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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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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.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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)

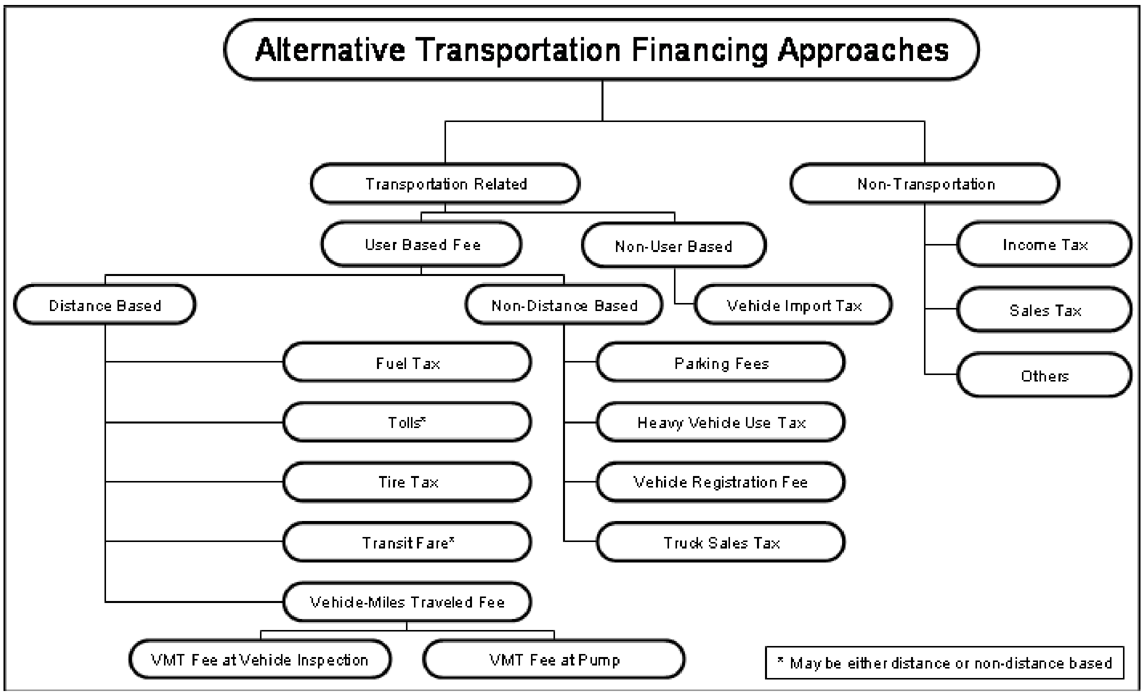
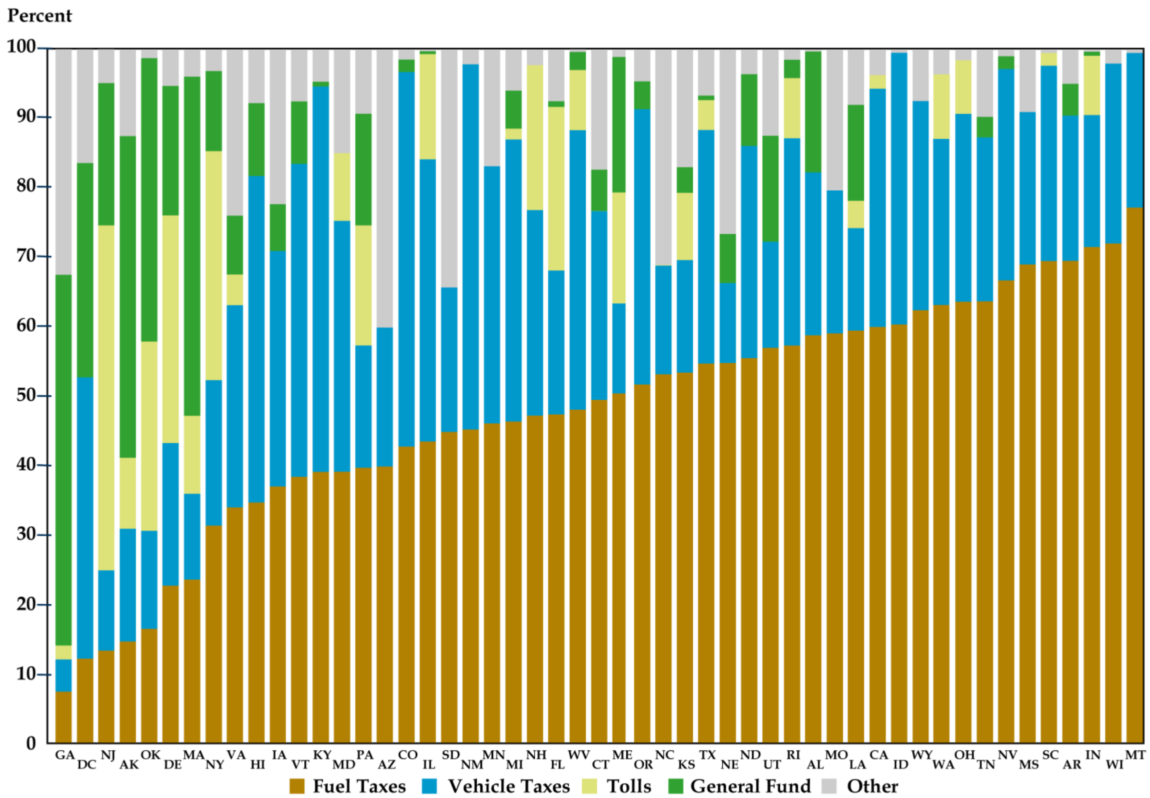


Figure 1. Alternative Transportation Financing Approaches

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)

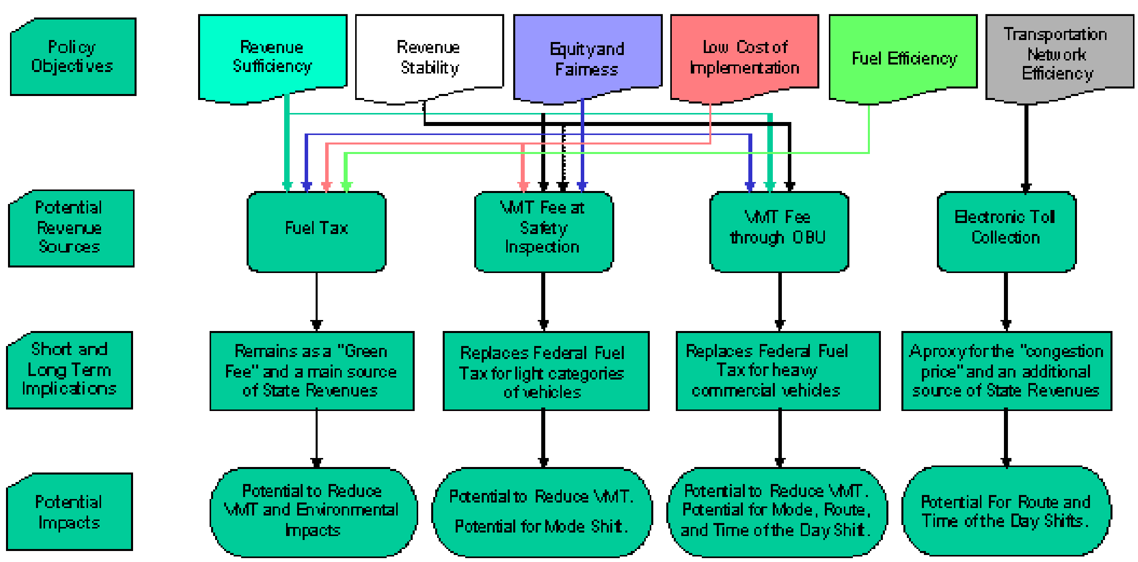


Figure 3. Alternative Finance Approaches Framework.

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.

