-945	-800	-680	-579	7	8	2	6	2618	2217	1883	1605		
0.1	0.1	806	681					118	100					240	202	171	146	-	-	-	-		
8	9	7	2	5772	4907	1657	1399	5	8	-942	-796	-674	-573	0	7	7	0	2611	2204	1868	1588		
0.1	**0.2**	804	677					117						239	201	170	144	-	-	-	-		
9	**0**	6	6	5727	4856	1652	1391	6	997	-940	-791	-669	-567	4	6	4	5	2604	2193	1853	1571		
0.2	0.2	802	674					116						238	200	169	143	-	-	-	-		
0	1	6	3	5684	4807	1648	1385	7	987	-937	-788	-664	-562	8	6	1	0	2597	2182	1839	1556		
0.2	0.2	800	671					115						238	199	167	141	-	-	-	-		
1	2	7	1	5644	4762	1644	1378	9	978	-935	-784	-659	-556	2	7	9	7	2591	2172	1826	1541		
0.2	**0.2**	798	668					115						237	198	166	140	-	-	-	-		
2	**3**	9	0	5606	4719	1640	1372	1	969	-933	-780	-655	-551	7	8	8	4	2585	2162	1814	1527		
0.2	0.2	797	665					114						237	197	165	139	-	-	-	-		
3	4	1	1	5569	4679	1637	1366	4	961	-931	-777	-650	-546	2	9	7	2	2580	2152	1802	1514		
0.2	**0.2**	795	662					113						236	197	164	138	-	-	-	-		
4	**5**	5	4	5535	4640	1633	1360	6	953	-929	-774	-646	-542	7	1	7	0	2574	2143	1791	1501		

0.2	0.2	793	659					113						236	196	163	137	-	-	-	-		
5	6	9	7	5502	4603	1630	1355	0	945	-927	-771	-643	-538	2	3	7	0	2569	2135	1780	1490		
0.2	**0.2**	792	657					112						235	195	162	135	-	-	-	-		
6	**7**	4	2	5470	4568	1627	1350	3	938	-925	-768	-639	-534	8	5	8	9	2564	2127	1770	1478		
0.2	0.2	790	654					111						235	194	161	134	-	-	-	-		
7	8	9	8	5440	4534	1624	1345	7	931	-924	-765	-635	-530	3	8	9	9	2559	2119	1760	1467		
0.2	0.2	789	652					111						234	194	161	134	-	-	-	-		
8	9	5	5	5411	4502	1621	1340	1	924	-922	-762	-632	-526	9	1	0	0	2555	2111	1751	1457		
0.2	**0.3**	788	650					110						234	193	160	133	-	-	-	-		
9	**0**	1	2	5383	4471	1618	1335	5	918	-921	-759	-629	-522	5	5	2	0	2550	2104	1742	1447		
0.3	0.3	786	648					110						234	192	159	132	-	-	-	-		
0	1	8	1	5356	4442	1616	1331	0	912	-919	-757	-626	-519	1	8	4	2	2546	2097	1733	1437		
0.3	**0.3**	785	646					109						233	192	158	131	-	-	-	-		
1	**2**	6	0	5331	4413	1613	1326	5	906	-918	-754	-623	-515	7	2	6	3	2542	2090	1725	1428		
0.3	0.3	784	644					108						233	191	157	130	-	-	-	-		
2	3	3	0	5306	4386	1611	1322	9	901	-916	-752	-620	-512	4	6	9	5	2538	2084	1717	1419		
0.3	**0.3**	783	642					108						233	191	157	129	-	-	-	-		
3	**4**	1	0	5282	4359	1608	1318	5	895	-915	-750	-617	-509	0	0	1	7	2534	2078	1709	1411		
0.3	0.3	782	640					108						232	190	156	128	-	-	-	-		
4	5	0	1	5258	4334	1606	1314	0	890	-913	-748	-614	-506	7	5	5	9	2531	2071	1702	1402		
0.3	0.3	780	638					107						232	189	155	128	-	-	-	-		
5	6	9	3	5236	4309	1603	1311	5	885	-912	-746	-612	-503	3	9	8	2	2527	2066	1694	1394		
0.3	**0.3**	779	636					107						232	189	155	127	-	-	-	-		
6	**7**	8	5	5214	4285	1601	1307	1	880	-911	-743	-609	-501	0	4	1	5	2523	2060	1687	1387		
0.3	0.3	778	634					106						231	188	154	126	-	-	-	-		
7	8	7	8	5193	4262	1599	1304	6	875	-910	-741	-607	-498	7	9	5	8	2520	2054	1681	1379		
0.3	**0.3**	777	633					106						231	188	153	126	-	-	-	-		
8	**9**	7	2	5173	4240	1597	1300	2	871	-908	-740	-604	-495	4	4	9	2	2517	2049	1674	1372		
0.3	0.4	776	631					105						231	187	153	125	-	-	-	-		
9	0	7	5	5153	4218	1595	1297	8	866	-907	-738	-602	-493	1	9	3	5	2513	2044	1668	1365		
0.4	**0.4**	775	630					105						230	187	152	124	-	-	-	-		
0	**1**	8	0	5134	4197	1593	1294	4	862	-906	-736	-600	-490	8	4	7	9	2510	2039	1661	1358		
0.4	0.4	774	628					105						230	187	152	124	-	-	-	-		
1	2	8	4	5115	4177	1591	1290	0	858	-905	-734	-597	-488	5	0	2	3	2507	2034	1655	1352		
0.4	0.4	773	626					104						230	186	151	123	-	-	-	-		
2	3	9	9	5097	4157	1589	1287	7	854	-904	-732	-595	-486	3	5	6	7	2504	2029	1649	1345		
