Smartlink – Baseline for Measurement of Benefits

by

Billy M. Williams, David W. Craft, John A. Wagner, Nagui M. Rouphail,

George F. List, Dylan R. Horne, and Brian L. Narron

North Carolina State University

Department of Civil, Construction, and Environmental Engineering

Campus Box 7908, Raleigh, NC 27695

Institute for Transportation Research and Education

Campus Box 8601, Raleigh, NC 27695-8601

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16. Abstract

The North Carolina Department of Transportation (NCDOT) operates several traffic management centers across the state along with accompanying field devices such as traffic condition data stations, traffic surveillance cameras, and variable message signs in addition to several regional incident management assistance patrols (IMAP). These centers currently operate independently in an environment without dedicated center-to-center communication or seamless interaction. Efficient system operation and management at the corridor and regional levels are severely hindered by this lack of integration. In order to remedy this unacceptable situation thereby unleashing the potential for significantly reducing delay and increasing system efficiency and reliability, NCDOT plans to procure a statewide ATMS systems.

This ATMS procurement was planned to occur during the performance of this research project. However, the procurement was delayed. Nonetheless the project achieved many of the original project goals. Although the baseline period did not come to an end during the project, the research established the framework for data assembly and baseline performance assessment. The project included a comprehensive review to the state of the practice and research in ATMS performance measurement and provided justification, data needs, and calculation methods for eighteen recommended performance measurements. The project also developed and tested a method for categorizing route performance based on analysis of full travel time distributions and developed and prototyped a multi-level reporting system for ongoing monitoring and assessment of ATMS performance.

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Executive Summary

This research project contributes several valuable research results that will assist the NCDOT Traffic Operations Unit as they continue to move toward the ultimate procurement of a statewide ATMS. In terms of system performance measurement, the research team conducted an extensive review of the national and international state of the practice and, in consultation with the project Steering and Implementation Committee, developed a recommend set of eighteen performance measures. These recommended measures include operations and incident management measures and can be found in Table 3-1 Selected Performance Measures.

The research team fully developed and documented the calculation methods and data requirements for the selected methods. This task is described in report Chapter 3 and formal templates containing the relevant information for each performance measure are included in Appendix B. The research team also developed a recommended hierarchy for the quarterly performance reporting. The hierarchy consists of three nested levels, namely a Statewide Summary report, Division reports, and County reports. The methodological details for producing these reports are provided in report section 5.1.1 and prototypes of Division and County level reports are provided in Appendix C along with an example detailed corridor report for a six-mile segment of I-40 in Wake County.

The research project also involved two extensive basic research efforts in support of the project goals. The first effort was the development of a method to classify all collisions as having either occurred in uncongested conditions, recurring congestion, or non-recurring congestion. This method served as the basis for a more detail method developed under the ongoing project RP 2014-12 *Incident Management Assistance Patrols – Assessment of Benefits/Costs, Route Selection, and Prioritization*. The collision classification methodology is discussed in report

section 5.2. The second basic research activity was the development of a route travel time distribution classification scheme. This research was motivated by the recommendation from the SHRP2 L02 *Establishing Monitoring Programs for Travel Time Reliability* project that agencies responsible for monitoring and working to improve travel time reliability should develop comfort and skill at evaluating the entire travel time distribution rather than focusing on one or two key points along the distribution. The research began with an unsupervised clustering based on a set of statistical measures and then demonstrated that a simple classification tree method could reproduce the automatic clusters. This clustering method holds the promise of making it practical to implement the L02 recommendations on a large number of routes. The classification scheme can both serve as an indicator of performance through the tracking of the proportion of routes in each cluster and as a screening tool to identify routes that need more detailed analysis.

The original overarching goal of this research project was to develop a benefit-cost monitoring and reporting methodology for a statewide ATMS for North Carolina that was planned for procurement sometime during the first year of the original research project performance period. The initial procurement activity was abandoned, and although the NCDOT remains committed to the eventual deployment of a statewide ATMS, there is no firm schedule for resuming the procurement process. This reality resulted in changes to the scope and ultimate outcome of this project. In simplest terms, the original goal of calculating the definitive pre-ATMS baseline performance measures based on the end of the pre-ATMS period was not possible because the pre-ATMS period continues. However, the contributions described above provide a solid foundation for continued development of the benefit-cost reporting system. This ongoing development is currently getting underway under FHWA's SHRP2 Implementation Assistance Program (IAP). The core research team for this project will be conducting the IAP research under RP 2016-32

SHRP2 L38 *Reliability Data and Analysis Tools Implementation Assistance Program Proof of Concept Pilot Study*.

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CHAPTER 1. INTRODUCTION

1.1 Project Motivation

The North Carolina Department of Transportation (NCDOT) operates several traffic management centers across the state along with accompanying field devices such as traffic condition data stations, traffic surveillance cameras, and variable message signs in addition to several regional incident management assistance patrols (IMAP). These centers currently operate independently in an environment without dedicated center-to-center communication or seamless interaction. Efficient system operation and management at the corridor and regional levels are severely hindered by this lack of integration. In order to remedy this unacceptable situation thereby unleashing the potential for significantly reducing delay and increasing system efficiency and reliability, NCDOT entered a contract in 2012 to develop a statewide, state-of-the-art advanced traffic management system (ATMS) that was to be known as Smartlink. Subsequent to award, the ATMS contract was ended. Therefore, the need for an integrated statewide ATMS remains. The delay in procuring the needed statewide system directly impacted the anticipated research tasks under this project as described and documented below. Readers of this report should be aware that NCDOT no longer intends to refer to the future statewide ATMS by the name Smartlink. Therefore, with the exception of the official project title and this introductory chapter, references to Smartlink have been removed and replaced with the generic phrase “statewide ATMS” or in some cases simply the acronym ATMS.

NCDOT’s commitment to ultimately acquiring a statewide, integrated ATMS remains. The ATMS will integrate the various independent traffic management centers (TMCs) across the state as well as completing the task of fully integrating all field devices to their respective TMCs. The

NCDOT vision for the ATMS is that it will be a state of the art system that takes advantage of years of deployment experience and transformative research.

Based on documented performance of ATMS deployments across the U.S. and around the world, NCDOT has a solid foundation for expecting significant quality of life and economic vitality benefits to accrue as a direct result of the future ATMS deployment. This strong expectation of benefits in turn provides a solid foundation for expecting a strong return on the ATMS system investment to the citizens of North Carolina. Nevertheless, NCDOT recognized the importance of accurate ongoing evaluation of ATMS costs and benefits both to provide honest and transparent accountability to citizens and officials and to support effective decision making regarding future ATMS enhancements.

As originally proposed, this research project was intended to lay the necessary groundwork for establishing a periodic ATMS cost-benefit estimation and reporting system. The key components of the proposed research included (a) selecting and defining the most appropriate performance measures for quantifying system benefits, (b) clearly identifying and specifying the necessary data elements needed to enable calculation of the selected measures, (c) assembling the required data elements necessary to adequately describe pre-ATMS transportation system status and performance, and (d) designing and developing the methodology for ongoing data collection and performance monitoring and periodic cost-benefit analysis reporting.

Going forward, NCDOT recognizes the critical need to assess the mobility benefits of the statewide ATMS system investment. This recognition provided the foundational motivation for this research project. Even though the research tasks had to be restructured to accommodate the delay in ATMS procurement, the research project as amended was successful nonetheless in laying the groundwork for ongoing evaluation of system benefits.

1.2 Project Objective

The original research objectives were spelled out in an NCDOT Call for New Research Needs statement. These objectives fourfold were –

1. Determine and formalize the set of Smartlink performance metrics that will be used in operational assessment and cost-benefit analysis. The metrics will be selected and refined in close coordination with the project steering and implementation committee.
2. Provide a data collection framework designed to ensure that all the required data elements needed to estimate the performance metrics are collected and appropriately archived.
3. Assemble all necessary data to create a comprehensive pre-system deployment baseline to enable detailed evaluation of current system performance in terms of the established metrics.
4. Establish a methodology for periodic, ongoing reporting of Smartlink system performance and cost-benefit analysis.

As mentioned above, the anticipated Smartlink system procurement that was planned to occur during the project was unsuccessful. Although a future statewide ATMS is planned, this system will not be referred to as Smartlink. The delay in statewide ATMS procurement necessitated modification of the project objectives and tasks. The modified research project achieved, at least partially, all of the objectives listed above. The first two objectives were met fully. The third objective could not be met fully given that the pre-system deployment period continued through and continues beyond the end of the project. However, as detailed in the relevant sections of this report, pre-deployment quarterly reports were compiled and are included in the report appendices. The fourth objective was met substantially in full. The reporting methodology was developed and

tested through the generation of the pre-deployment quarterly reports. It had been hoped that in the course of meeting the fourth objective, prudent modifications would be identified and implemented based on the post-deployment experience. The delay in statewide ATMS procurement of course negated this planned activity.

1.3 Research Tasks

In order to fully document the originally planned and modified research activities, the tasks as presented in the project authorization document are given below along with any modifications that were necessary during the course of the project.

1.3.1 Task 1 – Project Kickoff Meeting

1.3.1.1 Original Description

The project kickoff meeting will provide the venue for critically important initial communication between the project team and the project steering and implementation committee. A brief summary of the proposed tasks and schedule will be presented allowing committee members to seek clarification and propose modifications, if necessary. Early coordination will be especially important for this project given that the task for selecting and defining the appropriate performance measures (Task 3 below) is envisioned to involve close collaboration between the project team and selected NCDOT stakeholders. Tentative planning for the Task 5 interim meeting may also be on the kickoff meeting agenda. As always, the kickoff meeting will include discussion of the ultimate implementation plan.

1.3.1.2 Task Modifications

No modifications were necessary for this task.

1.3.2 Task 2 – Literature Review and ATMS Survey

1.3.2.1 Original Description

Following the project kick-off meeting, the project team will initiate the project with a comprehensive literature review of all related research, implementations, and case studies. The team will cast a broad net in an attempt to cover any research or field experience that could inform the problem of ATMS performance measurement and cost-benefit analysis. The project team is well acquainted with this area of research and practice. Nonetheless, a thorough review will be prudent to ensure that all lessons learned and current implementable research results are leveraged in the development of the Smartlink benefits measurement system. A key example of the research team's knowledge in this area relates to the SHRP2 research project L-02 Establishing Monitoring Programs for Mobility and Travel Time Reliability. The L-02 project included a nationwide ATMS survey, and the project team has in depth knowledge about systems such as Berkeley Transportation Systems' PeMS and OpenRoads.

In addition to a thorough literature review, the project team will conduct a brief survey to learn about performance evaluation and benefit-cost assessment processes for ATMS deployments of a similar scope and scale to Smartlink. The survey will serve to fill in important details regarding lessons learned from actual performance evaluation experience that may be missing from the literature.

1.3.2.2 Task Modifications

No modifications were necessary for this task.

1.3.3 Task 3 – Select and Define Appropriate Performance Measures

1.3.3.1 Original Description

In close consultation and collaboration with the project steering and implementation committee and supported by inputs gathered in Task 2, the project team will select and fully define the appropriate ATMS performance measures. The project team is heavily involved in research funded at both the national and state levels in monitoring and measurement of transportation system mobility and travel time reliability. The related research includes the NCDOT-sponsored Mobility and Reliability Performance Measurement project (RP 2011-07) that will be concluding just as this proposed project will be getting under way. There is likely to be substantial overlap and high value research findings and products from the various ongoing and recently completed research projects that will inform the metric selection and definition efforts. However, these related projects are targeted more generally. At the overarching conceptual level, a lack of consensus remains concerning the "what and how" of performance measurement, and the Smartlink benefits assessment project is neither general nor conceptual.

Therefore, careful analysis, reflection, and serious discussion will be necessary to identify the candidate performance measures. The final set of performance measures will need to be selected primarily on applicability and utility in supporting benefits assessment and secondarily on implementability. It is important to note that implementability is a fundamental requirement for the selected measures. Therefore, final assessment and selection of performance measures will require careful consideration of the findings of the data requirements task that follows.

It is also important to note that the final set of performance metrics will not be skewed toward the newer methodologies simply due to their novelty. The selection of appropriate performance measures will be driven by what can and should be measured on a continuing basis. All of

NCDOT's existing performance measures, such as incident response metrics, will be considered. The existing measures that the steering and implementation committee consider to be effective and useful will be retained.

1.3.3.2 Task Modifications

There were no modifications to this task in terms of research activity and task outcome. However this task was integrated with Task 4 – Definition and Specification of Data Requirements.

1.3.4 Task 4 – Definition and Specification of Data Requirements

1.3.4.1 Original Description

After the performance measures have been selected and defined, a clear and comprehensive specification of the data necessary to compute the selected performance measures will be developed. As mentioned in the Task 3 description above, these two tasks will need to proceed in parallel. Even though the data requirements cannot be finalized until the performance measure set has been finalized, it will be important to begin a broad assessment of the data elements that can be realistically collected and archived to inform the implementability evaluation of candidate performance measures. It is also clear that Tasks 3 and 4 will be iterative in nature, in that data availability and/or costs may result in modifying and refining the set of performance measures selected in Task 3.

1.3.4.2 Task Modifications

There were no modifications to this task in terms of research activity and task outcome. However, the project team realized that the iterative nature of Tasks 3 and 4 would be best served by more closely linking the two tasks. Therefore, the research activities in this task were integrated with the activities under Task 3 – Select and Define Appropriate Performance Measures.

1.3.5 Task 5 – Interim Project Meeting and Finalization of Metrics and Data Requirements

1.3.5.1 Original Description

An interim project meeting is envisioned to share, discuss, and finalize the results of Tasks 1 through 4 with the steering and implementation committee. After the interim meeting and any follow on discussion are concluded, the project team will prepare a project memorandum that documents the final set of performance metrics.

1.3.5.2 Task Modifications

No modifications were necessary for this task.

1.3.6 Task 6 – Assemble Pre-deployment Baseline Data

1.3.6.1 Original Description

Baseline data gathering will run through much of the project performance period up to the time when Smartlink deployment has reached a point where the "before condition" has effectively ended. The expectation is that the ultimate system will be built on continuously gathered, non-volatile data. However, there may be data needed for the performance measures that are not yet archived and therefore may be transient during the pre-deployment period. Although this will be an important point of discussion during the project kickoff meeting, a possible strategy will be to begin archiving, as soon as possible after the start of the project, all identifiable and available volatile data that may prove to be important. Another important detail for this task will be selection of the date or time window that will serve as the official baseline time frame.

1.3.6.2 Task Modifications

This task was impacted by two significant occurrences during the project execution. First, the delay in the statewide ATMS deployment pushed the end of the pre-deployment baseline beyond the end of the project. Second, one-minute archived INRIX data became available to NCDOT

through the Vehicle Probe Project of the I-95 Corridor Coalition. This second occurrence rendered to anticipated activity of created a physical, local archive of the pre-deployment data superfluous. The fact that NCDOT neither needs nor desires a physical, local archive of the pre-deployment data was verified with the project Steering and Implementation Committee at an interim progress meeting held on February 25, 2015.

1.3.7 Task 7 – Develop Performance Measurement Methodology

1.3.7.1 Original Description

After finalizing the performance measures and defining the supporting data, the detailed methodology for calculating the selected performance measures will be developed. This methodology will address issues such as dealing with missing or anomalous data and data imputation, performance measure update interval, performance measure aggregation over various traffic management center boundaries and time horizons, accounting for changes in traffic demand (e.g. VMT) in data interpretation, etc.

1.3.7.2 Task Modifications

No modifications were necessary for this task.

1.3.8 Task 8 – Develop Cost Benefit Analysis Reporting Methodology

1.3.8.1 Original Description

The performance measures alone will not yield a quantification of benefits. Benefits resulting from the Smartlink investment must be derived by comparing the "after deployment" performance measures to the baseline performance. This benefit quantification methodology along with an appropriate methodology for rolling the operational benefits into a clear and unbiased cost benefit analysis will be developed.

1.3.8.2 Task Modifications

This task was substantially completed as originally planned. However, the cost side of the cost benefit analysis was significantly curtailed due to the lack of hard ATMS cost data resulting from the procurement delay.

1.3.9 Task 9 – Calculate Baseline Performance Measures

1.3.9.1 Original Description

The performance measurement methodology will be applied to the defined baseline conditions. As mentioned above, this baseline assessment will form the basis for quantification of system benefits.

1.3.9.2 Task Modifications

The primary change in this task is that the pre-deployment baseline did not end during the project performance period. However, baseline performance measures were calculated in the form of quarterly reports, which are provided in the report appendices.

1.3.10 Task 10 – Conduct Initial Implementation of Online Measurement and Reporting System

1.3.10.1 Original Description

At some point during the two-year project performance period, it is anticipated that sufficient progress will be reached on the Smartlink deployment to allow initial implementation and testing of the online performance measurement and cost-benefit reporting system in a pilot-type environment. Although significant measurable benefits may not be evident until the Smartlink deployment becomes substantially complete, this initial implementation will serve to validate the measurement and reporting system and may reveal the need for modifications to the system

1.3.10.2 Task Modifications

This task was originally intended to use post-deployment data to test and validate the performance measurement and cost benefit analysis methodology. Given the delay in the ATMS procurement, this task was addressed through the quarterly reports mentioned above.

1.3.11 Task 11 – Project Final Report and Deliverables

1.3.11.1 Original Description

A comprehensive final report will be prepared documenting all project tasks. In addition to the project closeout meeting, the project team will meet with additional NCDOT system operations professionals as necessary and appropriate to facilitate technology transfer of the research results and recommendations. At this early stage, the online system deliverable is envisioned to be a web based system that the NCDOT could deploy either as a public, private, or combination public/private site.

1.3.11.2 Task Modifications

Given the delay in ATMS procurement, the research project deliverables are essentially limited to this project final report.

1.4 Summary

In this chapter, the motivations and purposes of this project were introduced. The project tasks were also presented in terms of the original task descriptions and modifications that were necessary during the course of the project research. In the following chapters, the research findings of the individual tasks are presented in more detail. This task detail is then following by chapters that present a summary of the primary conclusions and finally the project recommendations and technology transfer plan.

CHAPTER 2. LITERATURE REVIEW AND ATMS SURVEY (TASK 2)

A comprehensive literature review was conducted in order to review all materials from related research, implementations, and case studies that could lend insight to useful ATMS performance measures. The literature that was subject to review came from a variety of sources throughout the world and was written from a variety of perspectives over several decades. For the sake of brevity, only the most relevant and useful documents are mentioned individually in this literature review. Other sources are grouped together in order to reference their contributions to the research. Because the statewide ATMS is intended to be truly statewide in scope, performance measures, which are able to report statewide performance, are important. Therefore, reports that focused not only on ATMS evaluation, but also on statewide performance evaluation were considered. The review is broken up into two parts that first reviews literature regarding ATMS evaluation only, and then reviews statewide performance evaluation. Table 2-1 displays the locations of the sources that are referenced in this review.

Table 2-1 Referenced Source Locations

Location	Number of Sources
Arizona	1
California	1
Florida	8
Indiana	1
Maryland	1
Michigan	1
Minnesota	1
Oregon	2
Texas	2
Utah	2
Virginia	1
Washington	1
Washington D.C.	1
China	3
Netherlands	1
South Africa	2
United Kingdom	1

2.1 ATMS Performance Measure Evaluation

In Portland, Oregon, an 11-mile freeway corridor was the subject of generating specific performance measures from a week's worth of ATMS data archived in 2000. Those data are collected by the traffic operations center in order to measure performance along one of the region's congested corridors. The freeway corridor used devices such as loop detectors and ramp meters to gather and archive necessary data. Inductive loop detectors archive vehicle count, occupancy, and average speed over a twenty second aggregation period. In this study, performance measures were grouped into multiple categories which included mobility, economic development, quality of life, environmental/resource conservation, and safety. These categories were composed of a substantial list of performance measures which can be found in Appendix A. (Bertini, Leal, & Lovell, 2002).