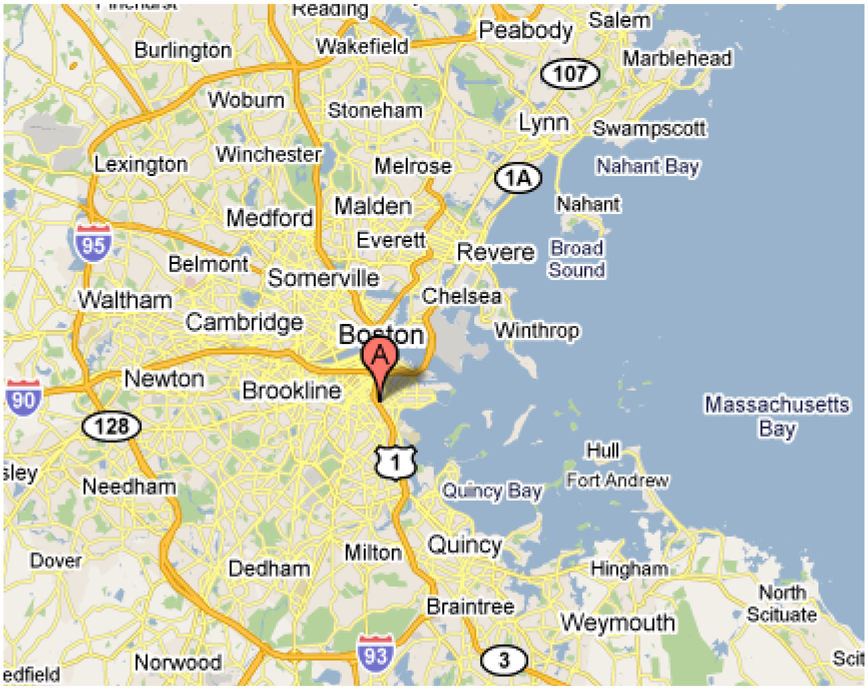


Figure 4. Boston Metropolitan Area Map

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

Month	Toll Transactions			Toll Revenue			Average Toll		
	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 CO_2 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**
0.00	0.01	63014	63014	63014	63014	15315	15315	15315	15315	-2291	-2291	-2291	-2291	-4435	-4435	-4435	-4435	-740	-740	-740	-740
0.01	**0.02**	60013	57285	54795	52512	14586	13923	13317	12763	-2182	-2083	-1992	-1909	-4224	-4032	-3857	-3696	-705	-673	-643	-617
0.02	0.03	58550	54558	50972	47738	14230	13260	12388	11602	-2129	-1984	-1853	-1736	-4121	-3840	-3587	-3360	-688	-641	-599	-561
0.03	0.04	57590	52798	48545	44754	13997	12832	11798	10877	-2094	-1920	-1765	-1627	-4053	-3716	-3417	-3150	-676	-620	-570	-526
0.04	**0.05**	56879	51510	46790	42623	13824	12519	11372	10359	-2068	-1873	-1701	-1550	-4003	-3625	-3293	-3000	-668	-605	-549	-501
0.05	0.06	56316	50500	45427	40984	13687	12274	11041	9961	-2047	-1836	-1652	-1490	-3964	-3554	-3197	-2884	-661	-593	-533	-481
0.06	0.07	55850	49672	44319	39662	13574	12072	10771	9639	-2031	-1806	-1611	-1442	-3931	-3496	-3119	-2791	-656	-583	-520	-466
0.07	**0.08**	55454	48972	43389	38560	13478	11902	10545	9372	-2016	-1780	-1578	-1402	-3903	-3447	-3054	-2714	-651	-575	-510	-453
0.08	0.09	55110	48368	42591	37619	13394	11755	10351	9143	-2004	-1759	-1548	-1368	-3879	-3404	-2998	-2648	-647	-568	-500	-442
0.09	0.10	54805	47836	41893	36802	13320	11626	10182	8944	-1993	-1739	-1523	-1338	-3857	-3367	-2948	-2590	-644	-562	-492	-432
0.10	**0.11**	54533	47363	41274	36080	13254	11511	10031	8769	-1983	-1722	-1501	-1312	-3838	-3333	-2905	-2539	-640	-556	-485	-424
0.11	0.12	54286	46936	40718	35436	13194	11407	9896	8612	-1974	-1706	-1480	-1288	-3821	-3303	-2866	-2494	-638	-551	-478	-416
0.12	0.13	54061	46548	40216	34855	13139	11313	9774	8471	-1965	-1692	-1462	-1267	-3805	-3276	-2830	-2453	-635	-547	-472	-409
0.13	**0.14**	53853	46193	39757	34327	13089	11227	9663	8343	-1958	-1679	-1445	-1248	-3790	-3251	-2798	-2416	-632	-542	-467	-403
0.14	0.15	53662	45865	39335	33843	13042	11147	9560	8225	-1951	-1668	-1430	-1230	-3777	-3228	-2768	-2382	-630	-539	-462	-397
0.15	0.16	53483	45561	38946	33398	12999	11073	9465	8117	-1944	-1656	-1416	-1214	-3764	-3207	-2741	-2351	-628	-535	-457	-392
0.16	**0.17**	53317	45278	38584	32986	12958	11005	9378	8017	-1938	-1646	-1403	-1199	-3753	-3187	-2716	-2322	-626	-532	-453	-387
0.17	0.18	53161	45014	38247	32602	12920	10940	9296	7924	-1933	-1637	-1391	-1185	-3741	-3168	-2692	-2295	-624	-529	-449	-383
0.18	0.19	53013	44765	37931	32244	12884	10880	9219	7837	-1927	-1628	-1379	-1172	-3731	-3151	-2670	-2269	-623	-526	-445	-379
0.19	**0.20**	52874	44531	37634	31908	12851	10823	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				-	-	-		-	-	-	-		-		-
4	5	9	0	4	0	2	9967	8084	6579	1845	1491	1209	-984	3571	2886	2341	1905	-596	482	-391	318

0.45	0.46	50683	40919	33153	26950	12318	9945	8058	6550	-1843	-1488	-1205	-980	-3567	-2880	-2333	-1897	-595	-481	-389	-316
0.46	**0.47**	50628	40831	33046	26834	12305	9924	8031	6522	-1841	-1484	-1201	-976	-3563	-2874	-2326	-1889	-595	-479	-388	-315
0.47	0.48	50574	40744	32940	26720	12292	9902	8006	6494	-1839	-1481	-1198	-971	-3559	-2868	-2318	-1881	-594	-478	-387	-314
0.48	0.49	50522	40659	32838	26609	12279	9882	7981	6467	-1837	-1478	-1194	-967	-3556	-2862	-2311	-1873	-593	-477	-386	-312
0.49	**0.50**	50470	40576	32738	26501	12266	9862	7957	6441	-1835	-1475	-1190	-963	-3552	-2856	-2304	-1865	-593	-477	-384	-311
0.5	0.51	50420	40495	32640	26395	12254	9842	7933	6415	-1833	-1472	-1187	-960	-3549	-2850	-2297	-1858	-592	-476	-383	-310
0.51	0.52	50370	40416	32544	26292	12242	9823	7910	6390	-1831	-1469	-1183	-956	-3545	-2845	-2290	-1850	-592	-475	-382	-309
0.52	**0.53**	50322	40339	32450	26192	12230	9804	7887	6366	-1830	-1467	-1180	-952	-3542	-2839	-2284	-1843	-591	-474	-381	-308
0.53	0.54	50274	40263	32359	26093	12219	9785	7865	6342	-1828	-1464	-1176	-949	-3538	-2834	-2277	-1836	-590	-473	-380	-306
0.54	0.55	50228	40188	32269	25997	12207	9767	7843	6318	-1826	-1461	-1173	-945	-3535	-2828	-2271	-1830	-590	-472	-379	-305
0.55	**0.56**	50182	40115	32181	25903	12196	9750	7821	6295	-1824	-1458	-1170	-942	-3532	-2823	-2265	-1823	-589	-471	-378	-304
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0.58	**0.59**	50050	39905	31929	25632	12164	9698	7760	6230	-1820	-1451	-1161	-932	-3523	-2809	-2247	-1804	-588	-469	-375	-301
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0.61	**0.62**	49925	39706	31690	25377	12134	9650	7702	6168	-1815	-1444	-1152	-923	-3514	-2795	-2230	-1786	-586	-466	-372	-298
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0.64	**0.65**	49807	39517	31465	25137	12105	9604	7647	6109	-1811	-1437	-1144	-914	-3505	-2781	-2215	-1769	-585	-464	-370	-295
0.65	0.66	49768	39457	31393	25060	12096	9590	7630	6091	-1809	-1435	-1141	-911	-3503	-2777	-2209	-1764	-584	-463	-369	-294
0.66	0.67	49731	39397	31321	24984	12087	9575	7612	6072	-1808	-1432	-1139	-908	-3500	-2773	-2204	-1758	-584	-463	-368	-293
0.67	**0.68**	49694	39338	31251	24910	12078	9561	7595	6054	-1807	-1430	-1136	-906	-3498	-2769	-2200	-1753	-584	-462	-367	-293
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0.70	**0.71**	49586	39168	31048	24694	12051	9519	7546	6002	-1803	-1424	-1129	-898	-3490	-2757	-2185	-1738	-582	-460	-365	-290
0.71	0.72	49551	39113	30983	24625	12043	9506	7530	5985	-1802	-1422	-1126	-895	-3487	-2753	-2181	-1733	-582	-459	-364	-289
0.72	0.73	49517	39058	30919	24557	12035	9493	7514	5968	-1800	-1420	-1124	-893	-3485	-2749	-2176	-1728	-581	-459	-363	-288
0.73	**0.74**	49483	39005	30855	24490	12026	9480	7499	5952	-1799	-1418	-1122	-890	-3483	-2745	-2172	-1724	-581	-458	-362	-288
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0.76	**0.77**	49384	38849	30671	24295	12002	9442	7454	5905	-1795	-1412	-1115	-883	-3476	-2734	-2159	-1710	-580	-456	-360	-285
0.77	0.78	49352	38799	30611	24232	11995	9430	7440	5889	-1794	-1411	-1113	-881	-3473	-2731	-2154	-1705	-580	-456	-359	-285
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0.82	**0.83**	49198	38557	30326	23931	11957	9371	7370	5816	-1789	-1402	-1103	-870	-3463	-2714	-2134	-1684	-578	-453	-356	-281
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0.85	**0.86**	49110	38420	30164	23761	11936	9338	7331	5775	-1785	-1397	-1097	-864	-3456	-2704	-2123	-1672	-577	-451	-354	-279
0.86	0.87	49081	38375	30111	23706	11929	9327	7318	5761	-1784	-1395	-1095	-862	-3454	-2701	-2119	-1668	-576	-451	-354	-278
0.87	0.88	49053	38331	30059	23651	11922	9316	7306	5748	-1783	-1394	-1093	-860	-3452	-2698	-2116	-1665	-576	-450	-353	-278
0.88	**0.89**	49025	38288	30008	23598	11915	9305	7293	5735	-1782	-1392	-1091	-858	-3450	-2695	-2112	-1661	-576	-450	-352	-277
0.89	0.9	48998	38245	29958	23545	11909	9295	7281	5722	-1781	-1390	-1089	-856	-3449	-2692	-2108	-1657	-575	-449	-352	-276
0.90	0.91	48971	38202	29908	23493	11902	9285	7269	5710	-1780	-1389	-1087	-854	-3447	-2689	-2105	-1653	-575	-449	-351	-276
0.91	**0.92**	48944	38160	29859	23441	11895	9275	7257	5697	-1779	-1387	-1086	-852	-3445	-2686	-2101	-1650	-575	-448	-351	-275
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0.94	**0.95**	48865	38037	29715	23291	11876	9245	7222	5661	-1777	-1383	-1080	-847	-3439	-2677	-2091	-1639	-574	-447	-349	-274