0.4	**0.4**	773	625					104						230	186	151	123	-	-	-	-		
3	**4**	0	5	5079	4138	1587	1284	3	850	-903	-731	-593	-483	0	1	1	1	2501	2024	1644	1339		
0.4	0.4	772	624					103						229	185	150	122	-	-	-	-		
4	5	1	1	5062	4119	1585	1281	9	846	-902	-729	-591	-481	7	7	6	6	2499	2019	1638	1333		
0.4	**0.4**	771	622					103						229	185	150	122	-	-	-	-		
5	**6**	3	7	5045	4101	1584	1279	6	842	-901	-727	-589	-479	5	3	1	0	2496	2015	1633	1327		
0.4	0.4	770	621					103						229	184	149	121	-	-	-	-		
6	7	4	3	5029	4083	1582	1276	3	838	-900	-726	-587	-477	2	9	6	5	2493	2011	1627	1321		
0.4	**0.4**	769	620					102						229	184	149	121	-	-	-	-		
7	**8**	6	0	5013	4066	1580	1273	9	835	-899	-724	-585	-475	0	5	1	0	2490	2006	1622	1316		
0.4	0.4	768	618					102						228	184	148	120	-	-	-	-		
8	9	8	7	4997	4049	1579	1270	6	831	-898	-723	-584	-473	7	1	7	5	2488	2002	1617	1310		
0.4	0.5	768	617					102						228	183	148	120	-	-	-	-		
9	0	0	5	4982	4033	1577	1268	3	828	-897	-721	-582	-471	5	7	2	0	2485	1998	1612	1305		

0.5	**0.5**	767	616					102						228	183	147	119	-	-	-	-		
0	**1**	2	2	4967	4017	1575	1265	0	825	-896	-720	-580	-469	3	3	8	5	2483	1994	1607	1300		
0.5	0.5	766	615					101						228	183	147	119	-	-	-	-		
1	2	5	0	4952	4001	1574	1263	7	822	-895	-718	-578	-467	1	0	3	0	2480	1990	1603	1295		
0.5	**0.5**	765	613					101						227	182	146	118	-	-	-	-		
2	**3**	8	8	4938	3986	1572	1260	4	818	-894	-717	-577	-466	8	6	9	6	2478	1986	1598	1290		
0.5	0.5	765	612					101						227	182	146	118	-	-	-	-		
3	4	0	7	4924	3971	1571	1258	1	815	-894	-716	-575	-464	6	3	5	1	2476	1983	1593	1285		
0.5	**0.5**	764	611					100						227	182	146	117	-	-	-	-		
4	**5**	3	6	4910	3956	1569	1256	8	812	-893	-714	-574	-462	4	0	1	7	2473	1979	1589	1280		
0.5	0.5	763	610					100						227	181	145	117	-	-	-	-		
5	6	6	4	4897	3942	1568	1253	6	809	-892	-713	-572	-460	2	6	7	3	2471	1975	1585	1276		
0.5	0.5	763	609					100						227	181	145	116	-	-	-	-		
6	7	0	4	4884	3928	1567	1251	3	806	-891	-712	-570	-459	0	3	3	9	2469	1972	1580	1271		
0.5	**0.5**	762	608					100						226	181	144	116	-	-	-	-		
7	**8**	3	3	4871	3914	1565	1249	0	804	-890	-710	-569	-457	8	0	9	4	2467	1968	1576	1267		
0.5	0.5	761	607											226	180	144	116	-	-	-	-		
8	9	6	2	4859	3900	1564	1247	998	801	-890	-709	-567	-456	6	7	6	0	2465	1965	1572	1262		
0.5	**0.6**	761	606											226	180	144	115	-	-	-	-		
9	**0**	0	2	4846	3887	1563	1245	995	798	-889	-708	-566	-454	4	4	2	7	2463	1962	1568	1258		
0.6	0.6	760	605											226	180	143	115	-	-	-	-		
0	1	4	2	4834	3874	1561	1243	993	796	-888	-707	-565	-453	2	1	8	3	2460	1958	1564	1254		
0.6	**0.6**	759	604											226	179	143	114	-	-	-	-		
1	**2**	7	2	4822	3862	1560	1241	990	793	-887	-706	-563	-451	0	8	5	9	2458	1955	1561	1250		
0.6	0.6	759	603											225	179	143	114	-	-	-	-		
2	3	1	2	4811	3849	1559	1239	988	790	-887	-705	-562	-450	9	5	1	5	2456	1952	1557	1246		
0.6	0.6	758	602											225	179	142	114	-	-	-	-		
3	4	5	3	4799	3837	1558	1237	985	788	-886	-703	-561	-448	7	2	8	2	2455	1949	1553	1242		
0.6	**0.6**	757	601											225	178	142	113	-	-	-	-		
4	**5**	9	3	4788	3825	1556	1235	983	785	-885	-702	-559	-447	5	9	5	8	2453	1946	1549	1238		
0.6	0.6	757	600											225	178	142	113	-	-	-	-		
5	6	3	4	4777	3813	1555	1233	981	783	-885	-701	-558	-445	3	6	1	5	2451	1943	1546	1234		
0.6	**0.6**	756	599											225	178	141	113	-	-	-	-		
6	**7**	8	5	4766	3802	1554	1231	979	781	-884	-700	-557	-444	2	4	8	1	2449	1940	1542	1230		
0.6	0.6	756	598											225	178	141	112	-	-	-	-		
7	8	2	6	4756	3791	1553	1229	977	778	-883	-699	-555	-443	0	1	5	8	2447	1937	1539	1227		