In Seattle, there was an attempt to evaluate the North Seattle Advanced Traffic Management System in order to quantify the potential benefits and costs of an arterial traffic data sharing system. Through information such as volumes and signal timing plans, plans were made to define quantitative measures of effectiveness such as changes in traffic performance due to coordinated traffic management. However, the goal of evaluating ATMS performance through the benefits of traffic management actions resulting from having real time data sharing and coordination capabilities could not be accomplished. This is due to the inability to collect sufficient data during the time periods where these benefits occurred, such as during incidents (Ishimaru & Hallenbeck, 2002).

Bertini and El-Geneidy discuss using ATMS data to evaluate ITS investments in *Assessing The Benefits and Costs of ITS* (Bertini & El-Geneidy, 2010). The ATMS measures of effectiveness can be categorized in terms of 10 individual ITS components. These ITS components and their measures of effectiveness are displayed in Table 2-2 on the next page.

Table 2-2 Bertini and El-Geneidy's ITS components and MOEs

ITS Component	MOEs
Freeway Management Systems	• Reduction in travel time or delay • Increased flows • Flow improvements • Safety
Incident Management Systems	• Incident Detection • Incident Verification • Incident Response • Incident Clearance • Incident Location • Traffic Management
Transit Management Systems	• Transit reliability • Transit efficiency
Arterial Management Systems	• Flow • Speed
Emergency Management Systems	• Reduction in response time of emergency vehicles
Electronic Payment Systems	• Congestion • Delay • Transit travel time reliability
Traveler Information Systems	• Congestion levels
Crash Prevention and Safety	• Crash prevention • Safety system benefits
Operations and Maintenance	• Archived Data
Road Weather Management Systems	• Cost of roadway upkeep • Roadway performance with and without

In Florida, the statewide Advanced Traffic Management System is operated by FDOT's SunGuide Software. Over the past 10 years, SunGuide has been disseminated to the TMCs within the state. The current version includes integration with CCTV, DMS, incident management, message attribution systems, traffic sensor systems, travel time, video switching, video walls, ramp

metering, RWIS sensors, HAR, safety barrier cable systems, inventory and maintenance, emergency evacuation, center-to-cent plug-in, 511, AVL/RR, event management, reporting, VSL, express lane, CAD, INRIX integration, smart phone application for road rangers, and connected vehicle integration. It allows the state to establish statewide performance measures (SunGuide Software,). District reports are available which present the performance measures selected from the SunGuide ATMS. District 4 publishes an annual report card which includes selected performance measures and their corresponding grade for the previous year based on a grading scale established by the district (Florida Department of Transportation, 2012a). District 4 also publishes a quarterly incident duration performance measurement report. The report also includes a cost-benefit analysis along with analysis of "travel reliability data" for specific corridors (Florida Department of Transportation, 2013a). District 6 releases an annual ITS report which summarizes the ITS deployments, TMC operations, incident management, IT/ITS management, Traveler Information, public outreach, and benefits to the public (Florida Department of Transportation, 2012c). District 6 also releases monthly travel time reliability reports which detail speeds and volumes, travel time indices, and travel time information for specific corridors (Florida Department of Transportation, 2015). Performance measures listed by these reports, along with the measures listed from districts 1, 5, 9, and 11 were also included in Appendix A (Florida Department of Transportation, 2012b; Florida Department of Transportation, 2013b; Florida Department of Transportation, 2013c).

In 2005, Michigan conducted a review in order to determine the best performance measures for a statewide ATMS. Measures were categorized into system, network, and operational performance measures. The performance measures were also explained in terms of their collection and reporting. MDOT desired their ATMS to be able to collect and organize traffic data from

detectors to measure traffic flow. Secondly, they wished for the ATMS to collect data in such a way that manual data entry methods would be decreased or eliminated. MDOT determined that their desired performance measures should be closely tied goals and objectives, and be good indicators of success, measurable, understandable to the public and high level decision-makers, accepted by decision-makers, consistent over time to track progress, and selective. MDOT also focused on measures that could be found using current technology that could be deployed in the near future. The list of MDOT selected performance measures are listed in Appendix A (Michigan Department of Transportation, 2007).

MDOT referenced several sources from which they based their decisions upon which performance measures were most desirable. The review listed the ITS Florida Advisory Council which identified performance measures to implement throughout the state of Florida. Preliminary measures were determined by this council and then refined through interviews with representatives of districts. The ITS program NaviGator in Georgia was also listed and the report described how performance measures were identified through conducting stakeholder workshops. In addition to these, the review also referenced Houston's TranStar program and the University of Virginia recommended performance measures for the Hampton Roads Smart Traffic Center (Houston TransStar Consortium, 2011; Pegues & Demetsky, 2005).

In Maryland, the Coordinated Highways Action Response Team (CHART) is used to improve operational efficiency throughout the state's highways system. The analysis of CHART performance is conducted yearly by the University of Maryland for the Maryland State Highway Administration. Performance measures to assess CHART's incident management and the efficiency of operations are used to determine the resulting benefits. The quality of the data is also

assessed in order to assure that the determined performance measures are reliable. The list of performance measures used to evaluate CHART is listed in Appendix A (Chang & Rochon, 2009).

Utah DOT has an ATMS called CommuterLink that includes a remote-controlled traffic signal system, ramp meters, Variable Message Signs, High Occupancy Vehicle Lanes, Highway Advisory Radio, complete freeway video coverage, and a traveler information system (Martin & Wu, 2003). Traffic monitoring systems are composed of inductive loop detectors that report traffic volume, speed, and occupancy data aggregated to 20 second intervals and are located every half mile on freeways. UDOT uses data from the TMS to create performance measures classified as point, link, corridor, or system measures. The measures used can be seen in Appendix A. The Utah DOT Traffic Management Division also publishes an annual report which lists a division summary for their ATMS. This report lists several performance measures through charts and graphs to displace the benefits of the ATMS. These measures are grouped into categories such as safety and incident response, freeway operations, arterial streets, traveler information, and customer service. The measures listed in this report are displayed in Appendix A.

Arizona DOT and their Regional Intelligent Transportation Systems Partnership in the Phoenix metropolitan area maintain an ATMS known as AZTech™. The evaluation of this project was based on a combination of a Performance Indicator Book and Dashboard released every two years as well as a quarterly dashboard report for its Advanced Traveler Information Systems (ATIS) Working Group. These reports cover a variety of performance measures, ranging from freeway congestion and arterial travel time to incident management thresholds and even social media followers (AZTech™ Strategy Task Force and Operations Committee, 2013).

In the United Kingdom, Van Vuren, Baker, Ogawa, Cooke, and Unwin evaluated the impact of a managed motorway on the M42 near Birmingham, England. Data was collected using

inductive loops, variable message signs, and National Traffic Control Centre's official record of reported incidents and roadwork. Traffic conditions were evaluated before and after through the usage of primary and secondary indicators, or performance measures. These indicators are listed in Appendix A (Vuren, Baker, Ogawa, Cooke, & Unwin, 2012).

In China, ATMS has been installed in cities such as Beijing, Shanghai, Guangzhou, and Hangzhou. In Beijing, ATMS offers traffic guidance information, automatic traffic incident detection, traffic signal timing plans, and real-time traffic information. In Shanghai, ATMS offers parking guidance, traffic signal timing plans, traffic information, EPS, incident information, and traffic violation detection. Guangzhou's ATMS offers real-time information, travel guidance, EPS, traffic signal timing plans, and incident detection. In Hangzhou, ATMS offers traffic signal timing plans, warning to motorists of accidents and congested areas, real-time parking, and traffic information (Du, 2005; Du, 2008; Huang, 2011).

2.2 Statewide and National Evaluation

Washington State Department of Transportation (WSDOT) maintains a quarterly accountability report titled The Gray Notebook. This report has been in use for more than a decade in order to report on the transportation system within the state. As part of the notebook, WSDOT publishes an annual congestion report that includes a comprehensive analysis of the system performance of the state highways. WSDOT aims to analyze the highway system performance on a statewide level and has purchased private sector probe-based speed data in order to evaluate system performance. WSDOT also uses data from approximately 6800 loop detectors. The annual congestion report contains a "dashboard of indicators" that displays the statewide highway system performance. These indicators compare the difference in performance across years and include demographic and economic, system-wide congestion, and corridor-specific congestion indicators

along with WSDOT congestion relief projects. The Gray Book categorizes measures as related to travel delay and VMT, throughput productivity, travel times, and HOV lane performance. The full list of performance measures used by The Gray Book included in Appendix A (Hammond, 2012; Hammond, 2013).

The University of Utah Department of Civil and Environmental Engineering classified performance measures by their purpose and use as operational MOEs, planning measures, environmental MOEs, Economic MOEs, Design MOEs, and system MOEs. These measures were determined to meet specific criteria best indicative of an effective performance measure. These criteria included relevancy, simplicity, measurability, sensitivity and applicability, non-redundancy, and appropriately detailed. The list of performance measures and their classification category as listed by the University of Utah can be found in Appendix A (Martin, Perrin Jr., & Kalyani, 2003). A comprehensive literature review was conducted that included reviewing methods used by California's Performance Measurement System, Portland's Traffic System Performance Evaluation System, a real time information processing algorithm, and the 2001 Urban Mobility report.

The Texas A&M Transportation Institute (TTI) provides an annual report of congestion for urban regions throughout the country. The Congested Corridors Report methodology provides the methods with which TTI produces its annual report. It provides a list of performance measures, their descriptions, and calculations (Texas Transportation Institute, 2011).

Researchers from the University of Southern California used newly-available data from the Regional Integration of Intelligent Transportation Systems (RIITS) in California as well as the Los Angeles Archived Data Management System (ADMS) to outline performance monitoring and evaluation strategies for freeway segments at the regional monitoring level. They identify data

continuity as a major obstacle to proper analysis and system evaluation, emphasizing that the only reliable way to properly monitor roadway performance (with or without an ATMS) is to have ubiquitous data presence with functional sensing equipment. Using a two-step cluster analysis, they demonstrate an analysis scheme and recommend four target performance measures: average speed, traffic volume, speed variance, and delay. Their recommendation for establishing a historical baseline measurement for these performance measures is to use a one-year rolling average for the year prior to the target (Giuliano, Rhoads, & and Chakrabarti, 2014). This regional analysis perspective will prove valuable, considering the project's goal of data and analysis integration across the state of North Carolina.

NCHRP Project 20-24(37)D notes the lack of consistency among states in terms of performance measure selection and definition. It discusses the need for national traffic incident management performance measures and their adoption. In 2009, the Federal Highway Administration developed national Traffic Incident Management performance measures. However, the report finds discrepancies in the definitions of these measures and their calculation when comparing amongst State DOT's. The report recommends specific definitions and performance measures for TIM data (Jacobs, Ivanov, & Pack, 2011).

In South Africa, a national ITS system is being designed, built, operated, and maintained by Kimley-Horn and Associates. Key performance indicators, or measures, are classified on regional ITS and national ITS scales. Regional performance indicators are categorized according to freeway management, maintenance and asset management, incident management, reporting, and the communications backbone. National performance measures are categorized according to advanced traveler information dissemination, reporting, and marketing (South African National Roads Agency Limited, 2011). As of December 2014, specific performance measures have not

been identified and corresponding baseline performance standards have not been constructed, but a framework has been put into place for this process. As outlined by South Africa's National Roads Agency Limited (SANRAL), this process will include a Key Performance Indicator approach (KPI), which will be used to develop the identified performance measures with scores and specific service level evaluation. The evaluations of the various performance measures will be aggregated in the form of performance management scorecards as well as a centralized dashboard (Struwig & Andersen, 2014).

Other sources of literature were considered which contained relevant information, but did not necessarily list specific performance measure recommendations or suggestions on how to categorize them. These reviews came from sources such as the Minnesota DOT regarding the ATMS software IRIS, the Indiana DOT's TrafficWise, and Delft University in the Netherlands (De Schutter et al., 1999; Indiana Department of Transportation, 2008; Kary, Rindels, & Kown, 2012).

2.3 Summary and Next Steps

Using the sources presented in this review, along with the compilation of performance measures, categorizations, descriptions, definitions, and data requirements for performance measure calculation, recommended performance measures could be created. Redundant performance measures were removed from the groupings and the remaining measures were then sorted by prevalence in literature, perceived availability of data requirements, and perceived overall relevance to all stakeholders of the performance measure. The compilation of performance measures from these studies was grouped into four categories, which seemed to be prevalent throughout the literature. These categories were Operations, Incident management, System Info, and Feedback. Operations related performance measures were categorized as those which pertain to mobility related issues on the roadway and their economic influence. Incident management related performance measures were categorized as those which are related to performance during and throughout the duration of an incident by looking at measures which show how efficiently incidents are managed. Systems Information related performance measures were classified as those which are characteristics or usage statistics regarding the system. These performance measures include information such as how much of certain types of equipment are

in the system and how they operate according to specifications or installation. It also includes information on system function in terms of usable data and failure by hardware. Feedback related performance measures were classified as those which come from the user of the system. These performance measures deal with data from customer feedback, 511, and web information. The performance measures would be defined by drawing upon past literature and the supporting data requirements would be listed along with a formula for performance measure calculation.

Table 2-3 on the next page shows examples of performance measures which were most prevalent in the literature.

Table 2-3 Common Performance Measures

Performance Measure	Category
Travel Time	Operations
Delay	Operations
Congested Hours Per Day	Operations
Travel Time Index	Operations
Traffic Throughput	Operations
Vehicle Miles Traveled	Operations
Number And Percent of Lane-Miles Congested	Operations
Travel Time Reliability	Operations
Average Speed	Operations
Fuel Consumption	Operations
Incident Clearance Time	Incident Management
Incident Response Time	Incident Management
Secondary Incidents	Incident Management
Number of Responses	Incident Management
Incident Notification Time	Incident Management
Roadway Clearance Time	Incident Management

CHAPTER 3. SELECTION AND DEFINITION OF ATMS PERFORMANCE MEASURES AND DATA REQUIREMENTS (TASKS 3 AND 4)

One of the core project goals was to address the lack of consensus concerning the "what and how" of performance measurement relating to ATMS implementation. Performance measures would be chosen for a variety of reasons, ranging from literature presence to data availability. Additionally, the measures should be considered primarily on applicability and utility in supporting benefits, with implementability being a secondary consideration. Drawing from the literature discussed in Chapter 2 and these criteria considerations, a total of 18 performance measures were selected for recommendation; 12 of these measures are related to operations management, and the other 6 are based on incident management. The performance measures presented in this chapter were originally discussed with NCDOT and the project steering and implementation committee in an interim project meeting in July 2013 (Task 5).

Each of the selected performance measures is identified in Table 3-1 on the next page as being a key indicator, support for decision making on reliability, or a candidate for monetary benefits. The travel time reliability measure is indicated as both a reliability/decision making performance measure and also as a candidate for monetary benefits. Although no consensus has yet been reached on how to assess the value of marginal improvements in travel time reliability, research is ongoing, and the project research team anticipates that a widely accepted, rational method for valuing reliability improvements will be available in the near future. Although the key indicator performance measures are not recommended for direct conversion to monetary value, the congestion-related key indicators are related to monetizable delay measures, and the incident response-related key indicators will feed into the models that estimate the monetizable measures.

For each of the selected performance measures in this chapter, the proposed definition and justification are presented. A full description of each performance measure (including calculation method, data requirements, application example, and literature summary) is included in Appendix B.

Table 3-1 Selected Performance Measures

Performance Measure	Type
Average Travel Time	Key Indicator
Average Congestion Duration	Key Indicator
Average Max Queue Length	Key Indicator
Congestion Occurrences	Key Indicator
Minute-Miles of Congestion	Key Indicator
Overall Delay	Candidate for Monetary Benefits
Delay Due to Congestion	Candidate for Monetary Benefits
Vehicle Miles Traveled	Key Indicator
Travel Time Index	Reliability/Decision Support
Travel Time Reliability	Reliability/Decision Support Candidate for Monetary Benefits
Emissions Rates	Candidate for Monetary Benefits
Wasted Fuel	Candidate for Monetary Benefits
Average Incident Clearance Time	Key Indicator
Average Incident Response Time	Key Indicator
Average Incident Notification Time	Key Indicator
Average Roadway Clearance Time	Key Indicator
Average Recovery Time	Key Indicator
Secondary Incidents	Candidate for Monetary Benefits

3.1 Operations Management Performance Measures

3.1.1 Average Travel Time

Defined as the average travel time along specific routes, defined by consecutive segments, or along a specific segment for a specified reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of travel times are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time is calculated (RITIS provides up to a 1 min resolution)

Average travel time as a performance measure is reserved for specific routes or corridors throughout the state, which are of the most interest and importance. Average travel time as a measure of effectiveness can be misleading due to large amounts of data across all time periods and roadways when considering an average system-wide travel time. Looking at peak travel times is more relevant as a change in travel times during non-peak periods may create misleading data, which are not based on system-wide improvements due to ATMS implementation. A distribution of peak average travel times may yield more insight into the effectiveness of ATMS implementation. By providing the distribution of the average peak travel times, it can be determined if the worst-case scenario shows improvement in addition to if the average peak travel time. Additional analysis of travel time data can be performed for various temporal, weather, or other conditions.

3.1.2 Average Congestion Duration

Defined as the average duration of time that a specific route, defined by consecutive segments, or a specific segment is congested due to each individual congestion occurrence for a specified reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of congestion occurrences are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time index is calculated (RITIS provides up to a 1 min resolution)

Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

Average congestion duration as a performance measure indicates the temporal extent or severity of congested events along a route or segment. Statewide ATMS implementation should help to alleviate congestion through decreasing the average length of congestion duration. Average congestion duration could be analyzed by observing values by time of day, day of week, peak vs. off peak, etc.

3.1.3 Average Max Queue Length

Defined as the average maximum queue length that a specific route, defined by consecutive segments, is congested for a reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of congestion occurrences are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

Average max queue length as a performance measure indicates the spatial extent and severity of congestion occurrences along a route or segment. Statewide ATMS implementation should help to alleviate congestion through decreasing the average queue length that occurs during congestion. Average max queue length could be analyzed by observing values by time of day, day of week, peak vs. off peak, etc.

3.1.4 Congestion Occurrences

Defined as the *number of times* a specific route, defined by consecutive segments, or a specific segment has its corresponding average speed reach and remain at or beyond the congestion threshold for a specified reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of congestion occurrences are computed, be it 15 minutes, peak hour or period, aggregated daily or

annually. Need to be specific in any aggregation whether all or only designated hours are considered.

- *Aggregation* interval is the *lowest unit of time* over which the travel time index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

As an example, assume the time period of interest is the pm peak period (4-7 pm), aggregated annually based on a 15 minute aggregation (and analysis) interval and a TTI of 1.3 as a congestion threshold for a specific route. In this case, assuming the worst condition, then the maximum value of n=3×4=12 congested time periods per peak period, and assuming weekdays only, gives 12 ×260= 3,120 max number of 15 minute periods that route could be congested on an annual basis. On the other hand, if the analysis period was one hour, then we would have a max of three congested periods per peak period or 780 hours per year.

The number of congestion occurrences as a performance measure helps to indicate routes or segments with the most recurring congestion, along with routes that have few congestion problems. Statewide ATMS implementation should help to alleviate congestion through decreasing the number of congestion occurrences in a given time period. Analyses of congestion occurrences can be performed by examining the number of congestion occurrences by segment, time of day, day of week, weather condition, or other factors.

3.1.5 Minute-Lane-Miles of Congestion

Defined as the total minute-miles of congestion along specific routes, defined by consecutive segments, along a specific segment, or reported statewide for all segments in a specified reporting time period. This measure can be extracted directly from the previous measure on the number of

congestion occurrences, since each occurrence is associated with an analysis period of a given duration in minutes. Similar to congestion occurrences, this measure requires:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of minutes of congestion are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation interval* is the *lowest unit of time* over which the route congestion index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

Minute-Miles of Congestion as a performance measure effectively gives an area of the congestion based upon the congestion duration and the queue length. Minute-miles of congestion provides for a statewide measure of congestion rather than ones which are aimed toward specific TMC segments or routes.