0.9	0.9	4883	3799	2966	2324	1187				-	-	-		-	-	-	-		-		-
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0.9	0.9	4881	3795	2962	2319	1186				-	-	-		-	-	-	-		-		-
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0.9	**0.9**	4878	3791	2957	2314	1185				-	-	-		-	-	-	-		-		-
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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9	**0**	**9**	**2**	**6**	**2**	**6**	**9197**	**7166**	**5603**	**1772**	**1376**	**1072**	**-838**	**3430**	**2663**	**2075**	**1622**	**-572**	**444**	**-346**	**271**

I93N (south of Boston)

		ND (1)				**ND (2)**				**ND (3)**				**ND (4)**				**ND (5)**			
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0.01	**0.02**	63849	60946	58297	55868	3960	3780	3616	3465	685	654	625	599	6289	6003	5742	5503	-4984	-4757	-4550	-4361
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0.03	0.04	61270	56172	51647	47614	3800	3484	3203	2953	657	602	554	511	6035	5532	5087	4690	-4783	-4385	-4031	-3717
0.04	**0.05**	60514	54802	49780	45347	3753	3399	3087	2813	649	588	534	486	5960	5398	4903	4466	-4724	-4278	-3886	-3540
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0.07	**0.08**	58998	52102	46162	41024	3659	3231	2863	2544	633	559	495	440	5811	5132	4547	4041	-4605	-4067	-3603	-3202
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0.19	**0.20**	56253	47376	40039	33947	3489	2938	2483	2105	603	508	429	364	5540	4666	3943	3344	-4391	-3698	-3125	-2650
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0.25	**0.26**	55505	46125	38465	32182	3442	2861	2386	1996	595	495	413	345	5467	4543	3788	3170	-4333	-3600	-3002	-2512
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0.28	**0.29**	55197	45616	37830	31476	3423	2829	2346	1952	592	489	406	338	5436	4493	3726	3100	-4309	-3561	-2953	-2457
0.29	0.3	55102	45459	37636	31261	3418	2819	2334	1939	591	488	404	335	5427	4477	3707	3079	-4301	-3548	-2938	-2440
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0.37	**0.38**	54445	44383	36308	29800	3377	2753	2252	1848	584	476	389	320	5362	4371	3576	2935	-4250	-3464	-2834	-2326
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0.82	**0.83**	52342	41021	32264	25460	3246	2544	2001	1579	561	440	346	273	5155	4040	3178	2508	-4086	-3202	-2518	-1987
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I93N (north of Boston)

		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**
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4	**5**	53	17	30	09	15	2	6	0	884	0	727	2	9	59	962	6	9	62	7	20	9283	8407	7636	6956
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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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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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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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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
0.4	0.4	428	346	281	228	920	743	603	490		63		42	104	84		55	252	20	165	13	-	-	-	-
4	5	66	47	02	70	2	7	3	9	788	7	517	1	3	3	684	6	4	40	4	46	8281	6693	5429	4418
0.4	0.4	428	345	280	227	919	742	601	488		63		41	104	84		55	252	20	164	13	-	-	-	-
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0.4	**0.4**	427	344	279	226	918	740	599	486		63		41	104	83		55	251	20	164	13	-	-	-	-
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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0.4	**0.5**	426	342	276	223	915	735	593	480		63		41	103	83		54	251	20	162	13	-	-	-	-
9	**0**	38	80	58	89	3	9	7	6	784	0	509	2	7	4	673	5	0	18	8	18	8237	6622	5343	4325
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0.5	**0.5**	425	340	274	221	912	731	588	475		62		40	103	82		53	250	20	161	13	-	-	-	-
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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0.5	0.5	424	339	272	219	910	728	585	471		62		40	103	82		53	249	19	160	12	-	-	-	-
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0.5	**0.5**	423	338	271	218	910	727	583	469		62		40	103	82		53	249	19	160	12	-	-	-	-
5	**6**	95	90	88	83	1	5	6	8	780	3	500	2	1	4	661	2	6	95	1	88	8190	6547	5252	4227
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8	**9**	84	13	74	54	7	7	0	8	778	0	496	8	9	0	656	7	9	85	8	75	8168	6513	5211	4183
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0.6	**0.6**	421	335	267	214	905	720	574	460		61		39	102	81		52	248	19	157	12	-	-	-	-
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4	**5**	78	85	82	36	3	7	6	9	774	4	489	1	4	2	647	7	7	65	5	50	8129	6449	5135	4102
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7	**8**	83	34	02	44	2	4	8	8	772	1	486	7	1	8	642	2	2	56	4	39	8110	6420	5100	4065
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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**	413	322	252	198	887	692	541	425	760	59	464	36	100	78	614	48	243	18	148	11	-	-	-	-

1	**2**	49	39	25	04	6	1	5	1		3		4	6	4		2	4	98	5	66	7988	6228	4873	3826
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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
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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
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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**	**- 0.0 5**	**- 0.1**	**- 0.1 5**	**- 0.2**	**- 0.0 5**	**-0.1**	**- 0.1 5**	**-0.2**	**- 0.0 5**	**-0.1**	**- 0.1 5**	**-0.2**	**- 0.0 5**	**-0.1**	**- 0.1 5**	**-0.2**	**- 0.0 5**	**-0.1**	**- 0.1 5**	**-0.2**
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00	1	01	01	01	01	12	12	12	12	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	3
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0.	**0.0**	548	497	451	411	84	76	69	62	290	262	238	217	133	120	109	-	303	275	249	227	844	764	694	632
04	**5**	81	01	47	26	05	12	14	99	3	9	8	5	2	7	6	998	8	1	9	7	2	5	5	6
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06	7	89	28	63	69	53	40	49	61	0	5	2	4	8	3	8	929	3	3	7	9	0	3	8	7
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07	**8**	07	53	66	06	95	37	12	98	283	249	221	196	129	114	101	903	296	261	231	206	823	726	644	572

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OP	NP	ND (1)				ND (2)				ND (3)				ND (4)				ND (5)				ND (6)			
0.91	**0.92**	47225	36820	28810	22618	7233	5639	4412	3464	-2498	-1948	-1524	-1196	-1146	-894	-699	-549	-2614	-2038	-1595	-1252	-7265	-5664	-4432	-3479
0.92	0.93	47199	36780	28763	22569	7229	5633	4405	3457	-2497	-1945	-1521	-1194	-1146	-893	-698	-548	-2613	-2036	-1592	-1249	-7261	-5658	-4425	-3472
0.93	0.94	47174	36741	28717	22520	7225	5627	4398	3449	-2495	-1943	-1519	-1191	-1145	-892	-697	-547	-2612	-2034	-1590	-1247	-7257	-5652	-4418	-3464
0.94	**0.95**	47149	36702	28671	22473	7221	5621	4391	3442	-2494	-1941	-1517	-1189	-1145	-891	-696	-546	-2610	-2032	-1587	-1244	-7253	-5646	-4410	-3457
0.95	0.96	47124	36663	28626	22425	7217	5615	4384	3435	-2493	-1939	-1514	-1186	-1144	-890	-695	-544	-2609	-2030	-1585	-1241	-7249	-5640	-4404	-3450
0.96	0.97	47100	36625	28581	22379	7214	5609	4377	3427	-2491	-1937	-1512	-1184	-1143	-889	-694	-543	-2607	-2028	-1582	-1239	-7245	-5634	-4397	-3443
0.97	**0.98**	47075	36587	28537	22333	7210	5604	4371	3420	-2490	-1935	-1509	-1181	-1143	-888	-693	-542	-2606	-2025	-1580	-1236	-7242	-5628	-4390	-3435
0.98	0.99	47051	36550	28494	22287	7206	5598	4364	3413	-2489	-1933	-1507	-1179	-1142	-887	-692	-541	-2605	-2023	-1577	-1234	-7238	-5622	-4383	-3428
0.99	**1.00**	**47027**	**36513**	**28450**	**22242**	**7203**	**5592**	**4357**	**3407**	**-2487**	**-1931**	**-1505**	**-1176**	**-1142**	**-886**	**-691**	**-540**	**-2603**	**-2021**	**-1575**	**-1231**	**-7234**	**-5617**	**-4377**	**-3422**