0.6	**0.6**	755	597											224	177	141	112	-	-	-	-		
8	**9**	6	7	4745	3779	1552	1227	974	776	-883	-698	-554	-441	8	8	2	4	2445	1934	1536	1223		
0.6	0.7	755	596											224	177	140	112	-	-	-	-		
9	0	1	9	4735	3769	1551	1226	972	774	-882	-697	-553	-440	7	6	9	1	2444	1931	1532	1219		
0.7	0.7	754	596											224	177	140	111	-	-	-	-		
0	1	6	0	4725	3758	1549	1224	970	772	-881	-696	-552	-439	5	3	6	8	2442	1929	1529	1216		
0.7	**0.7**	754	595											224	177	140	111	-	-	-	-		
1	**2**	0	2	4715	3747	1548	1222	968	769	-881	-695	-551	-438	3	1	3	5	2440	1926	1526	1213		
0.7	0.7	753	594											224	176	140	111	-	-	-	-		
2	3	5	4	4705	3737	1547	1220	966	767	-880	-694	-550	-436	2	8	0	2	2438	1923	1523	1209		
0.7	**0.7**	753	593											224	176	139	110	-	-	-	-		
3	**4**	0	5	4695	3727	1546	1219	964	765	-879	-693	-548	-435	0	6	7	9	2437	1921	1519	1206		
0.7	0.7	752	592											223	176	139	110	-	-	-	-		
4	5	5	7	4686	3717	1545	1217	962	763	-879	-692	-547	-434	9	4	4	6	2435	1918	1516	1203		

0.7	**0.7**	752	592											223	176	139	110	-	-	-	-		
5	**6**	0	0	4676	3707	1544	1216	960	761	-878	-691	-546	-433	7	1	1	3	2433	1916	1513	1199		
0.7	0.7	751	591											223	175	138	110	-	-	-	-		
6	7	5	2	4667	3697	1543	1214	958	759	-878	-691	-545	-432	6	9	9	0	2432	1913	1510	1196		
0.7	0.7	751	590											223	175	138	109	-	-	-	-		
7	8	0	4	4658	3687	1542	1212	957	757	-877	-690	-544	-431	4	7	6	7	2430	1911	1507	1193		
0.7	**0.7**	750	589											223	175	138	109	-	-	-	-		
8	**9**	5	7	4649	3678	1541	1211	955	755	-877	-689	-543	-430	3	4	3	4	2429	1908	1504	1190		
0.7	0.8	750	588											223	175	138	109	-	-	-	-		
9	0	0	9	4640	3669	1540	1209	953	753	-876	-688	-542	-429	2	2	1	2	2427	1906	1502	1187		
0.8	**0.8**	749	588											223	175	137	108	-	-	-	-		
0	**1**	6	2	4632	3660	1539	1208	951	751	-876	-687	-541	-427	0	0	8	9	2426	1903	1499	1184		
0.8	0.8	749	587											222	174	137	108	-	-	-	-		
1	2	1	5	4623	3651	1538	1206	949	750	-875	-686	-540	-426	9	8	6	6	2424	1901	1496	1181		
0.8	**0.8**	748	586											222	174	137	108	-	-	-	-		
2	**3**	7	7	4615	3642	1537	1205	948	748	-874	-685	-539	-425	7	6	3	3	2423	1899	1493	1178		
0.8	0.8	748	586											222	174	137	108	-	-	-	-		
3	4	2	0	4606	3633	1536	1203	946	746	-874	-684	-538	-424	6	4	1	1	2421	1896	1491	1176		
0.8	0.8	747	585											222	174	136	107	-	-	-	-		
4	5	8	3	4598	3624	1535	1202	944	744	-873	-684	-537	-423	5	2	8	8	2420	1894	1488	1173		
0.8	**0.8**	747	584											222	173	136	107	-	-	-	-		
5	**6**	3	6	4590	3616	1535	1201	943	742	-873	-683	-536	-422	3	9	6	6	2418	1892	1485	1170		
0.8	0.8	746	584											222	173	136	107	-	-	-	-		
6	7	9	0	4582	3607	1534	1199	941	741	-872	-682	-535	-421	2	7	3	3	2417	1890	1483	1167		
0.8	**0.8**	746	583											222	173	136	107	-	-	-	-		
7	**8**	5	3	4574	3599	1533	1198	939	739	-872	-681	-534	-420	1	5	1	1	2416	1888	1480	1165		
0.8	0.8	746	582											222	173	135	106	-	-	-	-		
8	9	0	6	4566	3591	1532	1196	938	737	-871	-681	-533	-419	0	3	9	8	2414	1885	1478	1162		
0.8	**0.9**	745	582											221	173	135	106	-	-	-	-		
9	**0**	6	0	4559	3583	1531	1195	936	736	-871	-680	-532	-418	8	2	6	6	2413	1883	1475	1159		
0.9	0.9	745	581											221	173	135	106	-	-	-	-		
0	1	2	3	4551	3575	1530	1194	935	734	-870	-679	-532	-418	7	0	4	4	2411	1881	1473	1157		
0.9	0.9	744	580											221	172	135	106	-	-	-	-		
1	2	8	7	4544	3567	1529	1192	933	732	-870	-678	-531	-417	6	8	2	1	2410	1879	1470	1154		
0.9	**0.9**	744	580											221	172	135	105	-	-	-	-		
2	**3**	4	1	4536	3559	1529	1191	931	731	-869	-678	-530	-416	5	6	0	9	2409	1877	1468	1152		
0.9	0.9	744	579											221	172	134	105	-	-	-	-		