3.1.6 Overall Delay

Defined as the total vehicle-hours of delay along specific routes, defined by consecutive segments, along a specific segment, or reported statewide for all segments in a specified reporting time period.

Delay as a performance measure can be used to evaluate statewide performance, performance along a specific route, or performance on a specific segment. Statewide ATMS implementation aims to decrease the statewide delay by decreasing the number of vehicle-hours travelled at speeds below the speed limit.

3.1.7 Delay Due to Congestion

Defined as the total vehicle-hours of non-recurring delay caused by congestion along specific routes, defined by consecutive segments, along a specific segment, or reported statewide for all segments in a specified reporting time period.

Delay due to congestion as a performance measure improves upon the delay performance measure. Statewide ATMS implementation aims to decrease the statewide delay by decreasing the number of vehicle-hours travelled at speeds below the speed limit. However, delay under conditions at which vehicles do not wish to increase their speed is delay which cannot be improved upon by Statewide ATMS implementation. Delay due to congestion is a more representative value of potential improvements in the system which can be brought about through Statewide ATMS implementation.

3.1.8 Vehicle Miles Traveled

Defined as the sum of the miles traveled by vehicles along a specific route, defined by consecutive segments, along a specific segment, or along all segments statewide for a specified reporting time period.

Vehicle Miles Traveled as a performance measure can be used to evaluate statewide performance, performance along a specific route, or on a specific segment. Vehicle Miles Traveled is a representative value that shows the amount of travel that occurs on the roadways. VMT is an important measure to consider when observing other performance measures during the pre and post ATMS implementation comparison. While the Statewide ATMS may bring about an overall reduction in delay, a resulting increase in VMT could disguise any apparent delay improvements.

3.1.9 Travel Time Index

Defined as the ratio of the average travel time for a specific route, defined by consecutive segments, or for a specific segment, to that same route or segment's posted speed travel time.

Travel time index as a performance measure gives an indication of delay in an easy to understand way. Statewide ATMS implementation will aim to decrease the travel time index. Travel time index can be analyzed in several ways, such as looking at its value during peak periods only. Because averaging travel time index over an entire day would include times during which traffic volumes are low, using only the peak period provides a more meaningful value for travel time index.

3.1.10 Travel Time Reliability

Travel time reliability is a function of the consistency of vehicle travel times and the level of congestion. The consistency of travel times can be represented by the standard deviation of travel times. The level of congestion can be represented by the semi standard deviation of travel times referenced to the posted speed limit.

Travel time reliability as a performance measures gives insight into how consistent the travel times along a segment are and how the traffic conditions vary. The proposed travel time reliability method will measure the segment or route's congestion and consistency. Proper travel time reliability performance measures are important for analyzing potential improvement in a roadway segment or a route.

Additional details relating to travel time reliability can be found in Chapter 7.

3.1.11 Emissions Rates

Defined as the amount of HC, CO, NO, and CO_2 produced by statewide delays.

Emissions rates is a performance measure that can be calculated for statewide, regional, or corridor specific evaluation. Statewide ATMS implementation is aimed toward decreasing the total delay, which will bring about a reduction in emissions. The reduction in emissions can be converted into a monetary savings for HC, CO, NO, and CO_2.

3.1.12 Wasted Fuel

Defined as the amount of fuel wasted statewide by factors such as delay.

Wasted fuel is a performance measure that can be calculated for statewide, regional, or corridor specific evaluation. Statewide ATMS implementation is aimed toward decreasing the total delay, which will bring about a reduction in wasted fuel. The reduction in wasted fuel can be converted into a monetary savings.

3.2 Incident Management Performance Measures

3.2.1 Average Incident Clearance Time

Defined as the average time between the first recordable awareness of the incident and the last responder to leave the scene of the incident.

Average incident clearance time provides a measurable value for evaluation of the Statewide ATMS post-implementation period. Statewide ATMS implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in incident response. A decrease in average incident clearance time would provide a representation of the improvements due to Statewide ATMS implementation. Average incident clearance time can be displayed in a variety of ways in order to evaluate incident management in more details. Average incident clearance time can be displayed graphically as a

distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average incident clearance time can be analyzed by factors to compare values by day vs. night, incident nature, lane blockage, pavement condition, heavy vehicle involvement, etc.

3.2.2 Average Incident Response Time

Defined as the average time for the first qualified responder to arrive on the incident scene.

Average incident response time provides a measurable value for evaluation of the statewide ATMS post-implementation period. Statewide ATMS implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in incident response. Studies have also shown that longer incident response times may produce more secondary incidents. A decrease in average incident response time would provide a representation of the improvements due to statewide ATMS implementation. Average incident response time can be displayed in a variety of ways in order to evaluate incident management in more details. Average incident response time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average incident response time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

3.2.3 Average Incident Notification Time

Defined as the average time from the first recordable awareness of an incident to the time when the first responding agency is notified.

Average incident notification time provides a measurable value for evaluation of the statewide ATMS post-implementation. Statewide ATMS implementation should bring about improved

incident management performance through improved data sharing and communication among multiple agencies involved in incident notification. A decrease in average incident notification time would provide a representation of the improvements due to statewide ATMS implementation. Average incident notification time can be displayed in a variety of ways in order to evaluate incident management in more details. Average incident notification time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average incident notification time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

3.2.4 Average Roadway Clearance Time

The average time from the first recordable awareness of an incident to the time when all travel lanes are cleared.

Average roadway clearance time provides a measurable value for evaluation of the statewide ATMS post-implementation. Statewide ATMS implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in roadway clearance. A decrease in average roadway clearance time would provide a representation of the improvements due to statewide ATMS implementation. Average roadway clearance time can be displayed in a variety of ways in order to evaluate incident management in more details. Average roadway clearance time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average roadway clearance time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

3.2.5 Average Recovery Time

The average time from the first recordable awareness of an incident to the time when the incident occurrence no longer influences roadway conditions.

Average recovery time provides a measurable value for evaluation of the statewide ATMS post-implementation. Statewide ATMS implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies. A decrease in average recovery time would provide a representation of the improvements due to statewide ATMS implementation. Average recovery time can be displayed in a variety of ways in order to evaluate incident management in more details. Average roadway clearance time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average roadway clearance time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

3.2.6 Secondary Incidents

The number of incidents that occur between primary incident detection and the time for roadway conditions to return to recover.

The number of secondary incidents that occur provide a measurable value for evaluation of the statewide ATMS post-implementation period. Statewide ATMS implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies. Primary incidents are known to cause secondary incidents due to queues, changes in traffic speeds, and rubbernecking. A decrease in the number of secondary incidents would provide a representation of the improvements due to statewide ATMS implementation. The number of secondary incidents can be displayed in a variety of ways

in order to evaluate incident management in more details. Secondary incidents can be displayed graphically as a distribution with bins representing the number of secondary incidents that occurred during an incident on the x-axis and the number of times each number of secondary incidents occurred which fall in those corresponding bins on the y-axis. Secondary incidents can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

For additional reference to supplement the descriptions of these performance measures, Figure 3-1 provides a visual representation of a typical incident progression.

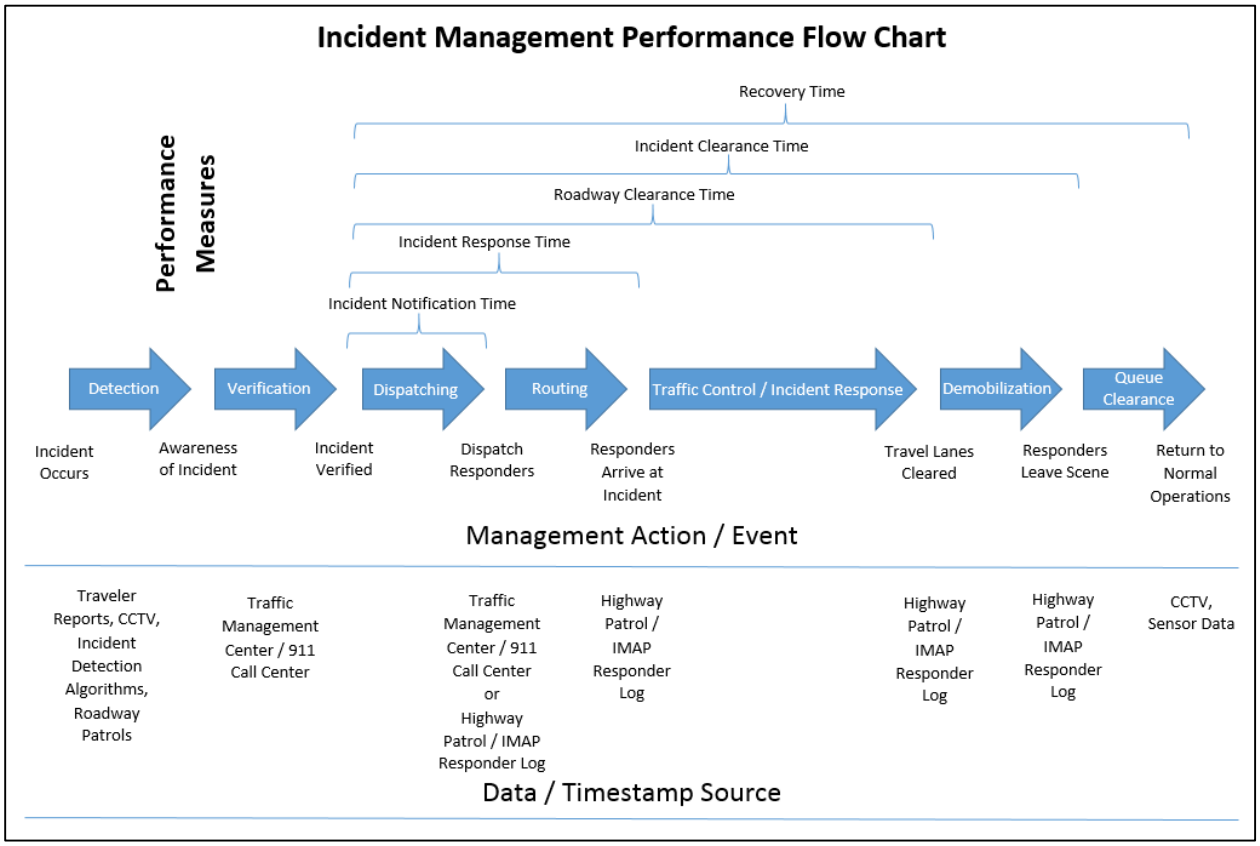


Figure 3-1 Incident Management Performance Flow Chart

CHAPTER 4. ASSEMBLY OF PRE-DEPLOYMENT BASELINE DATA (TASK 6)

The original goal of this task was to gather and store baseline data until ATMS deployment had reached a point where the "before" conditions within the monitored system had effectively ended. This goal anticipated that in the long term, an ideal system will be built on continuously gathered, non-volatile data. When the original project scope was being developed, ready availability of statewide data was not envisioned to occur until sometime after the project was completed. The ultimate source of this data and long-term archival nature of the data was also unknown at the original task development stage.

However, during the course of the project, the Center for Advanced Transportation Lab at the University of Maryland became the repository for data gathered under the I-95 Corridor Coalitions Vehicle Probe Project (VPP). At this time, archived one-minute TMC segment-based speed and travel time data became available for NCDOT download. The data available on NC roadways is expanding to include other vendors under the second edition of VPP, known as VPPII.

The data-driven methodologies described in the following chapters are built on one-minute INRIX data. This will be the primary statewide data source for NCDOT throughout the pre-deployment baseline period. The sources, data-types, and date ranges for data that were downloaded during the project period are described below. However, given the long-term commitment of the I-95 Coalition to the VPP data archive, the steering and implementation committee decided that a project deliverable consisting of a local, physical archive of the pre-deployment baseline data would be superfluous in addition to being incomplete as a result of the delay in statewide ATMS deployment. Furthermore, while the VPP data archive provides ready access to data and analysis routines, NCDOT also has access through the VPP to real-time data

feeds from the VPP data providers. Therefore, data resources should not be a constraint in future ATMS system monitoring and assessment.

4.1 INRIX One-Minute Data

As mentioned above, the primary data source was the one-minute data archive provided to I-95 Coalition partners through the VPP. For research purposes, the project team created a local archive dating from and including 2008. The one-minute data include the following fields –

Table 4.1 Detailed Data Attributes – INRIX

Field	Data type	Description
TmcCode	9 digit text	Unique spatial identifier for each segment and direction
TimeUTC	Date and Time	Date and Time in UTC format (UTC-5h=EST, -4hr-EDT) ONLY IN FIVE-MINUTE DATA RESOLUTION
measurement_tstamp	Date and Time	Local Date and Time ONLY FOR ONE-MINUTE DATA RESOLUTION
DTK	7 digit number	Date/Time code
Speed	Integer	Reported speed for the time period (MPH)
AverageSpeed	Integer	Average speed --unique for each segment, time period, and day of the year (MPH)
ReferenceSpeed	Integer	Reference speed --unique for each segment, identical at all times and days of the year (MPH)
Score	Integer	10, 20, or 30
TravelTimeMinutes	Number	Calculated from reported “Speed”; 2 decimal places for 5 min data, 3 decimal places for 1 min data
C_Value	Integer	0-100, “Confidence Value”, only reported if Score=30
Delta	Integer	=“Speed” – “AverageSpeed”; =0 if there is no AverageSpeed reported, ONLY IN ONE-MINUTE DATA

4.2 HERE (Formerly TRAFFIC.COM) Fixed-Point Sensor Data

NCDOT participated in the FHWA program to install fixed-point sensors through a memorandum of understanding executed with TRAFFIC.COM in 2007. The program included a mixture of side-fire microwave radar and acoustic sensors installed at 59 fixed permanent locations along 90 miles of interstate in the Triangle Region of North Carolina. The sensors are spaced approximately 1.5 miles apart along sections of I-40, I-440, and I-540. The project team created

a local archive of five-minute aggregation data from the TRAFFIC.COM sensors going back to the beginning of the archive. The sensors are now owned by HERE. The five-minute fixed-point sensor data includes the following fields –

Table 4.2 Detailed Data Attributes – Traffic.com

Field	Data type	Description
StationId	Number	Unique identifier for each station
StationDescription	Text	Text description of station location
Day	Text	3 letter designation for day of the week
Date	Date	Local Date
Time	Time	Local Time
Duration	Integer	Number of minutes sampled
Direction	Text	E/W designation
NumberOfLanes	Integer	Number of lanes travelling in the direction
Speed	Number	Speed in mph, 2 decimal places
Volume	Integer	Vehicle count in the reporting period
Occupancy	Number	% Occupancy, 2 decimal places
Class1	Integer	Count of non-commercial vehicles
Class2	Integer	Count of single-unit commercial vehicles
Class3	Integer	Count of single trailer commercial vehicles
Class4	Integer	Count of multi-trailer commercial vehicles
ReadingsTaken	Integer	Number of readings in reporting period
ValidReadings	Integer	Number of readings that the sensor does not detect an error in reporting period

4.3 Incident Data

The project team created a local archive of incident data, collected directly from the Traffic Engineering Accident Analysis System (TEAAS) and from a GIS data set of interstate crashes created by the Institute of Transportation Research and Education (ITRE) Commercial Vehicle Enforcement Resource Lab group. These data were used in the development of the collision classification methodology discussed in the following chapter.

CHAPTER 5. DEVELOPMENT OF PERFORMANCE MEASUREMENT (TASK 7) AND COST/BENEFIT REPORTING (TASK 8) METHODOLOGIES

5.1 Performance Measurement Methodology

5.1.1 Development of Quarterly Performance Reports

Central to the ATMS performance measurement process are the quarterly performance reports that show vital performance measurements for each three-month period. These reports are generated via use of the Performance Summaries tool in VPP. In Appendix C, there are examples of these reports generated from the first quarter of 2014 to the second quarter of 2015 for three sections of Interstate 40:

- Area of Interest: Exit 283/I-540 to Exit 289/Wade Avenue
- County Length (Wake County): Exit 283/I-540 to Johnston/Wake County Line
- Division Length (Division 5): Exit 270/US 15-501 to Johnston/Wake County Line

For each of these sections, a list of TMC codes (eastbound and westbound) has been provided as a deliverable, in addition to a report template Excel workbook. The following steps were employed to create each quarterly performance report:

1. In the VPP Performance Summaries tool, click the "List of TMC codes" tab under "1. Select one or more roads."
2. Under "2. Select one or more time periods to analyze," select the three-month period corresponding to the target quarter. Click the green "Add time period" button.
3. Check only the "INRIX" box under "3. Data source."
4. Under "4. Select a time range…", set the slider to 12 AM – 6 AM. Click "Submit."

5. A new tab will open. In this new tab, use the "Add another time range" button and the sliders under the "Selected time ranges" panel on the left to add four additional time ranges: 6 AM – 10 AM, 10 AM – 3 PM, 3 PM – 7 PM, and 7 PM – 12 AM. These time ranges isolate the morning and afternoon peaks and the periods in between. Click "Submit" on the left panel.
6. Export the results using the floppy disk "Save" button in the upper right (choose "Excel file").
7. Transfer the results into the template workbook; copy the results from each of the tables into the corresponding place in the template (there are separate tabs for eastbound and westbound classifications). Update the titles on the Westbound and Eastbound sheets (all bracketed items). Update the titles in the chart tabs to reflect the section and quarter (all bracketed items). The template has been designed to print all results in 6 pages per report, similar to the examples in Appendix C.
8. Repeat for subsequent route sections or quarters.

5.2 Collision Classification Methodology

Secondary crashes are an unfortunate reality of congestion inducing incidents. There has been a good deal of research on the problem of identifying whether or not reported crashes should be classified as secondary. Much of this research has involved a focus on determining whether or not a reported collision is within the congestion impact area of an earlier, downstream precipitating collision. While the pairing of primary and secondary collisions is a useful effort for highway safety analysis, it is limited in its ability to classify all reported collisions by the requirement to identify the primary collision. Furthermore, from a congestion management perspective, it is not necessary that the precipitating event be a collision. Reducing the time to clear incidents is a central

goal of advanced transportation management systems. Therefore, in monitoring the effectiveness of ATMS investments, there is value in being able to classify all collisions as having occurred in one of the three following situations –

- Uncongested conditions (these collisions would represent primary collisions)
- Recurring congestion (these collisions are assumed to not be secondary to any incident)
- Non-recurring congestion (these collisions can be considered to be representative of secondary collisions)

In terms of NCDOT business unit responsibility, the first category lies in the purview of the traffic safety unit. Collisions in uncongested conditions that occur in locations that are ultimately identified as hazardous through the Highway Safety Improvement Program vetting process, then the occurrence of these collisions can potentially be reduced through the implementation of safety countermeasures. For collisions in recurring congestion, if the presence of the normally occurring queue is the dominant correctible factor (other than driver inattention or error) then responsibility for alleviating the congestion lies with the units that plan, program, and construct capacity improvements to alleviate the capacity deficiency at the relevant recurring bottleneck location. However, for the third category, collisions in non-recurring congestion, ATMS deployments and strategies that reduce incident clearance time hold real promise for reducing the frequency and proportion of these collisions. Therefore, monitoring the number of collisions in non-recurring congestion and the proportion that such collisions represent out of all collisions over time as ATMS deployments are brought on line and new ATMS strategies are employed will provide a tangible indication of this important facet of expected ATMS benefit.

The method developed by the project research team is a simple process that uses two data sources, namely collision data from the NCDOT Traffic Engineering Accident Analysis System

(TEAAS) database and Traffic Message Channel (TMC) segment data from the I-95 Corridor Coalition VPP data archive. Figure 5-1 below illustrates the flow of the classification process. It should be noted that the conflagration of TEAAS data and TMC segment-based traffic data must be improved for this process to be fully automatable. Currently, because the TEAAS location data is in terms of the county milepost linear referencing system and furthermore that roadway direction is not explicit in the TEAAS collision data in a machine readable format, the matching of collision location to TMC segment.