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	15305	15305	15305	15305	-1747	-1747	-1747	-1747	-935	-935	-935	-935	226	226	226	226	-630	-630	-630	-630	-1545	-1545	-1545	-1545
0.01	**0.02**	14576	13914	13309	12754	-1664	-1588	-1519	-1456	-890	-850	-813	-779	215	205	197	188	-600	-573	-548	-525	-1471	-1405	-1343	-1288
0.02	0.03	14221	13251	12380	11595	-1623	-1513	-1413	-1323	-869	-810	-756	-708	210	196	183	171	-585	-545	-510	-477	-1436	-1338	-1250	-1170
0.03	0.04	13988	12824	11791	10870	-1597	-1464	-1346	-1241	-855	-783	-720	-664	207	189	174	161	-576	-528	-485	-447	-1412	-1295	-1190	-1097
0.04	**0.05**	13815	12511	11364	10352	-1577	-1428	-1297	-1182	-844	-764	-694	-632	204	185	168	153	-569	-515	-468	-426	-1395	-1263	-1147	-1045

0.05	0.06	13678	12266	11033	9954	-1561	-1400	-1259	-1136	-836	-749	-674	-608	202	181	163	147	-563	-505	-454	-410	-1381	-1238	-1114	-1005
0.06	0.07	13565	12064	10764	9633	-1548	-1377	-1229	-1100	-829	-737	-658	-588	200	178	159	142	-558	-497	-443	-397	-1369	-1218	-1087	-972
0.07	**0.08**	13469	11895	10539	9366	-1537	-1358	-1203	-1069	-823	-727	-644	-572	199	176	156	138	-554	-490	-434	-386	-1360	-1201	-1064	-945
0.08	0.09	13385	11748	10345	9137	-1528	-1341	-1181	-1043	-818	-718	-632	-558	198	173	153	135	-551	-484	-426	-376	-1351	-1186	-1044	-922
0.09	0.10	13311	11619	10175	8938	-1519	-1326	-1161	-1020	-813	-710	-622	-546	197	172	150	132	-548	-478	-419	-368	-1344	-1173	-1027	-902
0.10	**0.11**	13245	11504	10025	8763	-1512	-1313	-1144	-1000	-809	-703	-612	-535	196	170	148	129	-545	-474	-413	-361	-1337	-1161	-1012	-885
0.11	0.12	13185	11400	9890	8607	-1505	-1301	-1129	-982	-805	-696	-604	-526	195	168	146	127	-543	-469	-407	-354	-1331	-1151	-998	-869
0.12	0.13	13130	11306	9768	8466	-1499	-1290	-1115	-966	-802	-691	-597	-517	194	167	144	125	-540	-465	-402	-348	-1325	-1141	-986	-855
0.13	**0.14**	13080	11219	9656	8337	-1493	-1281	-1102	-952	-799	-685	-590	-509	193	166	143	123	-538	-462	-397	-343	-1320	-1133	-975	-842
0.14	0.15	13034	11140	9554	8220	-1488	-1272	-1091	-938	-796	-681	-584	-502	192	164	141	121	-536	-459	-393	-338	-1316	-1125	-964	-830
0.15	0.16	12990	11066	9459	8112	-1483	-1263	-1080	-926	-794	-676	-578	-496	192	163	140	120	-535	-456	-389	-334	-1311	-1117	-955	-819
0.16	**0.17**	12950	10997	9371	8012	-1478	-1255	-1070	-914	-791	-672	-573	-489	191	162	138	118	-533	-453	-386	-330	-1307	-1110	-946	-809
0.17	0.18	12912	10933	9289	7918	-1474	-1248	-1060	-904	-789	-668	-568	-484	191	161	137	117	-531	-450	-382	-326	-1303	-1104	-938	-799
0.18	0.19	12876	10873	9213	7831	-1470	-1241	-1052	-894	-787	-664	-563	-478	190	161	136	116	-530	-448	-379	-322	-1300	-1098	-930	-791
0.19	**0.20**	12842	10816	9141	7750	-1466	-1235	-1043	-885	-785	-661	-558	-473	190	160	135	114	-529	-445	-376	-319	-1296	-1092	-923	-782
0.20	0.21	12810	10762	9072	7673	-1462	-1228	-1036	-876	-783	-657	-554	-469	189	159	134	113	-527	-443	-373	-316	-1293	-1086	-916	-775
0.21	0.22	12780	10711	9008	7601	-1459	-122	-102	-868	-781	-65	-550	-46	189	158	133	112	-526	-44	-371	-31	-129	-108	-909	-767

							3	8			4		4						1		3	0	1		
0.22	**0.23**	12751	10662	8947	7532	-1455	-1217	-1021	-860	-779	-651	-547	-460	188	157	132	111	-525	-439	-368	-310	-1287	-1076	-903	-760
0.23	0.24	12723	10616	8889	7467	-1452	-1212	-1015	-852	-777	-649	-543	-456	188	157	131	110	-524	-437	-366	-307	-1284	-1072	-897	-754
0.24	0.25	12697	10572	8834	7406	-1449	-1207	-1008	-845	-776	-646	-540	-452	187	156	130	109	-523	-435	-364	-305	-1282	-1067	-892	-748
0.25	**0.26**	12671	10530	8781	7347	-1446	-1202	-1002	-839	-774	-643	-536	-449	187	155	130	108	-522	-433	-361	-302	-1279	-1063	-886	-742
0.26	0.27	12647	10490	8731	7291	-1444	-1197	-997	-832	-773	-641	-533	-445	187	155	129	108	-521	-432	-359	-300	-1277	-1059	-881	-736
0.27	0.28	12624	10451	8683	7237	-1441	-1193	-991	-826	-771	-638	-530	-442	186	154	128	107	-520	-430	-357	-298	-1274	-1055	-876	-731
0.28	**0.29**	12601	10414	8636	7186	-1438	-1189	-986	-820	-770	-636	-528	-439	186	154	128	106	-519	-429	-356	-296	-1272	-1051	-872	-725
0.29	0.3	12579	10378	8592	7137	-1436	-1185	-981	-815	-768	-634	-525	-436	186	153	127	105	-518	-427	-354	-294	-1270	-1048	-867	-720
0.3	0.31	12558	10344	8549	7089	-1433	-1181	-976	-809	-767	-632	-522	-433	185	153	126	105	-517	-426	-352	-292	-1268	-1044	-863	-716
0.31	**0.32**	12538	10310	8508	7044	-1431	-1177	-971	-804	-766	-630	-520	-430	185	152	126	104	-516	-424	-350	-290	-1266	-1041	-859	-711
0.32	0.33	12519	10278	8468	7000	-1429	-1173	-967	-799	-765	-628	-517	-428	185	152	125	103	-515	-423	-349	-288	-1264	-1038	-855	-707
0.33	0.34	12500	10247	8430	6958	-1427	-1170	-962	-794	-764	-626	-515	-425	185	151	124	103	-515	-422	-347	-286	-1262	-1034	-851	-702
0.34	**0.35**	12481	10217	8393	6917	-1425	-1166	-958	-790	-763	-624	-513	-423	184	151	124	102	-514	-421	-345	-285	-1260	-1031	-847	-698
0.35	0.36	12464	10188	8357	6878	-1423	-1163	-954	-785	-761	-622	-511	-420	184	150	123	102	-513	-419	-344	-283	-1258	-1028	-844	-694
0.36	0.37	12446	10160	8323	6840	-1421	-1160	-950	-781	-760	-621	-508	-418	184	150	123	101	-512	-418	-343	-282	-1256	-1026	-840	-690
0.37	**0.38**	12430	10132	8289	6803	-1419	-1157	-946	-777	-759	-619	-506	-416	184	150	122	100	-512	-417	-341	-280	-1255	-1023	-837	-687
0.3	0.3	124	1010	8256	6768	-	-	-	-	-	-	-	-	183	14	122	10	-	-	-	-	-	-	-	-