3	4	0	4	4529	3552	1528	1190	930	729	-869	-677	-529	-415	4	4	7	7	2408	1875	1466	1149		
0.9	**0.9**	743	578											221	172	134	105	-	-	-	-		
4	**5**	6	8	4522	3544	1527	1189	928	728	-869	-676	-528	-414	2	2	5	4	2406	1873	1463	1147		
0.9	0.9	743	578											221	172	134	105	-	-	-	-		
5	6	2	2	4515	3537	1526	1187	927	726	-868	-675	-527	-413	1	0	3	2	2405	1871	1461	1144		
0.9	**0.9**	742	577											221	171	134	105	-	-	-	-		
6	**7**	8	6	4508	3529	1525	1186	926	725	-868	-675	-526	-412	0	9	1	0	2404	1869	1459	1142		
0.9	0.9	742	577											220	171	133	104	-	-	-	-		
7	8	4	0	4501	3522	1525	1185	924	723	-867	-674	-526	-411	9	7	9	8	2403	1867	1456	1140		
0.9	0.9	742	576											220	171	133	104	-	-	-	-		
8	9	1	4	4494	3515	1524	1184	923	722	-867	-673	-525	-411	8	5	7	6	2401	1865	1454	1137		
0.9	**1.0**	741	575											220	171	133	104	-	-	-	-		
9	**0**	7	9	4487	3508	1523	1182	921	720	-866	-673	-524	-410	7	3	5	4	2400	1863	1452	1135		

1.0	1.0	741	575											220	171	133	104	-	-	-	-
0	1	3	3	4480	3501	1522	1181	920	719	-866	-672	-523	-409	6	2	3	2	2399	1862	1450	1133
1.0	**1.0**	740	574											220	171	133	104	-	-	-	-
1	**2**	9	7	4474	3494	1521	1180	919	717	-865	-671	-523	-408	5	0	1	0	2398	1860	1448	1131
1.0	1.0	740	574											220	170	132	103	-	-	-	-
2	3	6	1	4467	3487	1521	1179	917	716	-865	-671	-522	-407	3	8	9	8	2397	1858	1446	1128
1.0	**1.0**	740	573											220	170	132	103	-	-	-	-
3	**4**	2	6	4461	3480	1520	1178	916	715	-865	-670	-521	-407	2	7	7	6	2395	1856	1443	1126
1.0	1.0	739	573											220	170	132	103	-	-	-	-
4	5	9	0	4454	3474	1519	1177	915	713	-864	-669	-520	-406	1	5	5	4	2394	1854	1441	1124
1.0	1.0	739	572											220	170	132	103	-	-	-	-
5	6	5	5	4448	3467	1519	1176	913	712	-864	-669	-519	-405	0	3	3	2	2393	1853	1439	1122
1.0	**1.0**	739	572											219	170	132	103	-	-	-	-
6	**7**	2	0	4441	3461	1518	1174	912	711	-863	-668	-519	-404	9	2	1	0	2392	1851	1437	1120
1.0	1.0	738	571											219	170	132	102	-	-	-	-
7	8	8	4	4435	3454	1517	1173	911	709	-863	-667	-518	-403	8	0	0	8	2391	1849	1435	1118
1.0	**1.0**	738	570											219	169	131	102	-	-	-	-
8	**9**	5	9	4429	3448	1516	1172	909	708	-863	-667	-517	-403	7	9	8	6	2390	1847	1433	1116
1.0	1.1	738	570											219	169	131	102	-	-	-	-
9	0	1	4	4423	3441	1516	1171	908	707	-862	-666	-517	-402	6	7	6	4	2389	1846	1431	1114
1.1	**1.1**	737	569											219	169	131	102	-	-	-	-
0	**1**	8	8	4417	3435	1515	1170	907	705	-862	-666	-516	-401	5	5	4	2	2388	1844	1429	1112
1.1	1.1	737	569											219	169	131	102	-	-	-	-
1	2	5	3	4411	3429	1514	1169	906	704	-861	-665	-515	-401	4	4	2	0	2386	1842	1427	1110
1.1	1.1	737	568											219	169	131	101	-	-	-	-
2	3	1	8	4405	3423	1514	1168	905	703	-861	-664	-515	-400	3	2	1	8	2385	1841	1425	1108
1.1	**1.1**	736	568											219	169	130	101	-	-	-	-
3	**4**	8	3	4399	3417	1513	1167	903	702	-861	-664	-514	-399	2	1	9	7	2384	1839	1424	1106
1.1	1.1	736	567											219	168	130	101	-	-	-	-
4	5	5	8	4393	3411	1512	1166	902	700	-860	-663	-513	-398	1	9	7	5	2383	1837	1422	1104
1.1	**1.1**	736	567											219	168	130	101	-	-	-	-
5	**6**	2	3	4388	3405	1512	1165	901	699	-860	-663	-512	-398	0	8	5	3	2382	1836	1420	1102
1.1	1.1	735	566											218	168	130	101	-	-	-	-
6	7	9	8	4382	3399	1511	1164	900	698	-859	-662	-512	-397	9	7	4	1	2381	1834	1418	1100
1.1	**1.1**	735	566											218	168	130	101	-	-	-	-
7	**8**	5	4	4376	3393	1510	1163	899	697	-859	-662	-511	-396	8	5	2	0	2380	1833	1416	1098
1.1	1.1	735	565											218	168	130	100	-	-	-	-
8	9	2	9	4371	3387	1510	1162	898	696	-859	-661	-511	-396	8	4	0	8	2379	1831	1414	1096
1.1	1.2	734	565											218	168	129	100	-	-	-	-