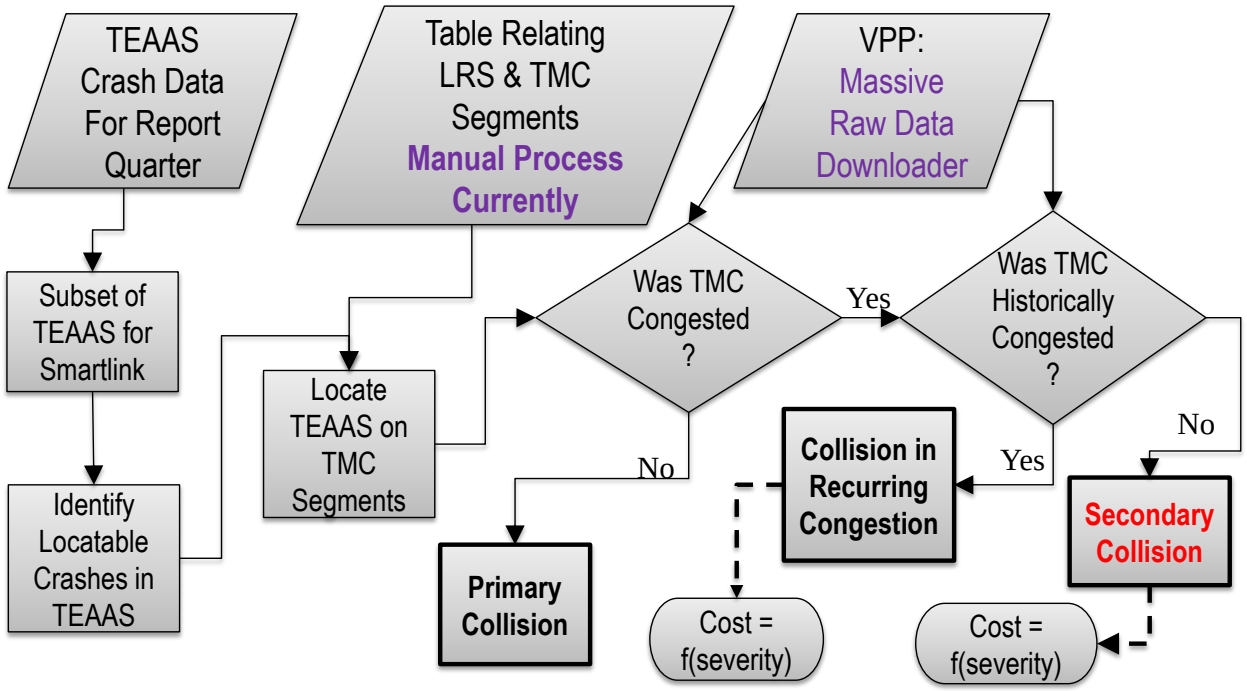


Figure 5-1 Collision Classification Flow Chart

The VPP congestion scan feature was used to evaluate the two key decisions above, namely –

- Was the TMC segment congested at the time of the collision?
- Is the TMC historically congested at the time of day and day of week that the collision occurred?

Important definitions that underlie the evaluation of these questions are –

- *Free Flow Speed*: the 85th percentile speed for TMC segment across all times, capped at 65 MPH
- *Historic Average Speed*: Two year average speed by time of day and of week, capped at 65 MPH
- The TMC segment is considered to have been congested at the time of the collision if $\frac{Recorded\ Speed}{Free\ Flow\ Speed} \leq$ A Defined Threshold
- The TMC segment is considered to be historically congested at the time of the collision if $\frac{Historic\ Speed}{Free\ Flow\ Speed} \leq$ A Defined Threshold

The definitions of free flow speed and historic average speed above are the published definitions provided by the VPP website at the time of the research.

The classification methodology was applied to collisions on I-40 in Durham and Wake County as a prototype test case. The data for the case study came from GIS geolocated TEAAS crashes for the period of January 1, 2010 through October 31, 2013. This geolocation was conducted by the ITRE Geovisual Analytics and Decision Management Group (GADA) under the Commercial Vehicle Enforcement Resource Lab (COVERLAB) project. The data included 62,076 collision records for all interstate highways in North Carolina. Through the following steps, this total number was filtered down to 65 collisions that were manually located and processed –

- Limited to Durham and Wake County Interstates – 11,883 collisions
- Select only collisions on I-40 – 5,864 collisions
- Select only collisions with a valid directional field (to allow proper location) – 4,593 collisions
- Selected only Collisions on I-40 EB Occurring between Sept 2012 and May 2013 (This date range corresponded to the NC Statewide Traffic Operations Center *Major Incident Log* data available to the researchers at the time) – 462 collisions

- Finally a set of 65 of these collisions were manually located – 53 of these collisions occurred on weekdays, and 12 of these collisions occurred on weekends

The results of the classification are summarized in Table 5.1 and Table 5.2.

Table 5.1 Classification Summary for Weekday Collisions

Type of Collision	70 % FFS Threshold		75% FFS Threshold		80% FFS Threshold	
	At Time	+/- 5 Min	At Time	+/- 5 Min	At Time	+/- 5 Min
Primary Collision	43 (81.1%)	42 (79.2%)	43 (81.1%)	39 (73.6%)	41 (77.5%)	38 (71.7%)
Secondary Collision	8 (15.1%)	9 (17.0%)	8 (15.1%)	12 (22.6%)	8 (15.1%)	10 (18.9%)
Collision in Recurrent Congestion	2 (3.8%)	2 (3.8%)	2 (3.8%)	2 (3.8%)	4 (7.5%)	5 (9.4%)

Table 5.2 Classification Summary for Weekend Collisions

Type of Collision	70 % FFS Threshold		75% FFS Threshold		80% FFS Threshold	
	At Time	+/- 5 Min	At Time	+/- 5 Min	At Time	+/- 5 Min
Primary Collision	10 (83.3%)	10 (83.3%)	10 (83.3%)	10 (83.3%)	10 (83.3%)	10 (83.3%)
Secondary Collision	2 (16.7%)	2 (16.7%)	2 (16.7%)	2 (16.7%)	2 (16.7%)	2 (16.7%)
Collision in Recurrent Congestion	0	0	0	0	0	0

The results are generally in line with other studies in terms of proportion of secondary collisions. However, the study was not sufficient in scope to draw general conclusion. More importantly, a

more robust classification scheme has now been developed under NCDOT research project RP 2014-12 titled *Incident Management Assistance Patrols – Assessment of Benefits/Costs, Route Selection, and Prioritization*. The research project team recommends that the RP 2014-12 collision classification scheme with any further improvement that may be necessary, be implemented in the anticipated ATMS benefit-cost reporting system. Nonetheless, the classification methodology developed and tested under this project served as the inspiration and provided the foundation for the RP 2014-12 method.

5.3 Freeway Segment Classification Methodology

One of the principal recommendations presented in the SHRP2 L02 *Guide to Establishing Monitoring Programs for Travel Time Reliability* is that agencies with the responsibility for monitoring travel time performance need to become comfortable with and skilled at evaluating full travel time probability and cumulative density functions to because actionable information lies in the entire travel time distribution far beyond what can be gleaned from one or two points along the distribution, such as the *TTI* and *PTI.*

While there is no question that this is a valuable and important recommendation, an agency like NCDOT with an extensive roadway network under its purview, cannot practically follow this recommendation with a strategy of human, visual inspection of the travel time distributions for all important routes. Therefore, the research team undertook an effort to create a robust, automatic distribution classification method based on a set of statistical measures. This research effort was developed into a successfully defended master's thesis by project research assistant David Craft (Craft, 2013) . An adequate summary for this project report required a dedicated chapter. The reader is referred to Chapter 7 for further details.

5.4 Cost Benefit Methodology

This subtask was not able to be fully developed due to the delay in ATSM procurement. The benefit assessment methodology was developed in terms of the selected performance measures. While not all of the selected performance measures are readily monetizable, when the final benefit-cost assessment methodology is developed, there will be sufficient monetary benefits to allow a reasonable and valid cost-benefit analysis. The monetizable performance measures will include –

- Total delay
- Non-recurrent delay
- Recurrent delay
- Travel time reliability (anticipates accepted methods for valuing variability)
- Secondary collisions

The anticipated positive movement of these performance measures will ultimately form the basis for valuing the benefits that accrue from the future ATMS system. The project research team recommends that assessment of travel time reliability be evaluated using the FREEVAL tool. The FREEVAL tool incorporates the new Highway Capacity Manual methodology for assessing travel time reliability and is sensitive to management strategies that improve incident clearance times and lower incident occurrence rates.

CHAPTER 6. CALCULATION OF SAMPLE BASELINE PERFORMANCE MEASURES AND INITIAL ONLINE IMPLEMENTATION (TASKS 9 AND 10)

It was not possible for the project team to complete either of these tasks as originally planned. As discussed elsewhere, the baseline period was defined to have ended when the initial stages of the ATMS deployment were to have come online. In essence and fact, the baseline period continues. Furthermore, in the absence of ATMS procurement, there are no costs on which to create the cost analysis element of the benefit-cost evaluation system.

Nonetheless, the performance monitoring elements have been implemented through prototype quarterly reports that are included in Appendix C. These prototype quarterly reports represent the three levels of reporting recommended by the project research team. A sample route level report for a portion of I-40 in Wake County begins on page 139, for Wake County on page 175, and for Division 5 on page 211. The reports span the period from the first quarter of 2014 through the second quarter of 2015. The procedure for generating these reports is given in section 5.1.1, and Excel versions of these reports along with the templates necessary to create additional reports will be provided as deliverables along with the final report.

CHAPTER 7. DISTRIBUTION-BASED TRAVEL TIME MEASURES USING STATISTICAL CLUSTERING METHODS (TASK 7 – SUBTASK)

7.1 Introduction

An important contribution to the understanding of travel time reliability is a proper interpretation of the underlying travel time distribution. Original work by Chase (Chase, 2012) indicated that measures that incorporate the entire distribution give a better perspective on the reliability performance of a route than say only the average or only the 95th percentile. From a decision making perspective, it would be important to know what the distribution is telling us; for example, is a route at a given time reliably congested? Reliably uncongested? Or just plain unreliable? This section explains a methodology that uses statistical cluster analysis techniques to attempt to answer such questions (Craft, 2013). The underlying mobility data came from archival speed and travel time observations accessible through the INRIX database, collected at a one minute resolution. To normalize the data across sites with different lengths and speed limits, travel rate (in minutes per mile) was the selected variable that was investigated for potential clustering.

The INRIX data used in his analysis came from six freeway routes selected from across North Carolina based on the conduct of a bottleneck analysis in RITIS; they were identified primarily through a RITIS bottleneck report from the pool of all NC freeway TMC's in calendar year 2012. An effort was made to include the most congested TMC segments as identified through this bottleneck analysis and identify routes that would provide sufficient occurrences of extreme congestion events. The selected routes are listed in Table 7-1 on the next page.

Table 7-1 Selected Routes for Clustering Analysis

Route #	Description	Length (mi)
Route 1	I-77 SB, Mecklenburg County Line to Gilead Road/Exit 23	7.68
Route 2	I-77 NB, Gilead Road/Exit 23 to Mecklenburg County Line	7.73
Route 3	I-40 WB, Apex Highway to I-440	14.20
Route 4	I-40 EB, I-440 to Apex Highway	14.22
Route 5	I-85 SB, NC-73 to Mallard Creek Church Road	9.37
Route 6	I-85 NB, Mallard Creek Church Road to NC-73	7.74

These six routes represented three pairs, two of which (1/2 and 5/6) were located in the Charlotte metropolitan area and one (3/4) that was located in the Raleigh-Durham metropolitan area. All of these routes were particularly susceptible to peak-hour congestion, providing a strong base of data points from which the cluster analysis could be developed. At the stated one minute resolution, one can generate 260 travel rate observations (one for each weekday in 2012) describing the distribution at a given entry time minute (say 8:06 am). Thus, there would be 1,440 (60 x 24) such distributions across a 24-hour period.

7.2 Statistical Measures

Seven core statistical measures were considered for use from the freeway travel rate distribution. Those seven measures are defined and computed as follows:

7.2.1 Average

Considered a rudimentary measure, the average travel rate provides information about the reliability of congestion for a particular route. Its major disadvantage was that it does not capture any variations in travel times, meaning that average travel time alone will not adequately describe the performance or congestion levels of the freeway route being studied.

$$\text{Avg} = \frac{1}{N}\sum_{i=1}^{N} TR_i$$

Where:

Avg = Average Travel Rate in Time Period (e.g. entering the route at 8:06 am)

N = Number of Observations in Time Period (e.g. 260 weekdays), and

TR = Travel Rate for Observation i (e.g. a specific weekday)

7.2.2 Standard Deviation

The standard deviation of travel rates reports the level of variation in the distribution of the routes travel rates. Lower values represented less spread from the average travel rate, while larger values represented greater spread. In turn, lower standard deviations suggested more reliable conditions (*but not necessarily less congested*), while higher standard deviations suggested less reliable and more uncertain conditions.

$$\text{Stdev} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(TR_i - Avg)^2}$$

Where Stdev = Standard Deviation of Travel Rate in Time Period and other variables as defined.

7.2.3 Coefficient of Variation

The coefficient of variation is used to normalize the standard deviation by dividing it by the average travel rate. As with the standard deviation, lower coefficient values suggested less spread while higher coefficient values suggested greater spread.

$$\text{CoV} = \frac{Stdev}{Avg}$$

Where CoV = Coefficient of Variation in Time Period and other variables as described.

7.2.4 Skew

The skew measure is intended to highlight both the shape and tail locations of the routes' travel rate distribution. Travel rate distributions typically have positive skew values, meaning that their tails lie on the right of a distribution plot (i.e. the deviation of the travel rate data occurs at the higher travel rates or lower speeds). Much like standard deviation and coefficient of variation, lower skew values implied more reliable freeway conditions; however, higher skew values have also produced inconclusive results with respect to reliability.

$$\text{Skew} = \frac{(\frac{1}{N}\sum_{i=1}^{N} TR_i{}^3) - 3(Avg)(Stdev)^2 - Avg^3}{Stdev^3}$$

Where Skew = Skew of Travel Rate Distribution in Time Period and other variables as defined.

7.2.5 Cubic Root of the Third Moment (CR3M)

The cubic root of the third moment was used as a supplemental measure to the Skew Statistic in much the same way that coefficient of variation was used to supplement standard deviation – i.e. for normalization purposes. As with skew, low CR3M values implied more reliable conditions, while higher CR3M values may or may not provide useful insight into reliability.

$$\text{CR3M} = (\frac{1}{N}\sum_{i=1}^{N} TR_i{}^3 - 3(Avg)(Stdev)^2 - Avg^3)^{\frac{1}{3}}$$

Where CR3M = Cubic Root of the Third Moment in Time Period and other variables as defined.

7.2.6 Kurtosis

Kurtosis was selected as a measure to characterize the shape of the peaks in the travel rate distributions; it was calculated from the fourth moment and standard deviation. High kurtosis values are normally associated with more, rather than less reliability.

$$\text{Excess Kurtosis} = [\frac{\left(\frac{1}{N}\sum_{i=1}^{N} TR_i{}^4\right) - 3\left(AVG^4\right) - 4(AVG)\left(\frac{1}{N}\sum_{i=1}^{N} TR_i{}^4\right) + 6(AVG^2)(\frac{1}{N}\sum_{i=1}^{N} TR_i{}^2)}{Stdev^4}] - 3$$

Where the value "-3" anchors the kurtosis value of a normal distribution to 0.

7.2.7 Quadratic Root of the Fourth Moment (QR4M)

The quadratic root of the fourth moment acts in much the same way with respect to kurtosis as the cubic root of the third moment does with respect to skew, in that it eliminates the standard deviation from calculation, normalizing the measure so that it would no longer be calculated about the mean. Like kurtosis, high QR4M values suggested good reliability.

$$\text{QR4M} = \left(\frac{1}{N}\sum_{i=1}^{N} TR_i{}^4 - 3(AVG^4) - 4(AVG)\left(\sum_{i=1}^{N} TR_i{}^4\right) + 6(AVG^2)\left(\frac{1}{N}\sum_{i=1}^{N} TR_i{}^2\right)\right)^{\frac{1}{4}}$$

Where QR4M = Quadratic Root of the Fourth Moment in Time Period and other variables as described.

The preceding seven measures were calculated using one-minute INRIX travel rate data and then grouped by time-of-day using fifteen-minute periods. The data were filtered prior to calculation based on INRIX-defined quality as shown in "confidence values." A period of fifteen minutes was chosen after a number of calibration experiments attempting to balance between the noise generated with smaller period lengths and the loss of feature details with longer period lengths.

7.3 Clustering and Classification Trees

To prepare for cluster analysis, travel rate distributions for the entire year 2012 were created for each minute of the day along each route (1,440 minutes * 6 routes = 8,640 distributions). In order to minimize correlation between variables, a linear correlation analysis was conducted; based on this correlation analysis, it was determined that a maximum of three of these values could be incorporated into the cluster analysis. Using the R-squared values from the correlation analysis, three statistics were selected for categorization and clustering: average travel rate, cubic root of the third moment (CR3M), and kurtosis.

Classification and Regression Trees (CART) were generated for travel rate statistical analysis in order to identify similar conditions that could be grouped together into clusters. The analyses of the routes was conducted using the R statistical modeling and analysis language and environment (R-REF) and its clustering, classification, and regression method packages.

The optimal number of groups (i.e. distinct distribution types) for the analysis of each route was reached via a k-means clustering, which tries to minimize the sum of squares between the values that are used to define the distributions within the same cluster, while maximizing it between clusters. In general, more cluster groups mean lower sums of squares. Through visual inspection of silhouette plots generated from R, it was determined that six groups would be the most appropriate number due to the drop in the value of sum of squares reduction when increasing the number of groups beyond 6.

To perform the cluster analysis proper, the **C**lustering **Lar**ge **A**pplications class (CLARA) in R's "cluster" package was used. CLARA partitions the input data into the specified number of clusters (6, as mentioned from the sum of squares discussion) by using the Euclidian distance between the target variables. A sample CLARA output classification tree for Route 1 (I-77 SB) is shown on the next page in Figure 7-1:

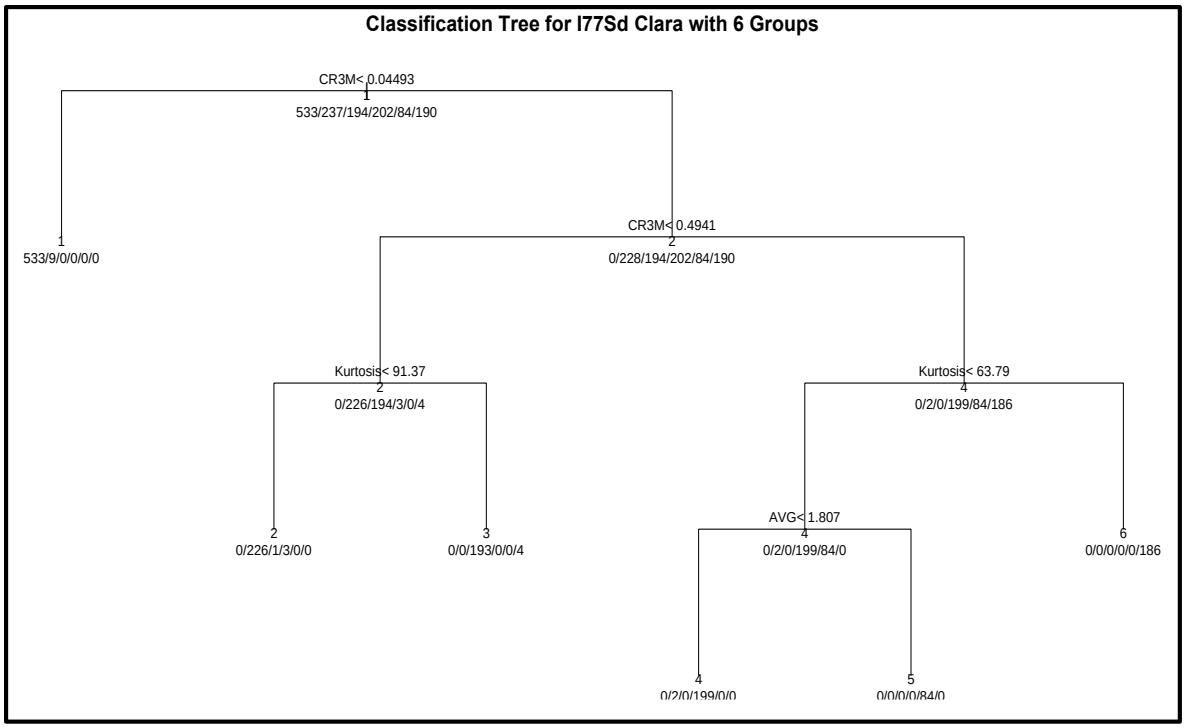


Figure 7-1 Sample CLARA Output Classification Tree

In the above classification tree, the classification criteria are shown at each diverging point, along with the corresponding group counts from CLARA that were evaluated by the individual criterion. If a distribution met the specified criterion, it flowed to the left; if it did not, it flowed to the right. The termini of the tree note the cluster numbers assigned by the classification tree as well as the number of travel rate distributions in each CLARA-defined group that were assigned to that cluster. This process was not able to produce perfect clustering, but the imperfections are minor. For example, cluster 2 from the tree contains 226 distributions classified as group 2 by CLARA, 1 distribution classified as group 3, and 3 distributions classified as group 4.