8	9	13	6			1417	1154	942	772	758	617	504	413		9		0	511	416	340	279	1253	1020	833	683
0.39	0.40	12397	10080	8225	6733	-1415	-1151	-939	-769	-757	-616	-502	-411	183	149	121	99	-510	-415	-339	-277	-1251	-1018	-830	-680
0.40	**0.41**	12382	10055	8194	6700	-1413	-1148	-935	-765	-756	-614	-501	-409	183	148	121	99	-510	-414	-337	-276	-1250	-1015	-827	-676
0.41	0.42	12367	10030	8164	6667	-1412	-1145	-932	-761	-755	-613	-499	-407	183	148	121	98	-509	-413	-336	-274	-1248	-1013	-824	-673
0.42	0.43	12352	10007	8135	6635	-1410	-1142	-929	-757	-755	-611	-497	-405	182	148	120	98	-508	-412	-335	-273	-1247	-1010	-821	-670
0.43	**0.44**	12338	9983	8107	6605	-1408	-1140	-925	-754	-754	-610	-495	-403	182	147	120	98	-508	-411	-334	-272	-1245	-1008	-818	-667
0.44	0.45	12324	9961	8079	6575	-1407	-1137	-922	-750	-753	-609	-494	-402	182	147	119	97	-507	-410	-333	-271	-1244	-1006	-816	-664
0.45	0.46	12310	9939	8052	6546	-1405	-1134	-919	-747	-752	-607	-492	-400	182	147	119	97	-507	-409	-331	-269	-1243	-1003	-813	-661
0.46	**0.47**	12297	9917	8026	6517	-1404	-1132	-916	-744	-751	-606	-490	-398	182	146	119	96	-506	-408	-330	-268	-1241	-1001	-810	-658
0.47	0.48	12284	9896	8001	6490	-1402	-1130	-913	-741	-750	-605	-489	-396	181	146	118	96	-506	-407	-329	-267	-1240	-999	-808	-655
0.48	0.49	12271	9875	7976	6463	-1401	-1127	-910	-738	-750	-603	-487	-395	181	146	118	95	-505	-407	-328	-266	-1239	-997	-805	-652
0.49	**0.50**	12258	9855	7951	6437	-1399	-1125	-908	-735	-749	-602	-486	-393	181	146	117	95	-505	-406	-327	-265	-1237	-995	-803	-650
0.50	0.51	12246	9836	7928	6411	-1398	-1123	-905	-732	-748	-601	-484	-392	181	145	117	95	-504	-405	-326	-264	-1236	-993	-800	-647
0.51	0.52	12234	9816	7904	6386	-1396	-1120	-902	-729	-747	-600	-483	-390	181	145	117	94	-504	-404	-325	-263	-1235	-991	-798	-645
0.52	**0.53**	12222	9798	7882	6361	-1395	-1118	-900	-726	-747	-599	-481	-389	180	145	116	94	-503	-403	-324	-262	-1234	-989	-796	-642
0.53	0.54	12211	9779	7859	6338	-1394	-1116	-897	-723	-746	-597	-480	-387	180	144	116	94	-503	-403	-324	-261	-1233	-987	-793	-640
0.54	0.55	12199	9761	7838	6314	-1393	-1114	-895	-721	-745	-596	-479	-386	180	144	116	93	-502	-402	-323	-260	-1232	-985	-791	-637

0.55	**0.56**	12188	9743	7816	6291	-1391	-1112	-892	-718	-745	-595	-478	-384	180	144	115	93	-502	-401	-322	-259	-1230	-984	-789	-635
0.56	0.57	12178	9726	7795	6269	-1390	-1110	-890	-716	-744	-594	-476	-383	180	144	115	93	-501	-400	-321	-258	-1229	-982	-787	-633
0.57	0.58	12167	9709	7775	6247	-1389	-1108	-887	-713	-743	-593	-475	-382	180	143	115	92	-501	-400	-320	-257	-1228	-980	-785	-631
0.58	**0.59**	12156	9692	7755	6226	-1388	-1106	-885	-711	-743	-592	-474	-380	180	143	115	92	-500	-399	-319	-256	-1227	-978	-783	-628
0.59	0.6	12146	9676	7735	6204	-1386	-1104	-883	-708	-742	-591	-473	-379	179	143	114	92	-500	-398	-318	-255	-1226	-977	-781	-626
0.60	0.61	12136	9660	7716	6184	-1385	-1103	-881	-706	-741	-590	-471	-378	179	143	114	91	-500	-398	-318	-255	-1225	-975	-779	-624
0.61	**0.62**	12126	9644	7697	6164	-1384	-1101	-879	-704	-741	-589	-470	-377	179	142	114	91	-499	-397	-317	-254	-1224	-974	-777	-622
0.62	0.63	12116	9628	7678	6144	-1383	-1099	-876	-701	-740	-588	-469	-375	179	142	113	91	-499	-396	-316	-253	-1223	-972	-775	-620
0.63	0.64	12107	9613	7660	6124	-1382	-1097	-874	-699	-740	-587	-468	-374	179	142	113	90	-498	-396	-315	-252	-1222	-970	-773	-618
0.64	**0.65**	12097	9598	7642	6105	-1381	-1096	-872	-697	-739	-586	-467	-373	179	142	113	90	-498	-395	-315	-251	-1221	-969	-771	-616
0.65	0.66	12088	9583	7625	6087	-1380	-1094	-870	-695	-738	-585	-466	-372	178	142	113	90	-498	-394	-314	-251	-1220	-967	-770	-614
0.66	0.67	12079	9569	7607	6068	-1379	-1092	-868	-693	-738	-585	-465	-371	178	141	112	90	-497	-394	-313	-250	-1219	-966	-768	-613
0.67	**0.68**	12070	9555	7590	6050	-1378	-1091	-866	-691	-737	-584	-464	-370	178	141	112	89	-497	-393	-312	-249	-1218	-965	-766	-611
0.68	0.69	12061	9541	7574	6032	-1377	-1089	-865	-689	-737	-583	-463	-369	178	141	112	89	-496	-393	-312	-248	-1218	-963	-765	-609
0.69	0.70	12052	9527	7557	6015	-1376	-1087	-863	-687	-736	-582	-462	-367	178	141	112	89	-496	-392	-311	-248	-1217	-962	-763	-607
0.70	**0.71**	12044	9513	7541	5998	-1375	-1086	-861	-685	-736	-581	-461	-366	178	140	111	89	-496	-392	-310	-247	-1216	-960	-761	-605
0.71	0.72	12035	9500	7525	5981	-1374	-108	-859	-683	-735	-58	-460	-36	178	140	111	88	-495	-39	-310	-24	-121	-959	-760	-604

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0.72	0.73	12027	9487	7510	5964	-1373	-1083	-857	-681	-735	-580	-459	-364	178	140	111	88	-495	-390	-309	-246	-1214	-958	-758	-602
0.73	**0.74**	12018	9474	7494	5948	-1372	-1081	-855	-679	-734	-579	-458	-363	177	140	111	88	-495	-390	-308	-245	-1213	-956	-757	-600
0.74	0.75	12010	9461	7479	5932	-1371	-1080	-854	-677	-734	-578	-457	-362	177	140	110	88	-494	-389	-308	-244	-1212	-955	-755	-599
0.75	0.76	12002	9448	7464	5916	-1370	-1078	-852	-675	-733	-577	-456	-361	177	140	110	87	-494	-389	-307	-244	-1212	-954	-753	-597
0.76	**0.77**	11994	9436	7449	5901	-1369	-1077	-850	-674	-733	-576	-455	-360	177	139	110	87	-494	-388	-307	-243	-1211	-953	-752	-596
0.77	0.78	11987	9424	7435	5885	-1368	-1076	-849	-672	-732	-576	-454	-360	177	139	110	87	-493	-388	-306	-242	-1210	-951	-751	-594
0.78	0.79	11979	9412	7421	5870	-1367	-1074	-847	-670	-732	-575	-453	-359	177	139	110	87	-493	-387	-305	-242	-1209	-950	-749	-593
0.79	**0.80**	11971	9400	7407	5856	-1366	-1073	-845	-668	-731	-574	-452	-358	177	139	109	86	-493	-387	-305	-241	-1208	-949	-748	-591
0.80	0.81	11964	9388	7393	5841	-1366	-1072	-844	-667	-731	-574	-452	-357	177	139	109	86	-492	-386	-304	-240	-1208	-948	-746	-590
0.81	0.82	11957	9376	7379	5827	-1365	-1070	-842	-665	-730	-573	-451	-356	177	138	109	86	-492	-386	-304	-240	-1207	-947	-745	-588
0.82	**0.83**	11949	9365	7366	5812	-1364	-1069	-841	-663	-730	-572	-450	-355	176	138	109	86	-492	-385	-303	-239	-1206	-945	-744	-587
0.83	0.84	11942	9354	7352	5798	-1363	-1068	-839	-662	-730	-571	-449	-354	176	138	109	86	-492	-385	-303	-239	-1206	-944	-742	-585
0.84	0.85	11935	9342	7339	5785	-1362	-1066	-838	-660	-729	-571	-448	-353	176	138	108	85	-491	-385	-302	-238	-1205	-943	-741	-584
0.85	**0.86**	11928	9332	7326	5771	-1362	-1065	-836	-659	-729	-570	-448	-353	176	138	108	85	-491	-384	-302	-238	-1204	-942	-740	-583
0.86	0.87	11921	9321	7313	5758	-1361	-1064	-835	-657	-728	-569	-447	-352	176	138	108	85	-491	-384	-301	-237	-1203	-941	-738	-581
0.87	0.88	11914	9310	7301	5745	-1360	-1063	-833	-656	-728	-569	-446	-351	176	137	108	85	-490	-383	-301	-236	-1203	-940	-737	-580
0.8	**0.8**	119	9299	7288	5732	-	-	-	-	-	-	-	-	176	13	108	85	-	-	-	-	-	-	-	-