9	0	9	4	4365	3382	1509	1161	896	694	-858	-660	-510	-395	7	2	9	6	2378	1830	1413	1094
1.2	**1.2**	734	564											218	168	129	100	-	-	-	-
0	**1**	6	9	4360	3376	1508	1160	895	693	-858	-660	-509	-394	6	1	7	5	2377	1828	1411	1093
1.2	1.2	734	564											218	167	129	100	-	-	-	-
1	2	3	5	4355	3371	1508	1159	894	692	-858	-659	-509	-394	5	9	6	3	2376	1827	1409	1091
1.2	**1.2**	734	564											218	167	129	100	-	-	-	-
2	**3**	0	0	4349	3365	1507	1158	893	691	-857	-659	-508	-393	4	8	4	1	2375	1825	1407	1089
1.2	1.2	733	563											218	167	129	100	-	-	-	-
3	4	7	5	4344	3360	1507	1157	892	690	-857	-658	-507	-392	3	7	2	0	2374	1824	1406	1087
1.2	**1.2**	733	563											218	167	129		-	-	-	-
4	**5**	4	1	4339	3354	1506	1156	891	689	-857	-658	-507	-392	2	5	1	998	2373	1822	1404	1085

1.2	1.2	733	562											218	167	128		-	-	-	-		
5	6	1	6	4333	3349	1505	1155	890	688	-856	-657	-506	-391	1	4	9	996	2372	1821	1402	1084		
1.2	1.2	732	562											218	167	128		-	-	-	-		
6	7	8	2	4328	3344	1505	1154	889	687	-856	-657	-506	-391	0	3	8	995	2371	1819	1401	1082		
1.2	**1.2**	732	561											218	167	128		-	-	-	-		
7	**8**	5	8	4323	3338	1504	1154	888	685	-856	-656	-505	-390	0	1	6	993	2370	1818	1399	1080		
1.2	1.2	732	561											217	167	128		-	-	-	-		
8	9	3	3	4318	3333	1504	1153	887	684	-855	-656	-504	-389	9	0	5	992	2370	1816	1397	1079		
1.2	**1.3**	732	560											217	166	128		-	-	-	-		
9	**0**	0	9	4313	3328	1503	1152	886	683	-855	-655	-504	-389	8	9	3	990	2369	1815	1396	1077		
1.3	1.3	731	560											217	166	128		-	-	-	-		
0	1	7	4	4308	3323	1502	1151	885	682	-855	-655	-503	-388	7	7	2	989	2368	1814	1394	1075		
1.3	**1.3**	731	560											217	166	128		-	-	-	-		
1	**2**	4	0	4303	3318	1502	1150	884	681	-854	-654	-503	-388	6	6	0	987	2367	1812	1393	1074		
1.3	1.3	731	559											217	166	127		-	-	-	-		
2	3	1	6	4298	3313	1501	1149	883	680	-854	-654	-502	-387	5	5	9	986	2366	1811	1391	1072		
1.3	1.3	730	559											217	166	127		-	-	-	-		
3	4	9	2	4294	3308	1501	1148	882	679	-854	-653	-501	-386	5	4	7	984	2365	1809	1389	1070		
1.3	**1.3**	730	558											217	166	127		-	-	-	-		
4	**5**	6	8	4289	3303	1500	1147	881	678	-853	-653	-501	-386	4	2	6	983	2364	1808	1388	1069		
1.3	1.3	730	558											217	166	127		-	-	-	-		
5	6	3	3	4284	3298	1500	1147	880	677	-853	-652	-500	-385	3	1	5	981	2363	1807	1386	1067		
1.3	**1.3**	730	557											217	166	127		-	-	-	-		
6	**7**	0	9	4279	3293	1499	1146	879	676	-853	-652	-500	-385	2	0	3	980	2362	1805	1385	1066		
1.3	1.3	729	557											217	165	127		-	-	-	-		
7	8	8	5	4275	3288	1499	1145	878	675	-852	-651	-499	-384	1	9	2	978	2362	1804	1383	1064		
1.3	**1.3**	729	557											217	165	127		-	-	-	-		
8	**9**	5	1	4270	3284	1498	1144	877	674	-852	-651	-499	-384	1	8	0	977	2361	1803	1382	1063		
1.3	1.4	729	556											217	165	126		-	-	-	-		
9	0	3	7	4265	3279	1497	1143	876	673	-852	-650	-498	-383	0	6	9	976	2360	1802	1380	1061		
1.4	1.4	729	556											216	165	126		-	-	-	-		
0	1	0	3	4261	3274	1497	1142	875	672	-851	-650	-498	-382	9	5	8	974	2359	1800	1379	1060		
1.4	**1.4**	728	555											216	165	126		-	-	-	-		
1	**2**	7	9	4256	3270	1496	1142	874	671	-851	-649	-497	-382	8	4	6	973	2358	1799	1377	1058		
1.4	1.4	728	555											216	165	126		-	-	-	-		
2	3	5	5	4252	3265	1496	1141	873	670	-851	-649	-497	-381	7	3	5	971	2357	1798	1376	1057		
1.4	**1.4**	728	555											216	165	126		-	-	-	-		
3	**4**	2	2	4247	3260	1495	1140	872	669	-851	-648	-496	-381	7	2	4	970	2357	1796	1374	1055		
1.4	1.4	728	554											216	165	126		-	-	-	-		
4	5	0	8	4243	3256	1495	1139	871	669	-850	-648	-496	-380	6	1	2	969	2356	1795	1373	1054		
1.4	**1.4**	727	554											216	164	126		-	-	-	-		