In order to make operational interpretation easier, letter names were assigned to the clusters to better reflect their operational characteristics. Specifically, clusters A, B, C, D, E, and F correspond to clusters 1, 3, 2, 6, 4, and 5, respectively. The clusters had clear operational

differences that can be seen from speed plots (basically the inverse of travel rates) as shown in Figure 7-2.

Cluster A represents optimal freeway conditions with very little variation in speed or travel rate, while Cluster B shows similar conditions with slight variations.

Cluster C indicates generally acceptable operation but with some deteriorating traffic conditions, while Cluster D demonstrates a more pronounced deterioration in operational performance.

Cluster E represents freeway breakdown in progress but not at its peak, with no vehicles experiencing free flow speed, along with a wide variation in speeds. Cluster F, however, illustrates freeway conditions at their worst, with very low and consistently low speeds with little variation.

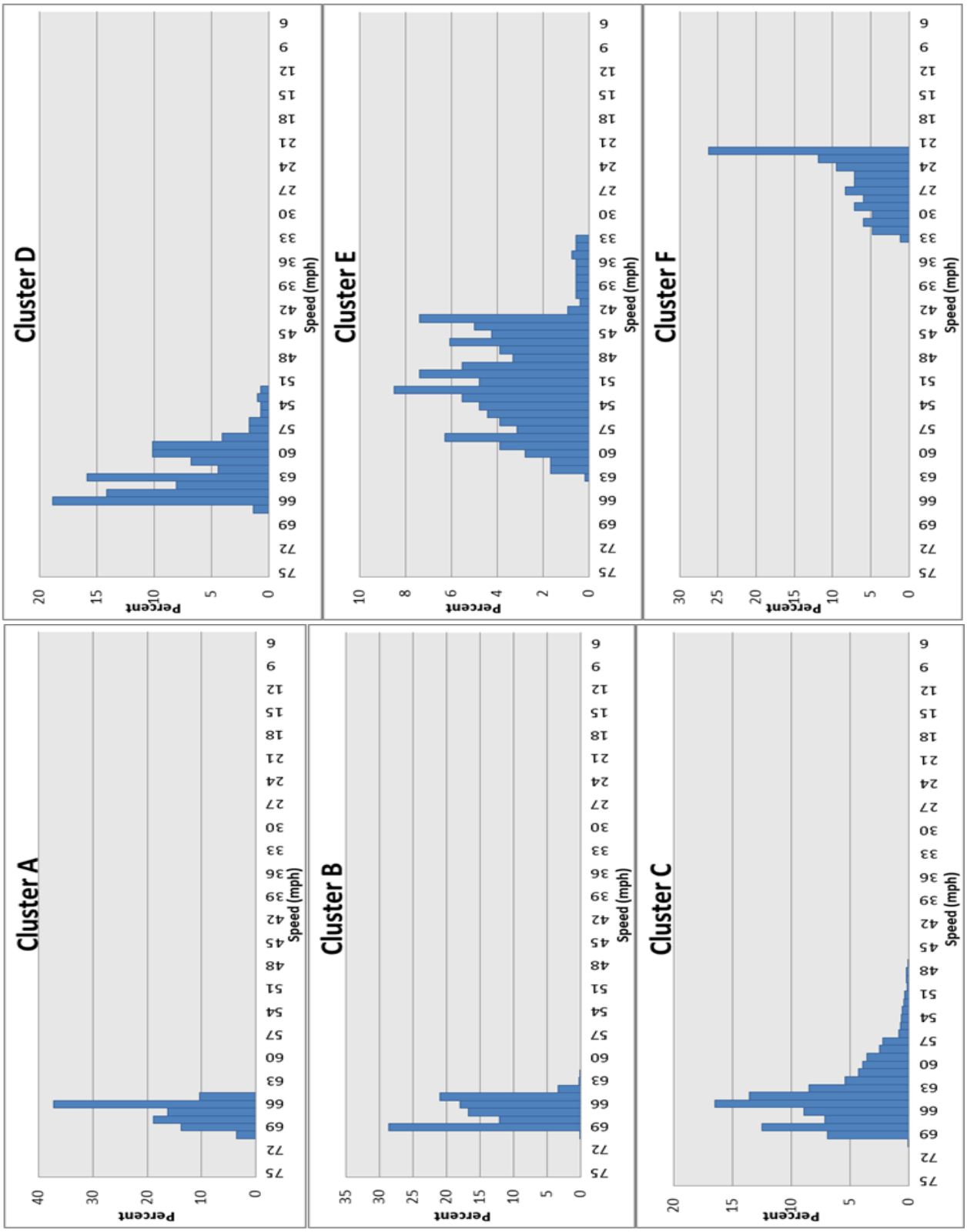


Figure 7-2 Clusters Developed from Sites' Speed Plots

7.4 Segment Categorization and Definition

As a result of the clustering analysis findings, as exemplified by the distribution classes in Figure 7-2, reliability categories for individual freeway routes were constructed. Those were based on careful and clear definitions resulting from the degrees to which they were considered to be "reliable" and/or be "congested". This categorization process required careful analysis of the obtained travel rate data. The following three categories for route reliability classification are proposed:

7.4.1 Reliable and Congested

A reliable and congested route is defined as one which commonly experiences congested conditions (often times recurring congestion events), with a travel rate distribution characterized by a peak of high travel rates and a short tail of low travel rates. Cluster F in Figure 7-2 is indicative of this type of behavior.

7.4.2 Reliable and Uncongested

A reliable and uncongested route is defined as one which routinely experiences uncongested conditions (low travel rates and high speeds), with only rare congestion events and a travel rate distribution characterized by a peak of low travel rates and a short tail of high travel rates. Clusters A and B from Figure 7-2 serve as examples of this sort of segment behavior.

7.4.3 Unreliable

An unreliable segment was defined as one which experiences a mixture of fluctuating congested and uncongested conditions, such that both free-flow speeds and congested speeds are commonly seen in the distribution. Distributions for unreliable segments have lower peaks for both high and low travel rates as well as longer tails that spread between those high and low values. In addition, these segments are observed to have periodic recurring congestion and are also

susceptible to non-recurring events such as work zones, incidents, or special events that temporarily create unusual demand patterns. Cluster E as shown in Figure 7-2 exhibits this type of behavior, and it is present to lesser degrees in Clusters C and D.

7.5 Conclusions

Travel time reliability remains one of the more difficult measures to characterize in terms of real-world freeway performance, and the statistical cluster analysis identified ways in which travel time reliability could achieve true meaning, particularly in operations evaluation situations like the one presented in this project with a statewide ATMS. This work emphasized the importance of evaluating travel time reliability based on the distribution of travel rates rather than the current methods of analysis that examine only a select few measures (e.g. buffer time, 95^{th} percentile travel time), citing the advantage of a method that groups distributions together based on their inherent features. Visual analysis or statistical sets, will usually fall short in highlighting the true reliability performance of freeway segments and routes.

Site selection, data filtering, and selection of an appropriate number of clusters were also identified as critical elements of using such a method for reliability analysis; as with any other statistical analysis methods, this analysis is as strong as the data it is founded upon. It is noted that the sites for which the clustering method was most effective contained little to no data with errors, had less than 20% of possible data points missing, and contained a wide variety of congestion levels.

CHAPTER 8. FINDINGS AND CONCLUSIONS

The key project findings and conclusion are summarized below. The discussion covers the following tasks –

Task 2 – Literature Review and ATMS Survey

Task 3 – Select and Define Appropriate Performance Measures

Task 4 – Definition and Specification of Data Requirements

Task 6 – Assemble Pre-deployment Baseline Data

Task 7 – Develop Performance Measurement Methodology

Task 8 – Develop Cost Benefit Analysis Reporting Methodology

Task 9 – Calculate Baseline Performance Measures

Task 10 – Conduct Initial Implementation of Online Measurement and Reporting System

As was done in the foregoing chapters, the discussion for Tasks 3 and 4, Tasks 7 and 8, and Tasks 9 and 10 are combined.

8.1 Task 2 – Literature Review and ATMS Survey

There is a wealth of research and agency attempts to establish performance measures for advanced transportation management systems. As summarized in Table 2-1, twelve states, the District of Columbia, and four foreign nations were surveyed to establish the state of the practice in ATMS performance measurement. The research team realized early on that a framework for organizing the diverse performance measures was needed. After cataloging and assessing the initial broad set of measure, the team settled on the following categories –

- Operations
- Incident management
- System Info
- User Feedback

The first two categories constitute the performance measures that are of potential value to the NCDOT's plans for ongoing monitoring of the benefits of the future statewide ATMS. Based on the completed the categorization and assessment of performance measures, the sixteen most common performance measures were identified. These common measures are summarized in

Table 2-3. Ten of these measures fall into the operations category, and six of them fall into the incident management category. Further detail on the full array of measures identified in the review can be found in Appendix A.

8.2 Task 3 – Select and Define Appropriate Performance Measures and Task 4 – Definition and Specification of Data Requirements

The project team determined early on the Tasks 3 and 4 were best conducted as parallel tasks. One of the central reasons for this is that selection of performance measures could not be finalized without and assessment of the data availability to support measurement calculation. Building on the literature review tasks, the project team settled on a recommended set of performance measures that included twelve operations measures and six incident management measures. These measures were summarized in Table 3-1, which is repeated here for convenience.

Table 8-1 Selected Performance Measures

Performance Measure	Type
Average Travel Time	Key Indicator
Average Congestion Duration	Key Indicator
Average Max Queue Length	Key Indicator
Congestion Occurrences	Key Indicator
Minute-Miles of Congestion	Key Indicator
Overall Delay	Candidate for Monetary Benefits
Delay Due to Congestion	Candidate for Monetary Benefits
Vehicle Miles Traveled	Key Indicator
Travel Time Index	Reliability/Decision Support
Travel Time Reliability	Reliability/Decision Support Candidate for Monetary Benefits
Emissions Rates	Candidate for Monetary Benefits
Wasted Fuel	Candidate for Monetary Benefits
Average Incident Clearance Time	Key Indicator
Average Incident Response Time	Key Indicator
Average Incident Notification Time	Key Indicator
Average Roadway Clearance Time	Key Indicator
Average Recovery Time	Key Indicator
Secondary Incidents	Candidate for Monetary Benefits

As can be seen in the summary table, the recommended measures were further categorized as Key Indicator, reliability/decision support, and candidate for monetary benefits. Full descriptions of the recommended measures can be found in Appendix B.

8.3 Task 6 – Assemble Pre-deployment Baseline Data

As discussed in Chapter 4, the continued development of the archival data store at the University of Maryland's CATT Lab has negated the original intention of creating a local archive of baseline data. While the project team has assembled a significant amount of data in support of the project research as described Chapter 4, the project steering and implementation committee concurred that the local assembly of the baseline data was not a prudent use of time and resources. This is very advantageous, especially in light of the fact that the baseline period continues, and therefore, any data sets that would have been provided would not have constitute a complete archive of the baseline data.

8.4 Task 7 – Develop Performance Measurement Methodology and Task 8 – Develop Cost Benefit Analysis Reporting Methodology

8.4.1 Performance measurement

The primary data source for operational performance measures in Table 8-1 was and is likely to be the VPP data archive. The commitment of NCDOT and other I-95 corridor coalition partners appears to be strong and is expected to provide a strong foundation for cooperative support for continued development of what is already an extremely valuable data and data analysis resource. FREEVAL with its powerful capabilities of modeling the impact of weather, work zones, and incidents will provide a powerful and effective tool for evaluating the reliability metrics.

The incident management metrics will rely on continued development of the Statewide Traffic Operations Center's incident documentation efforts. It is anticipated that the improved incident logging procedures that were launched in 2012 and 2013 will provide a solid basis for assessing baseline incident management performance and that the new ATMS will provide accurate information for identifying improvements in incident response. While the incident response

measures in Table 8-1 are indicated as key indicators that are not directly monetizable, incident response measures will be inputs into the integrated FREEVAL model, and therefore, improvements in these measures will lead to monetizable estimates of reliability improvement.

8.4.2 Route travel time distribution classification

The route travel time distribution classification developed under this project and presented in Chapter 7 provides a workable method to implement the central recommendation from the SHRP2 L02 *Establishing Monitoring Programs for Travel Time Reliability* project, namely that agencies responsible for monitoring and improving travel time reliability should consider the entire travel time distribution rather than focusing on one or two points along the distribution. This method can be applied to any set of route travel time distributions for which initial classification is desired. Although visual analysis will certainly be required for routes that are identified for further analysis, the classification proportions can directly serve as indicators of progress toward established system goals, such as a reduction in the proportion of routes classified as unreliability with extreme non-recurring congestion events, and can also serve as a screening mechanism for identifying high priority routes for various reliability improvement strategies.

8.4.3 Benefit-cost analysis

The delay in ATMS procurement rendered it impossible to fully develop and test a benefit-cost analysis method. However, the performance measurement methodology developed under Task 7 provides a solid framework for assessing benefits to which the cost analysis can be integrated when the future ATMS deployment takes shape.

8.5 Task 9 – Calculate Baseline Performance Measures and Task 10 – Conduct Initial Implementation of Online Measurement and Reporting System

The baseline period did not come to an end during the project as initially planned. Therefore, a full baseline analysis could not be performed. However, quarterly prototype baseline performance reports were developed and are included in this report in Appendix C. These reports were prepared in a manner that also served as a trial of the online reporting system initially envisioned.

CHAPTER 9. RECOMMENDATIONS AND IMPLEMENTATION AND TECHNOLOGY TRANSFER PLAN

9.1 Summary Recommendations

9.1.1 Performance Measures

The project team recommends that the NCDOT adopt the eighteen performance measures presented in Table 3-1 and Table 8-1. Operational measures based on the VPP data archive are currently implementable using the procedures outlined in report section 5.1.1. Performance measures that involve collision data will require improvements in the processes to merge TEAAS collision data with the TMC segment-based traffic condition data. The project team recommends that the NCDOT continue to explore options and work toward an ultimate solutions that would allow full automation of the collision classification methodology presented in report section 5.2.

The reliability performance measures will require integration of the ultimate benefit-cost monitoring and reporting system with the FREEVAL freeway facility analysis tool. Although experienced travel time variability can and should be monitored over time, the extreme year to year fluctuations that are possible in number of collision and weather events, will greatly hamper the effectiveness of direct comparisons over time to provide a valid estimate of the benefits of improvements such as shortened incident clearance times. Therefore, a validated and widely accepted analysis tool such as FREEVAL will be indispensable in providing clear assessment of the reliability improvement benefits.

9.1.2 Benefit-Cost Analysis

The monetizable performance benefits should provide the basis for establishing defensible quantification of ATMS benefits. The cost side of the analysis can be added when the investment structure and cost details are known for the future ATMS procurement. It will be important to

carefully allocate initial and periodic capital expenditures to the benefit-cost analysis reporting periods. If benefit-cost analysis is desired at the division or county level, it will also be necessary to devise a valid method for regional allocation of statewide ATMS costs. Although it is expected that the monetizable benefits, based on past ad hoc ATMS benefit-cost studies, will be sufficient to demonstrate positive return on investment, the ongoing benefit-cost analysis reports should also clearly highlight important benefits that cannot be readily valued in monetary terms.

The research team also recommends that the ultimate benefit-cost analysis and reporting system be based on the hierarchy represented in the prototype quarterly performance reports provided in Appendix C plus a statewide summary report. Specifically, the top level report is recommended to include summary statewide statistics and performance measures for key statewide routes. The next level will be by Division, and the final level by County. Figure 9-1 below illustrates the reporting hierarchy.

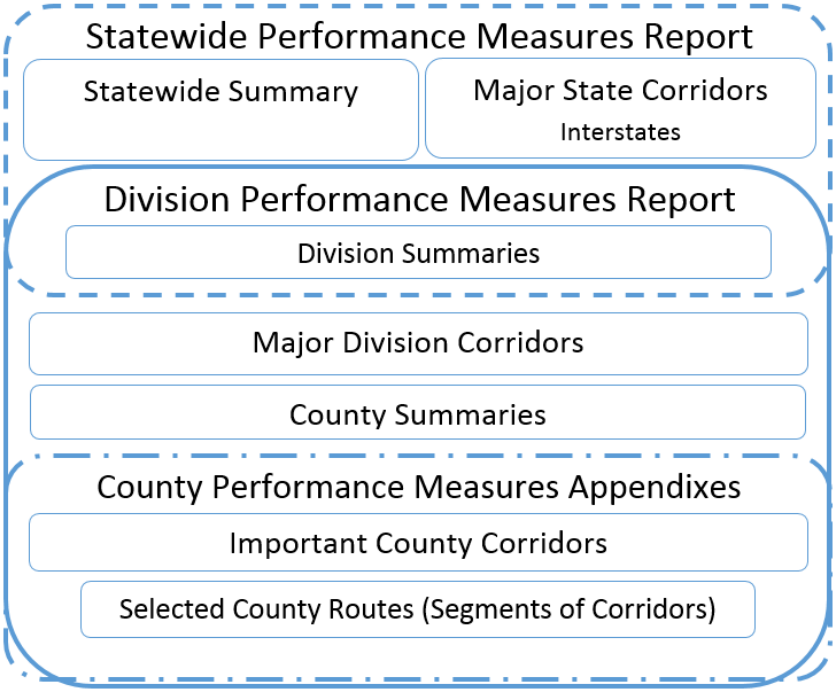


Figure 9-1 Performance Monitoring Report Hierarchy

9.1.3 Route Travel Time Distribution Classification

The project team recommends that the NCDOT Traffic Systems Operations Unit implement a route travel time classification system based on the methodology described in Chapter 7. The simple decision tree classification scheme illustrated in Figure 7-1 reproduced the automatic clustering to a high degree of accuracy. This result indicates that such a clustering scheme should provide a robust and effect method for classifying large sets of route travel time distributions. Because the classification outputs were not ultimately selected as one of the recommended base performance indicators, the research was limited to the case study described in in Chapter 7. Therefore, follow on research would be needed to determine if a single classification tree could be applied in all freeway route settings or if freeway operational factors that vary by region and level of urbanization will require a set of region specific classification trees.

9.2 Project Deliverables

As the primary project deliverable, this final report provides comprehensive documentation of the research activities, findings, conclusions, and recommendations. Additionally Appendix A provides complete tables of the performance measures found in all the review sources; Appendix B provides the performance measure templates that document calculation methods, data requirements, and background information; and Appendix C provides the prototype quarterly system performance reports. The project team will also provide the Excel template used to generate the reports in Appendix C.