8	**9**	07				1359	1061	832	654	727	568	445	350		7			490	383	300	236	1202	939	736	579
0.89	0.9	11901	9289	7276	5719	-1358	-1060	-831	-653	-727	-567	-445	-349	176	137	107	84	-490	-382	-300	-235	-1201	-938	-735	-577
0.9	0.91	11894	9279	7264	5706	-1358	-1059	-829	-651	-727	-567	-444	-349	176	137	107	84	-490	-382	-299	-235	-1201	-937	-733	-576
0.91	**0.92**	11888	9268	7252	5693	-1357	-1058	-828	-650	-726	-566	-443	-348	176	137	107	84	-489	-382	-299	-234	-1200	-936	-732	-575
0.92	0.93	11881	9258	7240	5681	-1356	-1057	-826	-648	-726	-566	-442	-347	175	137	107	84	-489	-381	-298	-234	-1199	-935	-731	-573
0.93	0.94	11875	9248	7229	5669	-1355	-1056	-825	-647	-725	-565	-442	-346	175	137	107	84	-489	-381	-298	-233	-1199	-934	-730	-572
0.94	**0.95**	11868	9239	7217	5657	-1355	-1055	-824	-646	-725	-564	-441	-346	175	136	107	84	-489	-380	-297	-233	-1198	-933	-729	-571
0.95	0.96	11862	9229	7206	5645	-1354	-1053	-823	-644	-725	-564	-440	-345	175	136	106	83	-488	-380	-297	-232	-1197	-932	-727	-570
0.96	0.97	11856	9219	7195	5633	-1353	-1052	-821	-643	-724	-563	-440	-344	175	136	106	83	-488	-379	-296	-232	-1197	-931	-726	-569
0.97	**0.98**	11850	9210	7183	5622	-1353	-1051	-820	-642	-724	-563	-439	-343	175	136	106	83	-488	-379	-296	-231	-1196	-930	-725	-567
0.98	0.99	11844	9200	7172	5610	-1352	-1050	-819	-640	-724	-562	-438	-343	175	136	106	83	-488	-379	-295	-231	-1196	-929	-724	-566
0.99	1.00	11838	9191	7162	5599	-1351	-1049	-817	-639	-723	-561	-438	-342	175	136	106	83	-487	-378	-295	-230	-1195	-928	-723	-565
1	**1.01**	11832	9182	7151	5588	-1351	-1048	-816	-638	-723	-561	-437	-341	175	136	106	83	-487	-378	-294	-230	-1194	-927	-722	-564
1.01	1.02	11826	9173	7140	5577	-1350	-1047	-815	-637	-722	-560	-436	-341	175	135	105	82	-487	-378	-294	-230	-1194	-926	-721	-563
1.02	1.03	11820	9164	7130	5566	-1349	-1046	-814	-635	-722	-560	-436	-340	175	135	105	82	-487	-377	-293	-229	-1193	-925	-720	-562
1.03	**1.04**	11815	9155	7119	5555	-1349	-1045	-813	-634	-722	-559	-435	-339	174	135	105	82	-486	-377	-293	-229	-1193	-924	-719	-561
1.04	1.05	11809	9146	7109	5544	-1348	-1044	-811	-633	-721	-559	-434	-339	174	135	105	82	-486	-376	-293	-228	-1192	-923	-718	-560

1.05	1.06	11803	9138	7099	5534	-1347	-1043	-810	-632	-721	-558	-434	-338	174	135	105	82	-486	-376	-292	-228	-1192	-922	-717	-559
1.06	**1.07**	11798	9129	7089	5523	-1347	-1042	-809	-630	-721	-558	-433	-337	174	135	105	82	-486	-376	-292	-227	-1191	-922	-716	-558
1.07	1.08	11792	9120	7079	5513	-1346	-1041	-808	-629	-720	-557	-432	-337	174	135	105	81	-485	-375	-291	-227	-1190	-921	-715	-557
1.08	1.09	11787	9112	7069	5503	-1345	-1040	-807	-628	-720	-557	-432	-336	174	135	104	81	-485	-375	-291	-227	-1190	-920	-714	-556
1.09	**1.10**	11781	9104	7060	5493	-1345	-1039	-806	-627	-720	-556	-431	-336	174	134	104	81	-485	-375	-291	-226	-1189	-919	-713	-554
1.10	1.11	11776	9095	7050	5483	-1344	-1038	-805	-626	-719	-556	-431	-335	174	134	104	81	-485	-374	-290	-226	-1189	-918	-712	-553
1.11	1.12	11771	9087	7040	5473	-1344	-1037	-804	-625	-719	-555	-430	-334	174	134	104	81	-485	-374	-290	-225	-1188	-917	-711	-552
1.12	**1.13**	11765	9079	7031	5463	-1343	-1036	-803	-624	-719	-555	-430	-334	174	134	104	81	-484	-374	-289	-225	-1188	-917	-710	-551
1.13	1.14	11760	9071	7022	5454	-1342	-1035	-801	-623	-718	-554	-429	-333	174	134	104	81	-484	-373	-289	-224	-1187	-916	-709	-551
1.14	1.15	11755	9063	7012	5444	-1342	-1035	-800	-621	-718	-554	-428	-333	174	134	104	80	-484	-373	-289	-224	-1187	-915	-708	-550
1.15	**1.16**	11750	9055	7003	5435	-1341	-1034	-799	-620	-718	-553	-428	-332	174	134	103	80	-484	-373	-288	-224	-1186	-914	-707	-549
1.16	1.17	11745	9047	6994	5425	-1341	-1033	-798	-619	-718	-553	-427	-331	173	134	103	80	-483	-372	-288	-223	-1186	-913	-706	-548
1.17	1.18	11740	9040	6985	5416	-1340	-1032	-797	-618	-717	-552	-427	-331	173	133	103	80	-483	-372	-288	-223	-1185	-913	-705	-547
1.18	**1.19**	11735	9032	6976	5407	-1339	-1031	-796	-617	-717	-552	-426	-330	173	133	103	80	-483	-372	-287	-223	-1185	-912	-704	-546
1.19	1.2	11730	9024	6968	5398	-1339	-1030	-795	-616	-717	-551	-426	-330	173	133	103	80	-483	-371	-287	-222	-1184	-911	-703	-545
1.20	1.21	11725	9017	6959	5389	-1338	-1029	-794	-615	-716	-551	-425	-329	173	133	103	80	-483	-371	-286	-222	-1184	-910	-702	-544
1.21	**1.22**	11720	9009	6950	5380	-1338	-102	-793	-614	-716	-55	-425	-32	173	133	103	79	-482	-37	-286	-22	-118	-909	-702	-543

							8				0		9						1		1	3			
1.22	1.23	11715	9002	6942	5371	-1337	-1028	-792	-613	-716	-550	-424	-328	173	133	103	79	-482	-371	-286	-221	-1183	-909	-701	-542
1.23	1.24	11711	8995	6933	5362	-1337	-1027	-791	-612	-715	-550	-424	-328	173	133	102	79	-482	-370	-285	-221	-1182	-908	-700	-541
1.24	**1.25**	11706	8988	6925	5354	-1336	-1026	-790	-611	-715	-549	-423	-327	173	133	102	79	-482	-370	-285	-220	-1182	-907	-699	-540
1.25	1.26	11701	8980	6917	5345	-1336	-1025	-790	-610	-715	-549	-423	-327	173	133	102	79	-482	-370	-285	-220	-1181	-907	-698	-540
1.26	1.27	11697	8973	6908	5337	-1335	-1024	-789	-609	-715	-548	-422	-326	173	133	102	79	-481	-369	-284	-220	-1181	-906	-697	-539
1.27	**1.28**	11692	8966	6900	5328	-1335	-1023	-788	-608	-714	-548	-422	-326	173	132	102	79	-481	-369	-284	-219	-1180	-905	-697	-538
1.28	1.29	11688	8959	6892	5320	-1334	-1023	-787	-607	-714	-547	-421	-325	173	132	102	79	-481	-369	-284	-219	-1180	-904	-696	-537
1.29	1.30	11683	8952	6884	5312	-1334	-1022	-786	-606	-714	-547	-421	-324	173	132	102	78	-481	-368	-283	-219	-1179	-904	-695	-536
1.30	**1.31**	11678	8945	6876	5304	-1333	-1021	-785	-605	-713	-546	-420	-324	172	132	102	78	-481	-368	-283	-218	-1179	-903	-694	-535
1.31	1.32	11674	8939	6868	5295	-1333	-1020	-784	-604	-713	-546	-420	-324	172	132	101	78	-481	-368	-283	-218	-1178	-902	-693	-535
1.32	1.33	11670	8932	6861	5287	-1332	-1020	-783	-604	-713	-546	-419	-323	172	132	101	78	-480	-368	-282	-218	-1178	-902	-693	-534
1.33	**1.34**	11665	8925	6853	5280	-1332	-1019	-782	-603	-713	-545	-419	-323	172	132	101	78	-480	-367	-282	-217	-1178	-901	-692	-533
1.34	1.35	11661	8918	6845	5272	-1331	-1018	-781	-602	-712	-545	-418	-322	172	132	101	78	-480	-367	-282	-217	-1177	-900	-691	-532
1.35	1.36	11657	8912	6838	5264	-1331	-1017	-780	-601	-712	-544	-418	-322	172	132	101	78	-480	-367	-281	-217	-1177	-900	-690	-531
1.36	**1.37**	11652	8905	6830	5256	-1330	-1016	-780	-600	-712	-544	-417	-321	172	131	101	78	-480	-367	-281	-216	-1176	-899	-689	-531
1.37	1.38	11648	8899	6823	5248	-1330	-1016	-779	-599	-712	-544	-417	-321	172	131	101	78	-479	-366	-281	-216	-1176	-898	-689	-530
1.3	1.3	116	8892	6815	5241	-	-	-	-	-	-	-	-	172	13	101	77	-	-	-	-	-	-	-	-