5	**6**	7	4	4238	3251	1494	1138	870	668	-850	-648	-495	-380	5	9	1	967	2355	1794	1372	1052		
1.4	1.4	727	554											216	164	126		-	-	-	-		
6	7	5	0	4234	3247	1494	1138	869	667	-850	-647	-495	-379	4	8	0	966	2354	1793	1370	1051		
1.4	1.4	727	553											216	164	125		-	-	-	-		
7	8	2	6	4230	3242	1493	1137	869	666	-849	-647	-494	-379	4	7	8	965	2353	1792	1369	1049		
1.4	**1.4**	727	553											216	164	125		-	-	-	-		
8	**9**	0	3	4226	3238	1493	1136	868	665	-849	-646	-494	-378	3	6	7	963	2352	1790	1367	1048		
1.4	**1.5**	**726**	**552**											**216**	**164**	**125**		**-**	**-**	**-**	**-**		
9	**0**	**7**	**9**	**4221**	**3234**	**1492**	**1135**	**867**	**664**	**-849**	**-646**	**-493**	**-378**	**2**	**5**	**6**	**962**	**2352**	**1789**	**1366**	**1046**		

I93N (South of Boston) -- Congestion

		ND (1)				ND (2)				ND (3)				ND (4)				ND (5)			
OP	NP	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**	**-0.05**	**-0.1**	**-0.15**	**-0.2**
0.00	0.01	13483	13483	13483	13483	634	634	634	634	589	589	589	589	1373	1373	1373	1373	-17	-17	-17	-17
0.01	**0.02**	12841	12257	11724	11236	604	576	551	528	561	535	512	491	1308	1248	1194	1144	-16	-15	-15	-14
0.02	0.03	12528	11674	10906	10214	589	549	513	480	547	510	476	446	1276	1189	1111	1040	-16	-15	-14	-13
0.03	**0.04**	12322	11297	10387	9576	579	531	488	450	538	494	454	418	1255	1150	1058	975	-16	-14	-13	-12
0.04	0.05	12170	11021	10012	9120	572	518	471	429	532	481	437	398	1239	1122	1019	929	-15	-14	-13	-11
0.05	**0.06**	12050	10805	9720	8769	567	508	457	412	526	472	425	383	1227	1100	990	893	-15	-14	-12	-11
0.06	0.07	11950	10628	9483	8486	562	500	446	399	522	464	414	371	1217	1082	966	864	-15	-13	-12	-11
0.07	**0.08**	11865	10479	9284	8251	558	493	437	388	518	458	406	360	1208	1067	945	840	-15	-13	-12	-10
0.08	0.09	11792	10349	9113	8049	554	487	429	378	515	452	398	352	1201	1054	928	820	-15	-13	-11	-10
0.09	**0.10**	11727	10235	8964	7874	551	481	421	370	512	447	392	344	1194	1042	913	802	-15	-13	-11	-10
0.10	0.11	11668	10134	8831	7720	549	477	415	363	510	443	386	337	1188	1032	899	786	-15	-13	-11	-10
0.11	**0.12**	11615	10043	8712	7582	546	472	410	357	507	439	381	331	1183	1023	887	772	-15	-13	-11	-10
0.12	0.13	11567	9960	8605	7458	544	468	405	351	505	435	376	326	1178	1014	876	759	-15	-13	-11	-9
0.13	**0.14**	11523	9884	8507	7345	542	465	400	345	503	432	372	321	1173	1006	866	748	-15	-12	-11	-9
0.14	0.15	11482	9814	8417	7241	540	461	396	341	502	429	368	316	1169	999	857	737	-14	-12	-11	-9
0.15	**0.16**	11444	9749	8333	7146	538	458	392	336	500	426	364	312	1165	993	849	728	-14	-12	-11	-9
0.16	0.17	11408	9688	8256	7058	536	456	388	332	498	423	361	308	1162	987	841	719	-14	-12	-10	-9
0.17	**0.18**	11375	9631	8184	6976	535	453	385	328	497	421	357	305	1158	981	833	710	-14	-12	-10	-9
0.18	0.19	11343	9578	8116	6899	533	450	382	324	496	418	355	301	1155	975	826	703	-14	-12	-10	-9
0.19	**0.20**	11313	9528	8052	6827	532	448	379	321	494	416	352	298	1152	970	820	695	-14	-12	-10	-9
0.20	0.21	11285	9481	7992	6760	531	446	376	318	493	414	349	295	1149	965	814	688	-14	-12	-10	-9
0.21	**0.22**	11258	9436	7936	6696	529	444	373	315	492	412	347	293	1146	961	808	682	-14	-12	-10	-8
0.22	0.23	11233	9393	7882	6636	528	442	371	312	491	410	344	290	1144	957	803	676	-14	-12	-10	-8
0.23	**0.24**	11208	9352	7831	6578	527	440	368	309	490	409	342	287	1141	952	797	670	-14	-12	-10	-8
0.24	0.25	11185	9314	7782	6524	526	438	366	307	489	407	340	285	1139	948	792	664	-14	-12	-10	-8
0.25	**0.26**	11163	9277	7736	6472	525	436	364	304	488	405	338	283	1137	945	788	659	-14	-12	-10	-8