9.3 Implementation and Technology Transfer Plan

The core of the project team is engaged with the NCDOT in a SHRP2 Implementation Assistance Program project, namely RP 2016-32 SHRP2 L38 *Reliability Data and Analysis Tools Implementation Assistance Program Proof of Concept Pilot Study*. This project is getting

underway in the fall of 2015. A key element of the pilot study involves continuing the effort to develop the benefit-cost analysis system envision for this project. Given that the statewide ATMS is likely to also not be active during the two-year performance period of the SHRP2 implementation pilot study, the elements of the study related to ATMS benefit-cost analysis will focus primarily on performance and benefits assessment within a framework that will allow for the cost analysis to be added at the appropriate time.

References

AZTech™ Strategy Task Force and Operations Committee. (2013). *AZTech™ traffic management and operations performance indicators book – 2013.* ().

Bertini, R. L., & El-Geneidy, A. M. (2010). Using advanced traffic management system data to evaluate intelligent transportation system investments.

Bertini, R. L., Leal, M., & Lovell, D. J. (2002). Generating performance measures from portland's archived advanced traffic management system data. *Transportation Research Board,*

Chang, G., & Rochon, S. (2009). Performance evaluation and benefit analysis for CHART. *Technical Rep,*

Chase, R. T. (2012). Monitoring freeway reliability utilizing network-wide link-based ITS data.

Craft, D. W. (2013). A method for generation of distribution based travel time reliability performance measures using clustered travel rate statistics.

De Schutter, B., Bellemans, T., Logghe, S., Stada, J., De Moor, B., & Immers, B. (1999). Advanced traffic control on highways. *Journal A, 40*(4), 42.

Du, Y. (2005). The research on advanced traffic management system of shanghai urban expressway. *The First Chinese Intelligent Transportation Annual Meeting*, Shanghai.

Du, Y. (2008). Pilot projects in national ITS construction demo cities. *Urban Transport of China, 6*(1), 33.

Florida Department of Transportation. (2012a). *2012 SMART SunGuide ITS annual report district 4.* (). Fort Lauderdale, Florida: Florida Department of Transportation.

Florida Department of Transportation. (2012b). *Annual incident duration. performance measures report. includes all responders, District 5.* ().Florida Department of Transportation.

Florida Department of Transportation. (2012c). *District six ITS annual report (fiscal year 2011-2012).* ().Florida Department of Transportation.

Florida Department of Transportation. (2013a). *District 4 quarterly incident duration. performance measures report. includes all responders.* ().Florida Department of Transportation.

Florida Department of Transportation. (2013b). *Incident duration. performance measures full detail report. includes all responders, District 9.* ().Florida Department of Transportation.

Florida Department of Transportation. (2013c). *Monthly incident duration. performance measures report. measures report. district 1.* ().Florida Department of Transportation.

Florida Department of Transportation. (2015). Intelligent transportation systems district 6 TMC reports. Retrieved from http://www.sunguide.info/sunguide/index.php/tmc_reports

Giuliano, G., Rhoads, M., & and Chakrabarti, S. (2014). New data, new applications: Using transportation system data for regional monitoring. *Transport Research Arena (TRA) 5th Conference,*

Hammond, P. J. (2012). *The 2012 congestion report.* ().

Hammond, P. J. (2013). *The gray notebook.* ().

Houston TransStar Consortium. (2011). *Houston TranStar2010 annual report.* ().Houston TransStar Consortium.

Huang, A. (2011). Evaluation of social-economic benefits to beijing ITMS. *Journal of Transportation Systems Engineering and Information Technology, 11*(3), 21.

Indiana Department of Transportation. (2008). *Final report - Traffic management strategic deployment plan. version 2.4.* ().Indiana Department of Transportation.

Ishimaru, J., & Hallenbeck, M. E. (2002). *NORTH SEATTLE ADVANCED TRAFFIC MANAGEMENT SYSTEM (NSATMS) PROJECT EVALUATION.* ().

Jacobs, T. H., Ivanov, N., & Pack, M. L. (2011). *Recommendations for improving the use of traffic incident management performance measures when comparing operations performance between state DOTs. final report.* (No. NCHRP 20-24(37)D).National Cooperative Highway Research Program.

Kary, B., Rindels, A., & Kown, E. (2012). *Improving traffic management on minnesota freeways.* (No. 2012-04TS).

Martin, P. T., Perrin Jr., J., & Kalyani, V. (2003). *REAL TIME MEASURES OF EFFECTIVENESS.* ().

Martin, P. T., & Wu, P. (2003). *Real-time measures of effectiveness (MOES) for ATMS contract modification.* ().

Michigan Department of Transportation. (2007). *ATMS software design study. performance measures memorandum.* ().Michigan Department of Transportation.

Pegues, J. A., & Demetsky, M. J. (2005). *Final report - the role of smart traffic centers in regional system operations: A hampton roads case study.* ().

South African National Roads Agency Limited. (2011). *Procurement of a national intelligent transport system and integrated supporting systems software and the deployment thereof in gauteng, kwazulu-natal, and the western cape*

Struwig, C. B., & Andersen, S. J. (2014). *Performance measurement trends in the implementation of intelligent transportation systems (ITS) within the south african transportation environment.* ().Department of Civil Engineering, Stellenbosch University.

SunGuide Software.Florida's advanced traffic management systems software. Retrieved from http://www.sunguidesoftware.com/about-hub/about-sunguide2

Texas Transportation Institute. (2011). *2011 congested corridors report powered by INRIX traffic data – methodology.* ().Texas Transportation Institute.

Vuren, T. v., Baker, J., Ogawa, J., Cooke, D., & Unwin, P. (2012). Managed motorways: Modeling and monitoring their effectiveness. *TRB 2012 Annual Meeting,* Washington, DC.

Appendix A. PERFORMANCE MEASURE TABLES FROM LITERATURE REVIEW

Table A-1 Performance Measures from Portland ATMS Study (ODOT, 2002)

Measure	Category / Sub-Category
Average Daily Traffic	Mobility
Average Daily Traffic Per Freeway Lane	Mobility
Average Speed	Mobility
Cost of Delay	Economic Development, Quality of Life, Environmental, and Resource Conservation
Delay Per Vehicle Miles Traveled	Mobility
Demand Vs. Capacity	Mobility
Fuel Cost	Economic Development, Quality of Life, Environmental, and Resource Conservation
Fusion Of Incident Response AVL Data With Loop Data	Fusion Of Incident Response AVL Data With Loop Data
Lost Time Due To Congestion	Mobility
Mobility Index	Mobility
Number And Percent Of Lane-Miles Congested	Mobility
Percent of The Freeway Uncongested During Peak Hours	Mobility
Percent of VMT at a Particular Level of Service	Mobility
Percent of VMT Which Occurs On Facilities With Particular V/C Ratio	Mobility
Person Hours Traveled	Mobility
Person Miles Traveled	Mobility
Person Miles Traveled By Congestion Level	Mobility
Reserve Capacity	Mobility
Safety	Safety
Travel Time	Mobility
Vehicle Hours Traveled	Mobility
Vehicle Miles Traveled	Mobility
Vehicle Miles Traveled By Congestion Level	Mobility

Table A-2 Performance Measures from Florida DOT ATMS Study

Measure	Category / Sub-Category
Delay	Mobility
Emissions Rates	Direct Benefits to Highway Users
Fatalities	Safety
Fuel Consumption	Direct Benefits to Highway Users
Monetary Benefits Due to Service Patrol	
Secondary Accidents	Safety
Travel Time	Mobility

Table A-3 Performance Measures from Michigan DOT ATMS Study, 2006

Measure	Category / Sub-Category
Amount Of Storage Required	Information Management
Average Response Time Regarding Customer Complaints	Customer Satisfaction
Buffer Index	System-Wide Congestion Monitoring
Calls By Day	511
Calls By Time Of Day	511
Calls Duration	511
Congested Hours Per Day	System-Wide Congestion Monitoring
Congested Lane-Miles	System-Wide Congestion Monitoring
Cost Per Equipment Repair/Failure	Maintenance
Data Quality	Information Management
Data Resolution	Information Management
Device Down Time	Maintenance
Device Mean Time Between Failures (MTBF) By Subsystem	Maintenance
Device Mean Time To Repair (MTTR) By Subsystem	Maintenance
FCP Assist Time By Type	Freeway Courtesy Patrol
FCP Assists By Location	Freeway Courtesy Patrol
FCP Assists By Type	Freeway Courtesy Patrol
FCP Patroller Full-Time Equivalents	General Measures of System Size
FCP Stops	Freeway Courtesy Patrol
FCP Tows	Freeway Courtesy Patrol
Freeway Centerline Miles Covered	General Measures of System Size
Freeway Lane Miles Covered	General Measures of System Size
Hours In Service Per Vehicle	Freeway Courtesy Patrol
Incident Clearance Time	Incident Management
Incident Communication Accuracy	Incident Management
Incident Detection Source	Incident Management
Incident Detection Time	Incident Management
Incident Response Time	Freeway Courtesy Patrol

Measure	Category / Sub-Category
Incident Verification Time	Incident Management
Incidents By Location	Incident Management
Incidents In Work Zones	Incident Management
Incidents Involving Commercial Vehicles	Incident Management
Information Dissemination Time	Incident Management
Lane-Mile-Hours Closed Due To Non-Routine Maintenance	Maintenance
Lane-Mile-Hours Closed Due To Work Zones	Work Zone Management
Maintenance Technician Full-Time Equivalents	General Measures of System Size
Miles Of Coverage Per Vehicle	Freeway Courtesy Patrol
Miles Traveled Per Vehicle	Freeway Courtesy Patrol
Number Of 511 Calls	511
Number Of Calls To Complain	Customer Satisfaction
Number Of Calls To Express Appreciation	Customer Satisfaction
Number Of Construction Workers Injured In Work Zones	Work Zone Management
Number of Devices By Type	General Measures of System Size
Number OF DMS Messages By Type	Dynamic Message Signs
Number Of FCP Assists	Freeway Courtesy Patrol
Number Of Forwarded Calls By Source	511
Number Of Incidents	Incident Management
Number Of Incidents By Impact	Incident Management
Number Of Incidents By Type	Incident Management
Number Of Lanes Blocked	Incident Management
Number Of Media Outlets Using MDOT Data	Media
Number Of Non-Routine Maintenance Jobs	Maintenance
Number Of Records Stored	Information Management
Number Of Requests For Data By ISPs Or The Media	Information Management
Number Of Requests For Data By Other Agencies	Information Management
Number Of Responses Due To Weather Detection	Road Weather Management
Number Of Routine Maintenance Jobs	Maintenance

Measure	Category / Sub-Category
Number Of System Generated Messages That Are Operator Modified	Dynamic Message Signs
Number Of Times FCP Is First Responder	Freeway Courtesy Patrol
Number Of Times Weather Station Saved Staff Response	Road Weather Management
Number Of Unique 511 Callers	511
Number Of Unique Callers As A Percentage Of The Coverage Area Population	511
Number Of Unique DMS Messages	Dynamic Message Signs
Number Of Unique Referring Web Sites	Web Site
Number Of Visits To Site	Web Site
Number Of Weather Stations Deployed	Road Weather Management
Number Of Work Zones	Work Zone Management
Page Load Time	Web Site
Peak Day	511
Percent Time By Message Type	Dynamic Message Signs
Port Utilization (peak)	511
Session Duration	Web Site
System Hardware Failures By Component	Maintenance
System Software Failures By Subsystem/Module	Maintenance
TMC Operator Full-Time Equivalents	General Measures of System Size
Top 5 Pages Viewed	Web Site
Total Incident Duration	Incident Management
Travel Delay	System-Wide Congestion Monitoring
Travel Speed	System-Wide Congestion Monitoring
Travel Time	System-Wide Congestion Monitoring
Travel Time Index	System-Wide Congestion Monitoring
Type Of Customer Complaints	Customer Satisfaction
Utilization Of CCTV Images	Media
Vehicle-Miles Traveled	General Measures of System Size
Vehicles in Operation By Shift	Freeway Courtesy Patrol

Measure	Category / Sub-Category
Web Pages Viewed	Web Site
Web-Based Customer Survey	Web Site

Table A-4 CHART Performance Measures, 2009

Measure	Category / Sub-Category
Average Clearance Time	Analysis Of Clearance Time
Average Clearance Time By CHART Involvement	Analysis Of Clearance Time
Average Clearance Time By Day/Night	Analysis Of Clearance Time
Average Clearance Time By Incident Nature	Analysis Of Clearance Time
Average Clearance Time By Lane Blockage	Analysis Of Clearance Time
Average Clearance Time By Pavement Condition	Analysis Of Clearance Time
Average Clearance Time By Heavy Vehicle Involvement	Analysis Of Clearance Time
Average Incident Duration	Reduction In Incident Duration
Distribution Of Assistance To Drivers By Request	Assistance To Drivers / Benefits from CHART's Incident Management
Distribution Of Average Incident Durations By CHART Involvement	Analysis Of Incident Durations
Distribution Of Average Incident Durations By County	Analysis Of Incident Durations
Distribution Of Average Incident Durations By Nature	Analysis Of Incident Durations
Distribution Of Average Incident Durations By Peak/Off-Peak Hours	Analysis Of Incident Durations
Distribution Of Average Incident Durations By Roads	Analysis Of Incident Durations
Distribution Of Average Incident Durations By Weekdays/Ends	Analysis Of Incident Durations
Distribution Of Incident And Disabled Vehicles By Road And Location	Distribution Of Incidents And Disabled Vehicles By Day And Time
Distribution Of Incidents And Disabled Vehicles By Blockage Duration	Distribution Of Incidents And Disabled Vehicles By Day And Time
Distribution Of Incidents And Disabled Vehicles By Day And Time	Distribution Of Incidents And Disabled Vehicles By Day And Time
Distribution Of Incidents And Disabled Vehicles By Lane Blockage Type	Distribution Of Incidents And Disabled Vehicles By Day And Time
Distribution Of Incidents/Disabled Vehicles By Peak And Off-Peak Periods	Distribution Of Incidents And Disabled Vehicles By Day And Time
Emissions Reduction	Direct Benefits To Highway Users / Benefits from CHART's Incident Management

Measure	Category / Sub-Category
Fuel Consumption Reduction	Direct Benefits To Highway Users / Benefits from CHART's Incident Management
Incident Duration Distribution	Analysis Of Response Efficiency
Reduction In Delay	Direct Benefits To Highway Users / Benefits from CHART's Incident Management
Reduction In Secondary Incidents	Reduction In Secondary Incidents / Benefits from CHART's Incident Management
Reduction Of Potential Incidents	Efficient Removal Of Stationary Vehicles / Benefits from CHART's Incident Management
Response Time By Incident Severity	Analysis Of Response Efficiency
Response Time By Lane Blockage	Analysis Of Response Efficiency
Response Time By Pavement Conditions	Analysis Of Response Efficiency
Response Time Distribution	Analysis Of Response Efficiency

Table A-5 Utah DOT CommuterLink Performance Measures, 2003

Measure	Category / Sub-Category
Delay by Lane, Road Segment	Link-Based Measures
Delay by Lane, Road	Corridor or System Measures
Occupancy	Point Measures
Speed at Detector Station	Point Measures
Speed by Lane, Road Segment	Link-Based Measures
Travel Time by Lane, Road Segment	Link-Based Measures
Travel Time by Lane, Road	Corridor or System Measures
Vehicle Hours Traveled	Corridor or System Measures
Vehicle Miles Traveled	Corridor or System Measures
Volume at Detector Station	Point Measures
Volume by Lane, Road Segment	Link-Based Measures

Table A-6 UK National Traffic Control Centre Performance Measures, 2012

Measure	Category / Sub-Category
Average Journey Times	Primary Indicators
Average Speed Profiles	Secondary Indicators
Average Speed/Flow Relationship	Secondary Indicators
Heavy Goods Vehicle %	Secondary Indicators
Lane Utilization	Secondary Indicators
Speed Differential Between lanes	Secondary Indicators
Speed Less Than X	Secondary Indicators
Speed Limit Compliance	Primary Indicators
Traffic Demand	Primary Indicators
Traffic Throughput	Primary Indicators
Variability In Journey Times	Primary Indicators

Table A-7 Performance Measures from *The Gray Book*, WSDOT

Measure	Category / Sub-Category
Clearance Time	Mobility
Delay	Mobility
Number of Recordable Workplace Injuries and Illnesses	Safety
Number Of Traffic Fatalities	Safety
Percent Reduction in Collisions Before and After State Highway Improvements	Safety
Rate of Traffic Fatalities per 100 Million Miles Traveled	Safety

Table A-8 University of Utah Performance Measures

Measure	Category / Sub-Category
Acceptable Delay	Planning Measures
Average Speed	Operational
Average Speed Or Travel Time	System
Average Travel Time	Operational
Average Travel Time From Origin To Destination	System
Average Trip Length	System
CO and (CO)x	Environmental
Congestion Index	Planning Measures
Delay At An Intersection	System
Delay Due To Congestion	System
Density	Design
Density	System
Economic Cost Of Crashes	Economic
Economic Cost Of Lost Time During Incidents	Economic
Flow	Operational
Flow Rate	System
Free Flow Speed	Design
Intersection Delay	Operational
Intersection LOS	Design
Level Of Service	System
Lost Time Due To Congestion	System
Maintenance And Construction Expenditures Per Vehicle Mile Traveled	Economic
(NO)x	Environmental
Number And Percentage Of Stops	Operational
Number And Percentage Of Stops	System
Origin-Destination Travel Times	System
Person Miles Of Travel	System
Queue Length	Operational

Measure	Category / Sub-Category
Queue Length	System
The Cost Of Travel From Origin To Destination	Economic
Throughput	System
Travel Rate	Planning Measures
Travel Rate Index	Planning Measures
Volume-to-Capacity (v/c) Ratio	Operational
Vehicle Emissions	Environmental
Vehicle Miles Traveled	System
Vehicle Miles Traveled By Congestion Level	System

Appendix B. OPERATIONS AND INCIDENT MANAGEMENT PERFORMANCE MEASURE TEMPLATES

The following pages contain "templates" for each selected ATMS performance measure as defined in Chapter 3. Each performance measure template contains:

- Proposed Definition
- Calculation Method
- Potential Data Sources
- Application Example
- Justification
- Literature Definitions
- Literature References

These templates have been generated so that all of the information relevant to a particular performance measure is presented within a few pages. Operations management performance measures are presented first, followed by incident management performance measures. Please note that the MOE templates in this appendix have not been modified to remove the original reference to "Smartlink" and instead are presented in the form in which they were presented to the project steering and implementation committee.

Average Travel Time

Proposed Definition:

The average travel time along specific routes, defined by consecutive segments, or along a specific segment for a specified reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of travel times are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time is calculated (RITIS provides up to a 1 min resolution)

Calculation Method:

a) Based on speed data as input

$$ATT\left(I,J\right)=\frac{\sum_{j=1}^{J}\sum_{i=1}^{I}\frac{L_i}{S_{ij}}}{J}$$

where:

$ATT(I,J)$ is the Average Travel Time for a route defined by I segments and J aggregation intervals

S_{ij} is the average segment speed for segment $i, i=1,\ldots,I$ in time interval $j, j=1,\ldots,J$

L_i is the segment length for segment $i, i=1,\ldots,I$

I is the number of TMC segments on a specified route

J is the number of aggregation intervals of duration t in reporting time period T

t is the length of the data aggregation interval

b) Based on travel time input

$$ATT\left(I,J\right)=\frac{\sum_{j=1}^{J}\sum_{i=1}^{I}\overline{tt_{ij}}}{J}$$

where:

$ATT(I,J)$ is the Average Travel Time for a route defined by I segments and J aggregation intervals

$\overline{tt_{ij}}$ is the average travel time for segment $i, i=1,\ldots,I$ in time interval $j, j=1,\ldots,J$

I is the number of TMC segments on a specified route

J is the number of aggregation intervals of duration t in reporting time period T

t is the length of the data aggregation interval

Potential Data Sources:

Performance metric inputs will come from data collected and archived by various sources. Potential sources include RITIS, loop detectors, Traffic.com, microwave radar, and other technologies, which collect and archive speed and/or travel time data. Segment length data will come from predefined segments determined by the individual source such as NAVTEQ's TMC segments.