8	9	44				1329	1015	778	598	711	543	416	320		1			479	366	281	216	1175	898	688	529
1.39	**1.40**	11640	8886	6808	5233	-1329	-1014	-777	-597	-711	-543	-416	-320	172	131	101	77	-479	-366	-280	-215	-1175	-897	-687	-528
1.40	1.41	11635	8880	6801	5226	-1328	-1014	-776	-597	-711	-542	-415	-319	172	131	100	77	-479	-366	-280	-215	-1175	-896	-687	-528
1.41	1.42	11631	8873	6793	5218	-1328	-1013	-775	-596	-711	-542	-415	-319	172	131	100	77	-479	-365	-280	-215	-1174	-896	-686	-527
1.42	**1.43**	11627	8867	6786	5211	-1327	-1012	-775	-595	-710	-542	-415	-318	172	131	100	77	-479	-365	-279	-215	-1174	-895	-685	-526
1.43	1.44	11623	8861	6779	5204	-1327	-1011	-774	-594	-710	-541	-414	-318	172	131	100	77	-478	-365	-279	-214	-1173	-894	-684	-525
1.44	1.45	11619	8855	6772	5197	-1326	-1011	-773	-593	-710	-541	-414	-317	172	131	100	77	-478	-364	-279	-214	-1173	-894	-684	-525
1.45	**1.46**	11615	8849	6765	5189	-1326	-1010	-772	-592	-710	-541	-413	-317	172	131	100	77	-478	-364	-278	-214	-1173	-893	-683	-524
1.46	1.47	11611	8843	6758	5182	-1325	-1009	-771	-592	-709	-540	-413	-317	171	131	100	77	-478	-364	-278	-213	-1172	-893	-682	-523
1.47	1.48	11607	8836	6751	5175	-1325	-1009	-771	-591	-709	-540	-412	-316	171	130	100	76	-478	-364	-278	-213	-1172	-892	-682	-522
1.48	**1.49**	11603	8831	6744	5168	-1324	-1008	-770	-590	-709	-539	-412	-316	171	130	100	76	-478	-363	-278	-213	-1171	-891	-681	-522
1.49	**1.5**	**11599**	**8825**	**6738**	**5161**	**-1324**	**-1007**	**-769**	**-589**	**-709**	**-539**	**-412**	**-315**	**171**	**130**	**99**	**76**	**-477**	**-363**	**-277**	**-212**	**-1171**	**-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**	**-0.1**	**-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	7171	7171	7171	7171	2507	2507	2507	2507	247	247	247	247	1339	1339	1339	1339	1541	1541	1541	1541	-2623	-2623	-2623	-2623
0.01	**0.02**	6830	6519	6236	5976	2388	2279	2180	2089	235	225	215	206	1275	1217	1164	1116	1468	1401	1340	1284	-2498	-2385	-2281	-2186
0.0	0.0	666	6209	5801	5433	2329	21	202	18	230	21	200	18	124	11	108	10	143	13	124	11	-	-	-	-

2	3	3					71	8	99		4		7	4	59	3	14	2	34	7	67	2437	2271	2122	1987
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
0.04	0.05	6473	5862	5325	4851	2263	2049	1862	1696	223	202	183	167	1209	1095	994	906	1391	1260	1144	1042	-2368	-2144	-1948	-1774
0.05	**0.06**	6409	5747	5170	4664	2241	2009	1807	1631	221	198	178	161	1197	1073	965	871	1377	1235	1111	1002	-2344	-2102	-1891	-1706
0.06	0.07	6356	5653	5044	4514	2222	1976	1763	1578	219	195	174	155	1187	1055	942	843	1366	1215	1084	970	-2325	-2068	-1845	-1651
0.07	**0.08**	6311	5573	4938	4388	2206	1948	1726	1534	217	192	170	151	1178	1041	922	819	1356	1198	1061	943	-2308	-2039	-1806	-1605
0.08	0.09	6271	5504	4847	4281	2193	1924	1694	1497	216	190	167	147	1171	1028	905	799	1348	1183	1042	920	-2294	-2013	-1773	-1566
0.09	**0.10**	6237	5444	4767	4188	2180	1903	1667	1464	215	188	164	144	1165	1016	890	782	1340	1170	1024	900	-2281	-1991	-1744	-1532
0.10	0.11	6206	5390	4697	4106	2170	1884	1642	1435	214	186	162	141	1159	1006	877	767	1334	1158	1009	882	-2270	-1972	-1718	-1502
0.11	**0.12**	6178	5341	4634	4033	2160	1867	1620	1410	213	184	160	139	1154	997	865	753	1328	1148	996	867	-2260	-1954	-1695	-1475
0.12	0.13	6152	5297	4577	3966	2151	1852	1600	1387	212	182	158	137	1149	989	855	741	1322	1138	983	852	-2250	-1938	-1674	-1451
0.13	**0.14**	6129	5257	4524	3906	2143	1838	1582	1366	211	181	156	135	1144	982	845	729	1317	1130	972	839	-2242	-1923	-1655	-1429
0.14	0.15	6107	5219	4476	3851	2135	1825	1565	1346	210	180	154	133	1140	975	836	719	1312	1122	962	828	-2234	-1909	-1637	-1409
0.15	**0.16**	6086	5185	4432	3801	2128	1813	1549	1329	210	179	153	131	1136	968	828	710	1308	1114	952	817	-2226	-1897	-1621	-1390
0.16	0.17	6067	5153	4391	3754	2121	1801	1535	1312	209	177	151	129	1133	962	820	701	1304	1107	944	807	-2219	-1885	-1606	-1373
0.17	**0.18**	6050	5123	4352	3710	2115	1791	1522	1297	208	176	150	128	1130	957	813	693	1300	1101	935	797	-2213	-1874	-1592	-1357
0.18	0.19	6033	5094	4317	3669	2109	1781	1509	1283	208	175	149	126	1126	951	806	685	1296	1095	928	789	-2207	-1863	-1579	-1342

0.19	**0.20**	6017	5068	4283	3631	2104	1772	1497	1269	207	175	148	125	1124	946	800	678	1293	1089	920	780	-2201	-1854	-1567	-1328
0.20	0.21	6002	5042	4251	3595	2098	1763	1486	1257	207	174	146	124	1121	942	794	671	1290	1084	913	773	-2195	-1844	-1555	-1315
0.21	**0.22**	5988	5018	4221	3561	2093	1754	1476	1245	206	173	145	123	1118	937	788	665	1287	1078	907	765	-2190	-1836	-1544	-1303
0.22	0.23	5974	4996	4192	3529	2089	1747	1466	1234	206	172	144	122	1116	933	783	659	1284	1074	901	758	-2185	-1827	-1533	-1291
0.23	**0.24**	5961	4974	4165	3499	2084	1739	1456	1223	205	171	143	121	1113	929	778	653	1281	1069	895	752	-2181	-1819	-1523	-1280
0.24	0.25	5949	4954	4139	3470	2080	1732	1447	1213	205	171	143	120	1111	925	773	648	1278	1064	889	746	-2176	-1812	-1514	-1269
0.25	**0.26**	5937	4934	4114	3442	2076	1725	1438	1203	204	170	142	119	1109	921	768	643	1276	1060	884	740	-2172	-1805	-1505	-1259
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1.30	1.31	5472	4191	3222	2485	1913	1465	1126	869	188	144	111	86	1022	783	602	464	1176	901	692	534	-2001	-1533	-1178	-909
1.31	**1.32**	5470	4188	3218	2481	1912	1464	1125	867	188	144	111	85	1021	782	601	463	1175	900	692	533	-2001	-1532	-1177	-908
1.32	1.33	5468	4185	3214	2477	1912	1463	1124	866	188	144	111	85	1021	781	600	463	1175	899	691	532	-2000	-1531	-1176	-906
1.33	**1.34**	5466	4182	3211	2474	1911	1462	1123	865	188	144	111	85	1021	781	600	462	1175	899	690	532	-1999	-1530	-1174	-905
1.34	1.35	5464	4179	3207	2470	1910	1461	1121	864	188	144	110	85	1020	780	599	461	1174	898	689	531	-1998	-1528	-1173	-903
1.35	**1.36**	5462	4176	3204	2466	1909	1460	1120	862	188	144	110	85	1020	780	598	461	1174	897	688	530	-199	-152	-117	-902

																						8	7	2	
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
1.37	**1.38**	5458	4169	3197	2459	1908	1458	1118	860	188	144	110	85	1019	779	597	459	1173	896	687	528	-1996	-1525	-1169	-899
1.38	1.39	5456	4166	3193	2456	1907	1457	1116	858	188	144	110	85	1019	778	596	459	1172	895	686	528	-1996	-1524	-1168	-898
1.39	**1.40**	5454	4163	3190	2452	1907	1456	1115	857	188	143	110	84	1018	777	596	458	1172	895	685	527	-1995	-1523	-1167	-897
1.40	1.41	5452	4160	3186	2449	1906	1454	1114	856	188	143	110	84	1018	777	595	457	1172	894	685	526	-1994	-1522	-1166	-896
1.41	**1.42**	5450	4157	3183	2445	1905	1453	1113	855	188	143	110	84	1018	776	594	457	1171	893	684	525	-1993	-1521	-1164	-894
1.42	1.43	5448	4155	3180	2442	1905	1452	1112	854	188	143	110	84	1017	776	594	456	1171	893	683	525	-1993	-1520	-1163	-893
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	892	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	-1516	-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	-1515	-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	-1514	-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	-1513	-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