0.26	0.27	11141	9241	7692	6423	524	435	362	302	487	404	336	281	1135	941	783	654	-14	-12	-10	-8
0.27	**0.28**	11121	9207	7649	6376	523	433	360	300	486	402	334	279	1132	938	779	649	-14	-12	-10	-8
0.28	0.29	11101	9174	7608	6330	522	431	358	298	485	401	332	277	1130	934	775	645	-14	-12	-10	-8
0.29	**0.30**	11082	9143	7569	6287	521	430	356	296	484	399	331	275	1128	931	771	640	-14	-12	-10	-8
0.30	0.31	11063	9112	7531	6245	520	428	354	294	483	398	329	273	1127	928	767	636	-14	-11	-9	-8
0.31	**0.32**	11046	9083	7495	6205	519	427	352	292	483	397	327	271	1125	925	763	632	-14	-11	-9	-8

0.32	0.33	11028	9055	7460	6167	519	426	351	290	482	396	326	269	1123	922	760	628	-14	-11	-9	-8
0.33	**0.34**	11012	9027	7426	6130	518	424	349	288	481	394	324	268	1121	919	756	624	-14	-11	-9	-8
0.34	0.35	10996	9001	7394	6094	517	423	348	287	480	393	323	266	1120	917	753	621	-14	-11	-9	-8
0.35	**0.36**	10980	8975	7362	6059	516	422	346	285	480	392	322	265	1118	914	750	617	-14	-11	-9	-8
0.36	0.37	10965	8950	7332	6026	516	421	345	283	479	391	320	263	1117	911	747	614	-14	-11	-9	-8
0.37	**0.38**	10950	8926	7302	5993	515	420	343	282	478	390	319	262	1115	909	744	610	-14	-11	-9	-8
0.38	0.39	10935	8903	7273	5962	514	419	342	280	478	389	318	260	1114	907	741	607	-14	-11	-9	-8
0.39	**0.40**	10921	8880	7246	5932	514	418	341	279	477	388	317	259	1112	904	738	604	-14	-11	-9	-7
0.40	0.41	10908	8858	7218	5902	513	417	339	278	477	387	315	258	1111	902	735	601	-14	-11	-9	-7
0.41	**0.42**	10895	8836	7192	5873	512	416	338	276	476	386	314	257	1109	900	732	598	-14	-11	-9	-7
0.42	0.43	10882	8815	7167	5846	512	415	337	275	475	385	313	255	1108	898	730	595	-14	-11	-9	-7
0.43	**0.44**	10869	8795	7142	5818	511	414	336	274	475	384	312	254	1107	896	727	593	-14	-11	-9	-7
0.44	0.45	10857	8775	7117	5792	511	413	335	272	474	383	311	253	1106	894	725	590	-14	-11	-9	-7
0.45	**0.46**	10845	8755	7094	5767	510	412	334	271	474	382	310	252	1104	892	722	587	-14	-11	-9	-7
0.46	0.47	10833	8736	7071	5742	509	411	332	270	473	382	309	251	1103	890	720	585	-14	-11	-9	-7
0.47	**0.48**	10821	8718	7048	5717	509	410	331	269	473	381	308	250	1102	888	718	582	-14	-11	-9	-7
0.48	0.49	10810	8700	7026	5694	508	409	330	268	472	380	307	249	1101	886	715	580	-14	-11	-9	-7
0.49	**0.50**	10799	8682	7005	5670	508	408	329	267	472	379	306	248	1100	884	713	577	-14	-11	-9	-7
0.50	0.51	10788	8665	6984	5648	507	407	328	266	471	379	305	247	1099	882	711	575	-14	-11	-9	-7
0.51	**0.52**	10778	8648	6963	5626	507	407	327	265	471	378	304	246	1098	881	709	573	-14	-11	-9	-7
0.52	0.53	10767	8631	6943	5604	506	406	326	264	470	377	303	245	1096	879	707	571	-14	-11	-9	-7
0.53	**0.54**	10757	8615	6924	5583	506	405	326	263	470	376	302	244	1095	877	705	569	-14	-11	-9	-7
0.54	0.55	10747	8599	6905	5562	505	404	325	262	469	376	302	243	1094	876	703	566	-14	-11	-9	-7
0.55	**0.56**	10737	8583	6886	5542	505	404	324	261	469	375	301	242	1093	874	701	564	-14	-11	-9	-7
0.56	0.57	10728	8568	6867	5523	504	403	323	260	469	374	300	241	1092	873	699	562	-14	-11	-9	-7
0.57	**0.58**	10718	8553	6849	5503	504	402	322	259	468	374	299	240	1091	871	697	560	-14	-11	-9	-7
0.58	0.59	10709	8538	6832	5484	504	401	321	258	468	373	298	240	1091	869	696	558	-14	-11	-9	-7
0.59	**0.60**	10700	8524	6814	5466	503	401	320	257	467	372	298	239	1090	868	694	557	-13	-11	-9	-7
0.60	0.61	10691	8510	6797	5448	503	400	320	256	467	372	297	238	1089	867	692	555	-13	-11	-9	-7
0.61	**0.62**	10682	8496	6781	5430	502	399	319	255	467	371	296	237	1088	865	690	553	-13	-11	-9	-7
0.62	0.63	10674	8482	6764	5412	502	399	318	255	466	371	295	236	1087	864	689	551	-13	-11	-9	-7
0.63	**0.64**	10665	8469	6748	5395	502	398	317	254	466	370	295	236	1086	862	687	549	-13	-11	-9	-7