Application Example:

b) Where RITIS provides travel time data for multiple TMC segments along a route:

tmc_code	measurement_tstamp	travel_time_minutes ($\overline{tt_{ij}}$)
125+04962	6/17/13 7:00	0.624858261
125+04963	6/17/13 7:00	0.178044348
125+04964	6/17/13 7:00	0.341715652
125+04965	6/17/13 7:00	1.096689565
125+04966	6/17/13 7:00	1.136059437
125P04962	6/17/13 7:00	0.500564571
125P04963	6/17/13 7:00	0.497581714
125P04964	6/17/13 7:00	0.623115211
125P04965	6/17/13 7:00	0.606810435
125P04966	6/17/13 7:00	0.955185205
125+04962	6/18/13 7:00	0.60725662
125+04963	6/18/13 7:00	0.178044348
125+04964	6/18/13 7:00	0.332089859
125+04965	6/18/13 7:00	1.081022571
125+04966	6/18/13 7:00	1.168988696
125P04962	6/18/13 7:00	0.493514366
125P04963	6/18/13 7:00	0.490573521
125P04964	6/18/13 7:00	0.5898824
125P04965	6/18/13 7:00	0.606810435
125P04966	6/18/13 7:00	0.982091831

m = 10 segments, n = 2 intervals, t = 1 minute, T = 2 days

ATT(T,R) = 6.55 minutes

Justification:

Average travel time as a performance measure is reserved for specific routes or corridors throughout the state, which are of the most interest and importance. Average travel time as a measure of effectiveness can be misleading due to large amounts of data across all time periods

and roadways when considering an average system-wide travel time. Looking at peak travel times is more relevant as a change in travel times during non-peak periods may create misleading data, which are not based on system-wide improvements due to ATMS implementation. A distribution of peak average travel times may yield more insight into the effectiveness of ATMS implementation. By providing the distribution of the average peak travel times, it can be determined if the worst-case scenario shows improvement in addition to if the average peak travel time. Additional analysis of travel time data can be performed for various temporal, weather, or other conditions.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
WSDOT	The average travel time on a route during the peak five-minute interval for all weekdays of the calendar year.	• Route Average Speed • Route Length
NTOC	The average time required to traverse a section of roadway in single direction.	• Average Speed • Segment Length
Utah DOT	How long it takes to travel along a particular segment of a corridor or length of a road.	• Average Segment Speed • Segment Length

References:

Agency or Institution	Performance Measure Category	Source Document
Oregon DOT	Mobility	Generating Performance Measures From Portland's Archived Advanced Traffic Management System Data
Michigan DOT	System-Wide Congestion Monitoring	Michigan Department of Transportation ATMS Performance Measures Report
MottMac	Primary Indicators	Managed Motorways: modeling and monitoring their effectiveness
NTOC	Key System Measures	Michigan Department of Transportation ATMS Performance Measures Report
University of Utah	Operational	Real Time Measures of Effectiveness
Utah DOT	a) Link-Based Measures b) Corridor or System Measures	Real Time Measures of Effectiveness For ATMS
Washington DOT	Congestion Performance Measures	The 2012 Congestion Report

Congestion Occurrences

Proposed Definition:

The *number of times* a specific route, defined by consecutive segments, or a specific segment has its corresponding average speed reach and remain at or beyond the congestion threshold for a specified reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of congestion occurrences are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

As an example, assume the time period of interest is the pm peak period (4-7 pm), aggregated annually based on a 15 minute aggregation (and analysis) interval and a TTI of 1.3 as a congestion threshold for a specific route. In this case, assuming the worst condition, then the maximum value of n=3×4=12 congested time periods per peak period, and assuming weekdays only, gives 12 ×260= 3,120 max number of 15 minute periods that route could be congested on an annual basis. On the other hand, if the analysis period was one hour, then we would have a max of three congested periods per peak period or 780 hours per year.

Calculation Method:

First, we need to calculate the travel time index (TTI), which is computed for each aggregation interval (j), assuming our route has (I) consecutive TMC segments.

$$TTI(I,J) = \frac{\sum_{j=1}^{J}\sum_{i=1}^{I}\frac{L_i}{S_{ij}}}{\sum_{j=1}^{J}\sum_{i=1}^{I}\frac{L_i}{FFS_i}}$$

where:

$TTI(I,J)$ is the Travel Time Index for a route defined by I segments and J aggregation intervals

S_{ij} is the average segment speed for segment $i, i = 1,\ldots,I$ in time interval $j, j = 1,\ldots,J$

L_i is the segment length for segment $i, i = 1,\ldots,I$

I is the number of TMC segments on a specified route

J is the number of aggregation intervals of duration t in reporting time period T

FFS_i is the speed limit for a segment (i)

t is the length of the data aggregation interval

The next calculation is to compare TTI (I, J) with the critical TTI specified by NCDOT TTI_{cr} Then, if TTI (I, J) $\geq TTI_{cr}$ then the number of congestion occurrences (n) is updated by a unit.

Alternatively, the congestion occurrences can be represented by the number of aggregation intervals that congestion occurs out of the total number of aggregation intervals in the reporting time period. This gives the proportion of time or aggregation intervals that a specific route or segment is congested for a reporting time period.

$$P(CO) = \frac{K}{J}$$

where:

$P(CO)$ is the probability of a congestion occurrence in the reporting time periods over which TTI is computed

K is the number of congested reporting time periods over which TTI is computed

Application Example:

A route consists of 3 segments, whose travel time and other properties are shown below. If the analysis time period is 30 minutes, and the aggregation interval is 15 minutes, how many congestion occurrences take place in the peak hour? Assume a critical TTI of 1.3

Segment(i)	Length (L)	FFS	Speed (j=1)	Speed (j=2)	Speed (j=3)	Speed (j=4)
1	0.50	60	50	40	55	55
2	0.40	60	48	40	45	60
3	0.60	60	50	40	50	58

In this case I= 3, and J= 30/15=2. We calculate TTI twice, one for each 30 minute analysis periods. Using the equation above, with speeds computed for j=1, 2 ONLY, TTI for the first 30 minutes analysis period is computed at TTI (1) = 1.3567. Using the data in columns j=3 and j=4 gives a TTI (2) =1.12164. In this case, since only the first TTI ≥ 1.3, then n=one congestion occurrence per analysis period.

On the other hand, if the analysis period were equal to the 15 min aggregation interval, then it can be shown that TTI(1)=1.213, TTI(2)=1.50, TTI(3)=1.20 and TTI(4)=1.04, in which case n=1 but means that only a single 15 min period is congested.

The probability of a congestion occurrence would be $P(CO) = 0.5\frac{(1)}{(2)}$ for the 30 minute analysis period and $P(CO) = 0.25\frac{(1)}{(4)}$ for the 15 minute analysis period.

Potential Data Sources:

RITIS provides the number of bottlenecks for roadways throughout the state. RITIS defines bottleneck occurrences as locations whose reported speeds remain below 60% of the posted speed for at least five minutes. Using the definition above, the aggregation interval would be 5 minutes, and the TTI_{cr} = 1.66 (quite high in our opinion). RITIS requires bottlenecks to have a total queue length of at least 0.3 miles. Other sources for congestion classification come from travel time or speed data from RITIS, Traffic.com, or other regional or local sensors.

Justification:

The number of congestion occurrences as a performance measure helps to indicate routes or segments with the most recurring congestion, along with routes that have few congestion problems. Smartlink implementation should help to alleviate congestion through decreasing the number of congestion occurrences in a given time period. Analyses of congestion occurrences can be performed by examining the number of congestion occurrences by segment, time of day, day of week, weather condition, or other factors.

Average Congestion Duration

Proposed Definition:

The average duration of time that a specific route, defined by consecutive segments, or a specific segment is congested due to each individual congestion occurrence for a specified reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of congestion occurrences are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

Calculation Method:

$$ACD(CO) = \sum_{co=1}^{CO} \frac{t_{uncon_{co}} - t_{con_{co}}}{CO}$$

where:

$ACD(CO)$ is the Average Congestion Duration in reporting time period T

t_{uncon_i} is the time congestion begins for each event $co, co = 1, \ldots, CO$

t_{con_i} is the time congestion ends for each event $co, co = 1, \ldots, CO$

CO is the number of congestion occurrences in reporting time period T

Potential Data Sources:

RITIS provides the average duration of bottlenecks for roadways throughout the state. RITIS defines bottleneck locations as those whose reported speeds remain below 60% of the posted speed for at least five minutes. RITIS requires bottlenecks to have a total queue length of at least 0.3 miles. Other sources for congestion classification come from travel time or speed data from RITIS, Traffic.com, or other regional or local sensors.

Application Example:

Using the data presented in the example for congestion occurrences, with a critical TTI of 1.3 and using a 15 minute aggregation interval, it can be seen that segment 1 and segment 3 have average congestion duration of 15 minutes, while segment 2 has an average congestion duration of 30 minutes.

Justification:

Average congestion duration as a performance measure indicates the temporal extent or severity of congested events along a route or segment. Smartlink implementation should help to alleviate congestion through decreasing the average length of congestion duration. Average congestion duration could be analyzed by observing values by time of day, day of week, peak vs. off peak, etc.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
Michigan DOT	The amount of time a certain percentage of the freeway coverage area is congested. This is a measure of the length of the peak period.	• Percentage of freeway congested • Uncongested Time • Congested Time
North Carolina DOT	The time duration during which the prevailing speed of vehicles on a given roadway section averages less than 40 mph on Interstates and freeways with posted speeds of 55 mph and greater.	• Average Speed • Congested Time • Uncongested Time
NTOC	The time duration during which more than 20% of the roadway sections in a predefined area are congested as defined by the "Extent of Congestion – Spatial" performance measure.	• Percentage of freeway congested • Uncongested Time • Congested Time
WSDOT	The average weekday peak period time (in minutes) when average vehicle speeds drop below 75% of posted speeds.	• Segment Speed • Uncongested Time • Congested Time

References:

Agency or Institution	Performance Measure Category	Source Document
Oregon DOT	Mobility	Generating Performance Measures From Portland's Archived Advanced Traffic Management System Data
Michigan DOT	System-Wide Congestion Monitoring	Michigan Department of Transportation ATMS Performance Measures Report
NTOC	Key System Measures	Michigan Department of Transportation ATMS Performance Measures Report
NaviGator	-	Michigan Department of Transportation ATMS Performance Measures Report
Washington DOT	Congestion Performance Measures	The 2012 Congestion Report

Average Max Queue Length

Proposed Definition:

The average max queue length that a specific route, defined by consecutive segments, is congested for a reporting time period. This measure requires a number of spatial and temporal definitions, including:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of congestion occurrences are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation* interval is the *lowest unit of time* over which the travel time index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

Calculation Method:

$$AMQL(CO) = \sum_{co=1}^{CO} \frac{Q_{f_{co}} - Q_{o_{co}}}{CO}$$

where:

$AMQL(CO)$ is the Average Max Queue Length in reporting time period T

$Q_{f_{co}}$ is the end point of the queue for each congestion occurrence $co, co = 1,...,CO$

$Q_{o_{co}}$ is the start point of the queue for each congestion occurrence $co, co = 1,...,CO$

CO is the number of congestion occurrenes in reporting time period T

Potential Data Sources:

RITIS provides the average max length of bottlenecks for roadways throughout the state. RITIS defines bottleneck locations as those whose reported speeds remain below 60% of the posted speed for at least five minutes. RITIS requires bottlenecks to have a total queue length of at least 0.3 miles. Other sources for congestion classification come from travel time or speed data from RITIS, Traffic.com, or other regional or local sensors.

Application Example:

Using the data presented in the example for congestion occurrences, with a critical TTI of 1.3 and using a 15 minute aggregation interval, it can be seen that the route consisting of segments 1,2 and 3 has an average max queue length of 1.5 miles, as all three of the segments are congested in time period two.

Justification:

Average max queue length as a performance measure indicates the spatial extent and severity of congestion occurrences along a route or segment. Smartlink implementation should help to alleviate congestion through decreasing the average queue length that occurs during congestion. Average max queue length could be analyzed by observing values by time of day, day of week, peak vs. off peak, etc.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
Michigan DOT	The number of freeway miles where the travel time index exceeds some threshold value, typically chosen as 30% higher than free flow travel times. This is typically reported by 15-minute or one-hour time periods.	• Travel Time Index • Segment Lengths
NTOC	Miles of roadway within a predefined area and time period for which average travel times are 30% longer than unconstrained travel times	• Segment Lengths • Average Travel Times

References:

Agency or Institution	Performance Measure Category	Source Document
Michigan DOT	System-Wide Congestion Monitoring	Michigan Department of Transportation ATMS Performance Measures Report
NTOC	Key System Measures	Michigan Department of Transportation ATMS Performance Measures Report
Uni. Of Utah	Operational MOEs	Real Time Measures of Effectiveness

Minute-Lane-Miles of Congestion

Proposed Definition:

The total minute-miles of congestion along specific routes, defined by consecutive segments, along a specific segment, or reported statewide for all segments in a specified reporting time period. This measure can be extracted directly from the previous measure on the number of congestion occurrences, since each occurrence is associated with an analysis period of a given duration in minutes. Similar to congestion occurrences, this measure requires:

- Spatial definition of route, i.e. a unique listing of consecutive, directional segments
- Temporal definition of *reporting* time period over which the number of minutes of congestion are computed, be it 15 min, peak hour or period, aggregated daily or annually. Need to be specific in any aggregation whether all or only designated hours are considered.
- *Aggregation interval* is the *lowest unit of time* over which the route congestion index is calculated (RITIS provides up to a 1 min resolution)
- Congestion definition, which means specifying a threshold *travel time index* above which the *entire route* will be considered congested.

Calculation Method:

No new calculations are needed. Essentially, for each analysis period in which the computed TTI exceeds the critical threshold established by NCDOT, the length of each TMC segment of the route in question (in miles) is multiplied by corresponding number of lanes along with the duration of the analysis period (in minutes) and added to the aggregated value for the route. Again, the analysis period can be aggregated to daily, monthly or annual statistics. Similar to congestion occurrences, minute-lane-miles of congestion can be represented by the proportion or percentage of minute-lane-miles that a specific route or the statewide network is congested in the reporting time period.

Application Example:

Applying the example for the number of congestion occurrences, and assuming first the case of a 30 minute analysis period for a two lane route, then the minute miles of congestion for that route is $30 \times (0.5+ 0.4 + 0.6) \times 2 = 90$ min.ln.mi. of congestion. This is because the TTI computed for the first 30 min (1.3567) exceeds the specified threshold of 1.3. On the other hand, should a 15 min analysis period is chosen, only the second 15-min time period gives an TTI (1.5) that exceeds the threshold. In this case the minute miles of congestion would be $15 \times (0.3+ 0.4+ 0.60) \times 2 = 45$ min.ln.mi of congestion. Selecting *an appropriate analysis period* therefore is an important consideration for this measure. The proportion or percentage of minute-lane-miles congested would yield the same values as calculated for congestion occurrences along the route.

This is primarily due to the entire route being considered either congested or uncongested when analyzing on a route level. Analysis on an individual segment level would yield a result of 15 × 2 × 0.5 = 15 min.ln.mi of congestion for segment 1 when analyzing the segment at a 15 minute analysis period. This would yield $P(CO) = 0.25\frac{(15)}{(60)}$.

Potential Data Sources:

RITIS provides the number of bottlenecks for roadways throughout the state. RITIS defines bottleneck occurrences as locations whose reported speeds remain below 60% of the posted speed for at least five minutes. Using the definition above, the aggregation interval would be 5 minutes, and the TTI_{cr} = 1.66 (quite high in our opinion). RITIS requires bottlenecks to have a total queue length of at least 0.3 miles. Other sources for congestion classification come from travel time or speed data from RITIS, Traffic.com, or other regional or local sensors.

Justification:

Minute-Miles of Congestion as a performance measure effectively gives an area of the congestion based upon the congestion duration and the queue length. Minute-miles of congestion provides for a statewide measure of congestion rather than ones which are aimed toward specific TMC segments or routes.

Overall Delay

Proposed Definition:

The total vehicle-hours of delay along specific routes, defined by consecutive segments, along a specific segment, or reported statewide for all segments in a specified reporting time period.

Calculation Method:

$$D(I,J) = \sum_{j=1}^{J} \sum_{i=1}^{I} \left[\max(tt_{a_{ij}} - tt_{p_i}, 0) \right] * V_{ij}$$

where:

$D(I,J)$ is the total delay on I segments in J aggregation intervals in reporting time period T

tt_{p_i} is the travel time at the posted speed limit for segment $i, i = 1,\ldots,I$

$tt_{a_{ij}}$ is the travel time at the average speed for segment $i, i = 1,\ldots,I$ in aggregation interval $j, j = 1,\ldots,J$

I is the total number of TMC segments

J is the number of aggregation intervals of duration t in reporting time period T

t is the length of the data aggregation interval

V_{ij} is the volume on segment $i, i = 1,....,I$ in aggregation interval $j,\ j\ =\ 1,...,J$

Potential Data Sources:

Performance measure inputs will come from data collected and archived by various sources. Potential sources include RITIS, loop detectors, Traffic.com, microwave radar, and other technologies which collect and archive segment travel times or speed data. The necessary volumes can be provided through Average Annual Daily Traffic values provided by NCDOT or other sources of traffic volume data such as Traffic.com or loop detectors.

Application Example:

Using the AADTs provided by NCDOT, TMC segments can be assigned an AADT based on their location to the nearest AADTs. Adjustment factors can then be applied to the AADT to get day of the week volumes. Hourly profiles can then be applied to the day of week volumes to get time of day volumes. This is one of several potential methods that could be used in calculating delay. The current delay and cost of delay calculations performed by RITIS currently uses this method. RITIS allows for supplemental volumes to be provided in order to improve their delay calculation results. http://vpp.ritis.org/static/delay_analysis/docs/DelayCalculations.pdf
http://vpp.ritis.org/static/delay_analysis/docs/PreferredVolumeFormat.pdf

Justification:

Delay as a performance measure can be used to evaluate statewide performance, performance along a specific route, or performance on a specific segment. Smartlink implementation aims to decrease the statewide delay by decreasing the number of vehicle-hours travelled at speeds below the speed limit.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
WSDOT	The average total daily hours of delay per mile based on the maximum throughput speed of 50 mph measured annually for weekdays as cumulative (total) delay.	• Posted Speed or Maximum Throughput Speed • Measured Speed
Utah DOT	The difference between the actual travel time and the travel time obtained by assuming vehicles are traveling at free-flow speed on the section being studied.	• Actual Travel Time • Free-flow Travel Time

References:

Agency or Institution	Performance Measure Category	Source Document
Washington DOT	Congestion Performance Measures	The 2012 Congestion Report
CHART	Direct Benefits to Highway Users	Performance Evaluation and Benefit Analysis for CHART in Year 2011
Michigan DOT	System-Wide Congestion Monitoring	Michigan Department of Transportation ATMS Performance Measures Report
National Traffic Operations Center	Key System Measures	Michigan Department of Transportation ATMS Performance Measures Report
University of Utah	Operational MOEs	Real Time Measures of Effectiveness
Utah DOT	Corridor or System Measures	Real Time Measures of Effectiveness For ATMS
Oregon DOT	Mobility	Generating Performance Measures From Portland's Archived Advanced Traffic Management System Data

Delay Due To Congestion

Proposed Definition:

The total vehicle-hours of non-recurring delay caused by congestion along specific routes, defined by consecutive segments, along a specific segment, or reported statewide for all segments in a specified reporting time period.