0.25	0.26	7939	6597	5502	4603	1630	1355	1130	945	-927	-771	-643	-538	2362	1963	1637	1370	-2569	-2135	-1780	-1490
0.26	**0.27**	7924	6572	5470	4568	1627	1350	1123	938	-925	-768	-639	-534	2358	1955	1628	1359	-2564	-2127	-1770	-1478
0.27	0.28	7909	6548	5440	4534	1624	1345	1117	931	-924	-765	-635	-530	2353	1948	1619	1349	-2559	-2119	-1760	-1467
0.28	0.29	7895	6525	5411	4502	1621	1340	1111	924	-922	-762	-632	-526	2349	1941	1610	1340	-2555	-2111	-1751	-1457
0.29	**0.30**	7881	6502	5383	4471	1618	1335	1105	918	-921	-759	-629	-522	2345	1935	1602	1330	-2550	-2104	-1742	-1447
0.30	0.31	7868	6481	5356	4442	1616	1331	1100	912	-919	-757	-626	-519	2341	1928	1594	1322	-2546	-2097	-1733	-1437
0.31	**0.32**	7856	6460	5331	4413	1613	1326	1095	906	-918	-754	-623	-515	2337	1922	1586	1313	-2542	-2090	-1725	-1428
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0.33	**0.34**	7831	6420	5282	4359	1608	1318	1085	895	-915	-750	-617	-509	2330	1910	1571	1297	-2534	-2078	-1709	-1411
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0.35	0.36	7809	6383	5236	4309	1603	1311	1075	885	-912	-746	-612	-503	2323	1899	1558	1282	-2527	-2066	-1694	-1394
0.36	**0.37**	7798	6365	5214	4285	1601	1307	1071	880	-911	-743	-609	-501	2320	1894	1551	1275	-2523	-2060	-1687	-1387
0.37	0.38	7787	6348	5193	4262	1599	1304	1066	875	-910	-741	-607	-498	2317	1889	1545	1268	-2520	-2054	-1681	-1379
0.38	**0.39**	7777	6332	5173	4240	1597	1300	1062	871	-908	-740	-604	-495	2314	1884	1539	1262	-2517	-2049	-1674	-1372
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0.40	**0.41**	7758	6300	5134	4197	1593	1294	1054	862	-906	-736	-600	-490	2308	1874	1527	1249	-2510	-2039	-1661	-1358
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0.43	**0.44**	7730	6255	5079	4138	1587	1284	1043	850	-903	-731	-593	-483	2300	1861	1511	1231	-2501	-2024	-1644	-1339
0.44	0.45	7721	6241	5062	4119	1585	1281	1039	846	-902	-729	-591	-481	2297	1857	1506	1226	-2499	-2019	-1638	-1333
0.45	**0.46**	7713	6227	5045	4101	1584	1279	1036	842	-901	-727	-589	-479	2295	1853	1501	1220	-2496	-2015	-1633	-1327
0.46	0.47	7704	6213	5029	4083	1582	1276	1033	838	-900	-726	-587	-477	2292	1849	1496	1215	-2493	-2011	-1627	-1321
0.47	**0.48**	7696	6200	5013	4066	1580	1273	1029	835	-899	-724	-585	-475	2290	1845	1491	1210	-2490	-2006	-1622	-1316
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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

0.75	**0.76**	7520	5920	4676	3707	1544	1216	960	761	-878	-691	-546	-433	2237	1761	1391	1103	-2433	-1916	-1513	-1199
0.76	0.77	7515	5912	4667	3697	1543	1214	958	759	-878	-691	-545	-432	2236	1759	1389	1100	-2432	-1913	-1510	-1196
0.77	0.78	7510	5904	4658	3687	1542	1212	957	757	-877	-690	-544	-431	2234	1757	1386	1097	-2430	-1911	-1507	-1193
0.78	**0.79**	7505	5897	4649	3678	1541	1211	955	755	-877	-689	-543	-430	2233	1754	1383	1094	-2429	-1908	-1504	-1190
0.79	0.80	7500	5889	4640	3669	1540	1209	953	753	-876	-688	-542	-429	2232	1752	1381	1092	-2427	-1906	-1502	-1187
0.80	**0.81**	7496	5882	4632	3660	1539	1208	951	751	-876	-687	-541	-427	2230	1750	1378	1089	-2426	-1903	-1499	-1184
0.81	0.82	7491	5875	4623	3651	1538	1206	949	750	-875	-686	-540	-426	2229	1748	1376	1086	-2424	-1901	-1496	-1181
0.82	**0.83**	7487	5867	4615	3642	1537	1205	948	748	-874	-685	-539	-425	2227	1746	1373	1083	-2423	-1899	-1493	-1178
0.83	0.84	7482	5860	4606	3633	1536	1203	946	746	-874	-684	-538	-424	2226	1744	1371	1081	-2421	-1896	-1491	-1176
0.84	0.85	7478	5853	4598	3624	1535	1202	944	744	-873	-684	-537	-423	2225	1742	1368	1078	-2420	-1894	-1488	-1173
0.85	**0.86**	7473	5846	4590	3616	1535	1201	943	742	-873	-683	-536	-422	2223	1739	1366	1076	-2418	-1892	-1485	-1170
0.86	0.87	7469	5840	4582	3607	1534	1199	941	741	-872	-682	-535	-421	2222	1737	1363	1073	-2417	-1890	-1483	-1167
0.87	**0.88**	7465	5833	4574	3599	1533	1198	939	739	-872	-681	-534	-420	2221	1735	1361	1071	-2416	-1888	-1480	-1165
0.88	0.89	7460	5826	4566	3591	1532	1196	938	737	-871	-681	-533	-419	2220	1733	1359	1068	-2414	-1885	-1478	-1162
0.89	**0.90**	7456	5820	4559	3583	1531	1195	936	736	-871	-680	-532	-418	2218	1732	1356	1066	-2413	-1883	-1475	-1159
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0.92	**0.93**	7444	5801	4536	3559	1529	1191	931	731	-869	-678	-530	-416	2215	1726	1350	1059	-2409	-1877	-1468	-1152
0.93	0.94	7440	5794	4529	3552	1528	1190	930	729	-869	-677	-529	-415	2214	1724	1347	1057	-2408	-1875	-1466	-1149
0.94	**0.95**	7436	5788	4522	3544	1527	1189	928	728	-869	-676	-528	-414	2212	1722	1345	1054	-2406	-1873	-1463	-1147
0.95	0.96	7432	5782	4515	3537	1526	1187	927	726	-868	-675	-527	-413	2211	1720	1343	1052	-2405	-1871	-1461	-1144
0.96	**0.97**	7428	5776	4508	3529	1525	1186	926	725	-868	-675	-526	-412	2210	1719	1341	1050	-2404	-1869	-1459	-1142
0.97	0.98	7424	5770	4501	3522	1525	1185	924	723	-867	-674	-526	-411	2209	1717	1339	1048	-2403	-1867	-1456	-1140
0.98	0.99	7421	5764	4494	3515	1524	1184	923	722	-867	-673	-525	-411	2208	1715	1337	1046	-2401	-1865	-1454	-1137
0.99	**1.00**	7417	5759	4487	3508	1523	1182	921	720	-866	-673	-524	-410	2207	1713	1335	1044	-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	-	-	-	-
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1.1	1.1	737	568											219	169	131	101	-	-	-	-
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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	-	-	-	-
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1.1	**1.1**	736	567											219	168	130	101	-	-	-	-
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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	-	-	-	-
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1.1	1.1	735	565											218	168	130	100	-	-	-	-
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1.2	**1.2**	734	564											218	168	129	100	-	-	-	-
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1.2	1.2	734	564											218	167	129	100	-	-	-	-
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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	-	-	-	-
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1.2	1.2	733	562											218	167	128		-	-	-	-
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1.2	1.2	732	562											218	167	128		-	-	-	-
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1.3	1.3	730	557											217	166	127		-	-	-	-
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1.3	1.3	729	557											217	165	127		-	-	-	-
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1.3	1.3	729	557											217	165	127		-	-	-	-
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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		-	-	-	-
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1.4	1.4	728	554											216	165	126		-	-	-	-
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1.4	1.4	727	554											216	164	126		-	-	-	-
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1.4	1.4	727	554											216	164	126		-	-	-	-
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1.4	1.4	727	553											216	164	125		-	-	-	-
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1.4	1.4	727	553											216	164	125		-	-	-	-
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1.4	1.5	726	552											216	164	125		-	-	-	-
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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
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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
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0.59	**0.60**	10700	8524	6814	5466	503	401	320	257	467	372	298	239	1090	868	694	557	-13	-11	-9	-7
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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
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0.65	**0.66**	10649	8442	6717	5362	501	397	316	252	465	369	293	234	1084	860	684	546	-13	-11	-8	-7
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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
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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
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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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0.95	**0.96**	10450	8130	6348	4973	491	382	298	234	457	355	277	217	1064	828	646	506	-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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1.49	**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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