0.64	0.65	10657	8455	6733	5379	501	398	317	253	466	369	294	235	1085	861	686	548	-13	-11	-8	-7
0.65	**0.66**	10649	8442	6717	5362	501	397	316	252	465	369	293	234	1084	860	684	546	-13	-11	-8	-7
0.66	0.67	10641	8430	6702	5346	500	396	315	251	465	368	293	234	1084	858	682	544	-13	-11	-8	-7
0.67	**0.68**	10633	8417	6687	5330	500	396	314	251	464	368	292	233	1083	857	681	543	-13	-11	-8	-7

0.68	0.69	10625	8405	6672	5314	500	395	314	250	464	367	291	232	1082	856	679	541	-13	-11	-8	-7
0.69	**0.70**	10617	8393	6658	5299	499	395	313	249	464	367	291	231	1081	855	678	540	-13	-11	-8	-7
0.70	0.71	10610	8381	6643	5284	499	394	312	248	463	366	290	231	1080	853	677	538	-13	-11	-8	-7
0.71	**0.72**	10602	8369	6629	5269	499	394	312	248	463	366	290	230	1080	852	675	537	-13	-11	-8	-7
0.72	0.73	10595	8357	6616	5254	498	393	311	247	463	365	289	230	1079	851	674	535	-13	-11	-8	-7
0.73	**0.74**	10588	8346	6602	5240	498	392	310	246	463	365	288	229	1078	850	672	534	-13	-11	-8	-7
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0.75	**0.76**	10574	8323	6576	5212	497	391	309	245	462	364	287	228	1077	848	670	531	-13	-10	-8	-7
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0.77	**0.78**	10560	8302	6550	5185	497	390	308	244	461	363	286	226	1075	845	667	528	-13	-10	-8	-7
0.78	0.79	10553	8291	6537	5172	496	390	307	243	461	362	286	226	1075	844	666	527	-13	-10	-8	-7
0.79	**0.80**	10546	8281	6525	5159	496	389	307	243	461	362	285	225	1074	843	664	525	-13	-10	-8	-7
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0.81	**0.82**	10533	8260	6501	5133	495	388	306	241	460	361	284	224	1073	841	662	523	-13	-10	-8	-6
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0.89	**0.90**	10484	8183	6410	5038	493	385	301	237	458	357	280	220	1068	833	653	513	-13	-10	-8	-6
0.90	0.91	10478	8174	6399	5027	493	384	301	236	458	357	280	220	1067	832	652	512	-13	-10	-8	-6
0.91	**0.92**	10472	8165	6389	5016	492	384	300	236	457	357	279	219	1066	831	651	511	-13	-10	-8	-6
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0.97	**0.98**	10439	8113	6328	4952	491	382	298	233	456	354	276	216	1063	826	644	504	-13	-10	-8	-6
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1.04	1.05	10403	8057	6263	4884	489	379	294	230	454	352	274	213	1059	821	638	497	-13	-10	-8	-6
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1.07	**1.08**	10388	8035	6236	4857	488	378	293	228	454	351	272	212	1058	818	635	495	-13	-10	-8	-6
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1.17	**1.18**	10342	7964	6154	4771	486	374	289	224	452	348	269	208	1053	811	627	486	-13	-10	-8	-6
1.18	1.19	10338	7957	6146	4763	486	374	289	224	452	348	268	208	1053	810	626	485	-13	-10	-8	-6
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1.20	1.21	10329	7943	6131	4747	486	374	288	223	451	347	268	207	1052	809	624	483	-13	-10	-8	-6
1.21	**1.22**	10325	7937	6123	4739	486	373	288	223	451	347	267	207	1051	808	624	483	-13	-10	-8	-6
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1.23	**1.24**	10317	7924	6108	4724	485	373	287	222	451	346	267	206	1051	807	622	481	-13	-10	-8	-6
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1.30	1.31	10288	7880	6058	4672	484	371	285	220	449	344	265	204	1048	802	617	476	-13	-10	-8	-6
1.31	**1.32**	10284	7874	6051	4665	484	370	285	219	449	344	264	204	1047	802	616	475	-13	-10	-8	-6
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1.49	**1.50**	**10219**	**7774**	**5936**	**4547**	**480**	**366**	**279**	**214**	**446**	**340**	**259**	**199**	**1041**	**792**	**604**	**463**	**-13**	**-10**	**-7**	**-6**

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