Calculation Method:

$$DDC(I,J) = \sum_{j=1}^{J}\sum_{i=1}^{I}\left(tt_{a_{ij}} - tt_{p_i}\right) * V_{ij} \;\; \forall \; tt_{a_{ij}} > tt_{c_i}$$
$$0 \text{ otherwise}$$

where:

$DDC(I,J)$ is the total delay due to congestion on I segments in J aggregation intervals in reporting time period T

tt_{p_i} is the travel time at the posted speed limit for segment $i, i = 1,\ldots,I$

$tt_{a_{ij}}$ is the travel time at the average speed for segment $i, i = 1,\ldots,I$ in aggregation interval $j, j = 1,\ldots,J$

tt_{c_i} is the travel time at 60% of the posted speed limit for segment $i, i = 1,\ldots,I$

I is the total number of TMC segments

J is the number of congested aggregation intervals of duration t in reporting time period T

t is the length of the data aggregation interval

V_{ij} is the volume on segment $i, i = 1,....,I$ in aggregation interval $j,\ j\ =\ 1,...,J$

Potential Data Sources:

Performance measure inputs will come from data collected and archived by various sources. Potential sources include RITIS, loop detectors, Traffic.com, microwave radar, and other technologies which collect and archive segment travel times or speed data. The necessary volumes can be provided through Average Annual Daily Traffic values provided by NCDOT or other sources of traffic volume data such as Traffic.com or loop detectors.

Application Example:

Using the same data and process as presented for calculating delay, delay due to congestion can be determined. Delay due to congestion is calculated for all time periods where travel times are greater than or equal to the travel time at 60% of the posted speed. In contrast, overall delay is calculated for all time periods with average travel times greater than the travel time at the posted speed.

Justification:

Delay due to congestion as a performance measure improves upon the delay performance measure. Smartlink implementation aims to decrease the statewide delay by decreasing the number of vehicle-hours travelled at speeds below the speed limit. However, delay under conditions at which vehicles do not wish to increase their speed is delay which cannot be improved upon by Smartlink implementation. Delay due to congestion is a more representative value of potential improvements in the system which can be brought about through Smartlink implementation.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
NTOC	Vehicle delays in excess of recurring delay for the current time-of-day, day-of-week, and day-type.	• Delay

References:

Agency or Institution	Performance Measure Category	Source Document
NTOC	Key System Measures	Michigan Department of Transportation ATMS Performance Measures Report
University of Utah	System MOEs	Real Time Measures of Effectiveness
Oregon DOT	Mobility	Generating Performance Measures From Portland's Archived Advanced Traffic Management System Data

Vehicle Miles Traveled

Proposed Definition:

The sum of the miles traveled by vehicles along a specific route, defined by consecutive segments, along a specific segment, or along all segments statewide for a specified reporting time period.

Calculation Method:

$$VMT(I) = \sum_{i=1}^{I} V_{s_i} * L_{s_i}$$

where:

$VMT(I)$ is the Vehicle Miles Traveled in reporting time period T

V_{s_i} is the segment volume in vehicles for segment $i, i = 1, ..., I$

L_{s_i} is the segment length in miles for segment $i, i = 1, ..., \mathrm{I}$

I is the total number of TMC segments

Potential Data Sources:

The data requirements necessary for calculating Vehicle Miles Travelled can be provided by a variety of sources. By using INRIX's Traffic Message Channels for segment classification, the segment length can be determined. The corresponding volumes for each segment can be provided by statewide AADT estimates, regional microwave sensors, or local detector data. Because AADTs can be highly directional, other sources could provide more accurate volume counts to determine individual segment VMTs.

Application Example:

TMC segment 125-04859 has a length of 0.90 miles. NCDOT AADT maps show the segment corresponds to an AADT value of 157,000. If the reporting time period T for this segment is one year, the vehicle miles travelled will be:

$VMT(T)$ = (365*157,000)*0.9 = 51.575 million vehicle miles

Justification:

Vehicle Miles Traveled as a performance measure can be used to evaluate statewide performance, performance along a specific route, or on a specific segment. Vehicle Miles Traveled is a representative value that shows the amount of travel that occurs on the roadways. VMT is an important measure to consider when observing other performance measures during

pre and post implementation Smartlink comparison. While Smartlink may bring about an overall reduction in delay, a resulting increase in VMT could disguise any apparent delay improvements.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
Utah DOT	The number of vehicle-miles traveled in a given amount of time	• Volume • Miles

References:

Agency or Institution	Performance Measure Category	Source Document
Michigan DOT	General Measures of System Size	Michigan Department of Transportation ATMS Performance Measures Report
University Of Utah	-	Real Time Measures of Effectiveness
Utah DOT	Corridor or System Measures	Real Time Measures of Effectiveness For ATMS
Washington DOT	System-Wide Congestion Indicators	The 2012 Congestion Report
Oregon DOT	Mobility	Generating Performance Measures From Portland's Archived Advanced Traffic Management System Data

Travel Time Index

Proposed Definition:

The ratio of the average travel time for a specific route, defined by consecutive segments, or for a specific segment, to that same route or segment's posted speed travel time.

Calculation Method:

$$TTI(I,J) = \frac{\sum_{j=1}^{J}\sum_{i=1}^{I}\frac{L_i}{S_{ij}}}{\sum_{j=1}^{J}\sum_{i=1}^{I}\frac{L_i}{FFS_i}}$$

where:

$TTI(I,J)$ is the Travel Time Index for a route defined by I segments and J aggregation intervals

S_{ij} is the average segment speed for segment $i, i = 1,\ldots,I$ in time interval $j, j = 1,\ldots,J$

L_i is the segment length for segment $i, i = 1,\ldots,I$

I is the number of TMC segments on a specified route

J is the number of aggregation intervals of duration t in reporting time period T

FFS_i is the speed limit for a segment (i)

t is the length of the data aggregation interval

Potential Data Sources:

The data required for calculating the travel time index would come from the previously collected and calculated average travel time. Posted speed limit data could be provided by DOT in order to calculate posted travel times.

Application Example:

A route consists of 3 segments, whose travel time and other properties are shown below. If the analysis time period is 30 minutes, and the aggregation interval is 15 minutes, what is the TTI?

Segment(i)	Length (L)	FFS	Speed (j=1)	Speed (j=2)	Speed (j=3)	Speed (j=4)
1	0.50	60	50	40	55	55
2	0.40	60	48	40	45	60
3	0.60	60	50	40	50	58

In this case I= 3, and J= 30/15=2. We calculate TTI twice, one for each 30 minute analysis periods. Using the equation above, with speeds computed for j=1, 2 ONLY, TTI for the first 30 minutes analysis period is computed at TTI (1) = 1.3567. Using the data in columns j=3 and j=4 gives a TTI (2) =1.12164.

Justification:

Travel time index as a performance measure gives an indication of delay in an easy to understand way. ATMS implementation will aim to decrease the travel time index. Travel time index can be analyzed in several ways, such as looking at its value during peak periods only. Because averaging travel time index over an entire day would include times during which traffic volumes are low, using only the peak period provides a more meaningful value for travel time index.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
Michigan DOT	The prevailing travel time over a segment compared to a free flow travel time, which could simply be the travel time at the posted speed limit.	• Average Travel Time • Free Flow Travel Time
North Carolina DOT	Ratio of travel time in peak periods to ideal travel time	• Peak Period Travel Time • Speed Limit Travel Time
Utah TOC	A measure of delay associated with freeway travel, and is an indicator of the overall congestion level of the freeways. It is measured by percentage.	• Average Travel Time • Free Flow Travel TIme
WSDOT	The ratio of average peak travel time compared to maximum throughput speed travel time	• Average Peak Travel Time • Maximum Throughput Speed Travel Time

References:

Agency or Institution	Performance Measure Category	Source Document
Michigan DOT	System-Wide Congestion Monitoring	Michigan Department of Transportation ATMS Performance Measures Report
North Carolina DOT	-	Performance Measures Working Group
Utah TOC	Freeway Operations	UDOT Traffic Management Division Annual Report – Fiscal Year 2005
Washington DOT	Congestion Performance Measures	The 2012 Congestion Report

Travel Time Reliability

Proposed Definition:

The travel time reliability along specific routes, defined by consecutive segments, or along a specific segment for a specified reporting time period. Travel time reliability is a function of the consistency of vehicle travel times and the level of congestion. The consistency of travel times can be represented by the standard deviation of travel times. The level of congestion can be represented by the semi standard deviation of travel times referenced to the posted speed limit.

Calculation Method:

$$StdDev = \sqrt{\frac{1}{I}\sum_{i=1}^{I}\left(tt_{a_i} - u\right)^2}$$

where:

StdDev is the standard deviation of the travel time during reporting time period *T*

I is the number of aggregated travel time observations during reporting time period *T*

tt_{a_i} is the travel time at the average speed for aggregation interval *i* in reporting time period *T*

u is the mean of the observed travel time aggregation intervals in reporting time period *T*

$$SemiDev = \sqrt{\frac{1}{I}\sum_{i=1}^{I}\left[\max\left(tt_{a_i} - tt_p, 0\right)\right]^2}$$

where:

SemiDev is the semi standard deviation of the travel time during reporting time period *T*

I is the number of aggregated travel time observations during reporting time period *T*

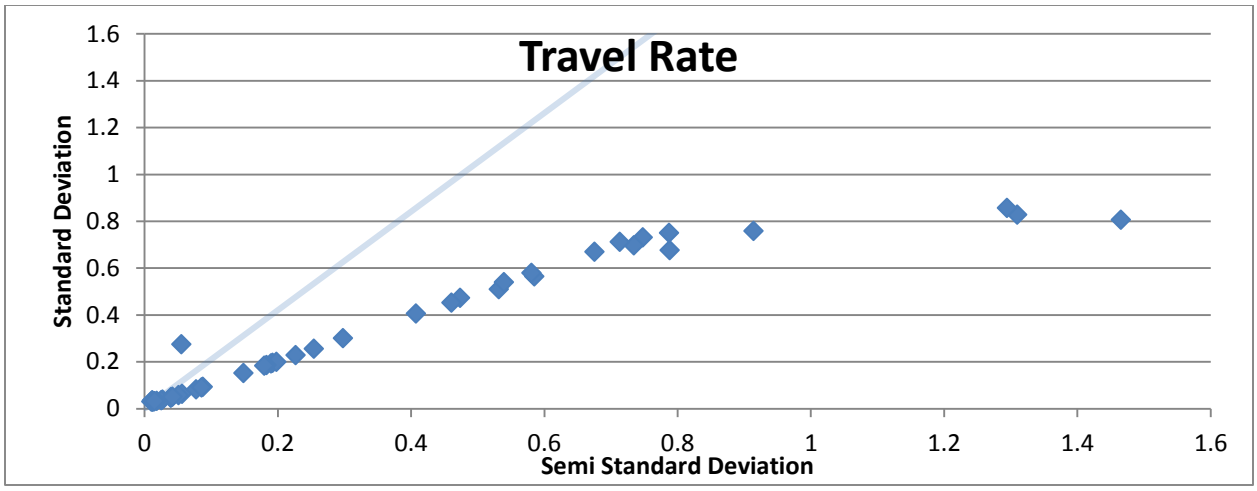
tt_{a_i} is the travel time at the average speed for aggregation interval *i* in reporting time period *T*

tt_p is the travel time at the posted speed limit

Once the standard deviation and semi standard deviation values have been determined, they can be plotted graphically to observe where they fall relative to other segment or route values and relative to previous values for the same segment or route. Segments and routes with lower standard deviation values exhibit higher travel time reliability, while segments with lower semi standard deviation values exhibit reduced congestion. This method rewards improvements in the semi standard deviation, or congestion, which may go unnoticed by other representation of travel time reliability such as Planning Time Index, in which improvements in the travel times of users below the 95th percentile does not yield any improvement in the reliability of the segment or route. Relating the data provided by semi standard and standard deviation to travel time reliability is currently being evaluated.

Application Example:

Current proposed methods to determine travel time reliability information from standard deviation and standard deviation would produce plots such as those displayed below, where each data point represents a period of time for a moving window analysis of the data.


Travel Rate
Standard Deviation
Semi Standard Deviation
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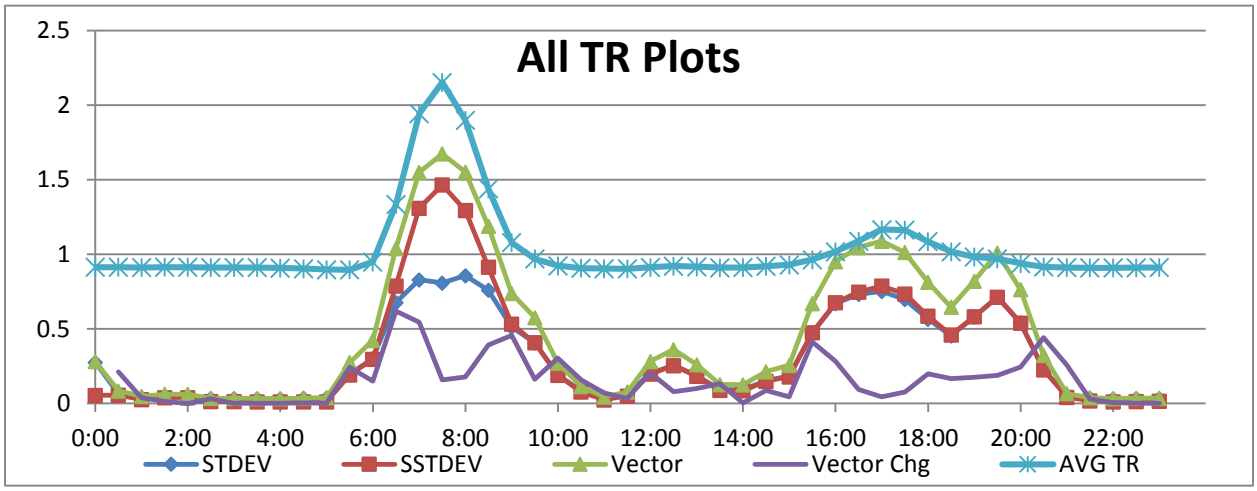
0.4
0.6
0.8
1
1.2
1.4
1.6


All TR Plots
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2
1.5
1
0.5
0
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2:00
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6:00
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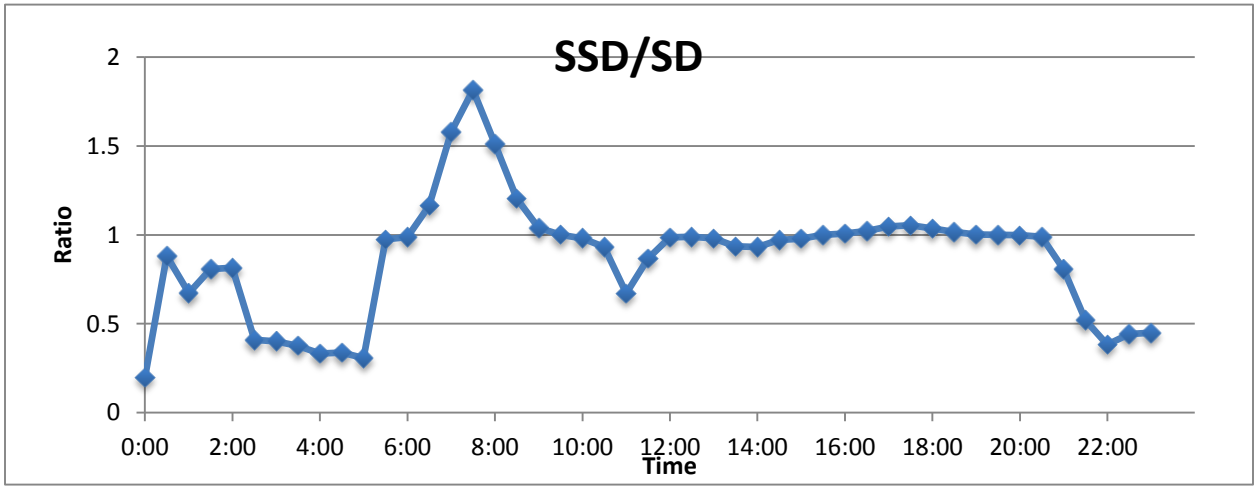
22:00
STDEV
SSTDEV
Vector
Vector Chg
AVG TR


SSD/SD
Ratio
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1
0.5
0
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2:00
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10:00
12:00
14:00
16:00
18:00
20:00
22:00

Potential Data Sources:

The data for calculating travel time reliability consists of the travel times or the speeds from which travel times are derived. Potential sources include RITIS, loop detectors, Traffic.com, microwave radar, and other technologies, which collect and archive speed or travel time data.

Justification:

Travel time reliability as a performance measures gives insight into how consistent the travel times along a segment are and how the traffic conditions vary. The proposed travel time reliability method will measure the segment or route's congestion and consistency. Proper travel time reliability performance measures are important for analyzing potential improvement in a roadway segment or a route.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
Michigan DOT	The difference between the 95th percentile travel time for a given trip at a given time of day and the free flow travel time for that trip.	• 95th Percentile Travel Time • Free Flow Travel Time
North Carolina DOT	Planning Time Index is the 95th percentile travel time over the free-flow travel time.	• 95th Percentile Travel Time • Free Flow Travel Time
NTOC	The Buffer Time is the additional time that must be added to a trip (measured as defined by Travel Time), to ensure that travelers making the trip will arrive at their destination at, or before, the intended time 95% of the time.	• 95th Percentile Travel Time • Average Travel Time
WSDOT	Travel time with 95% certainty	• 95th Percentile Travel Time

References:

Agency or Institution	Performance Measure Category	Source Document
Michigan DOT	System-Wide Congestion Monitoring	Michigan Department of Transportation ATMS Performance Measures Report
MottMac	Primary Indicators	Managed Motorways: modeling and monitoring their effectiveness
NTOC	Key System Measures	Michigan Department of Transportation ATMS Performance Measures Report
North Carolina DOT	-	Performance Measures Working Group
Washington DOT	Congestion Performance Measures	The 2012 Congestion Report
University of Virginia	Traffic Management	The Role of Smart Traffic Centers in Regional System Operations: A Hampton Roads Case Study

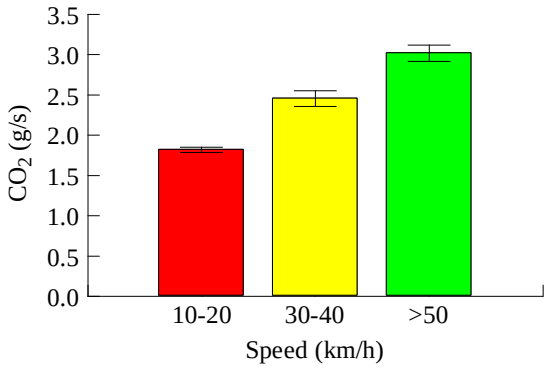
Emissions Rates

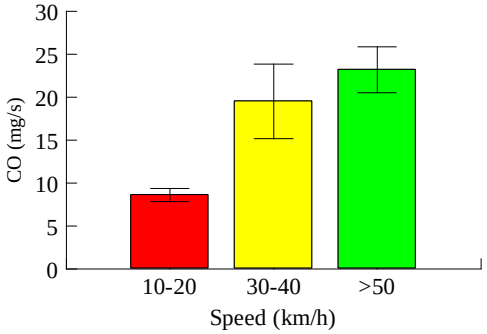
Proposed Definition:

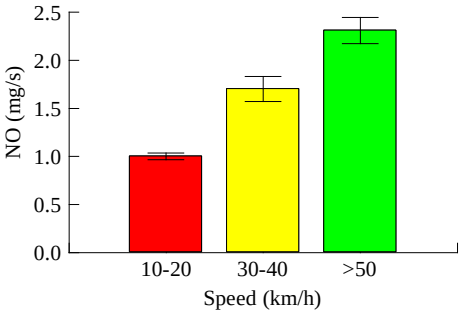
The amount of HC, CO, NO, and CO_2 produced by statewide delays.

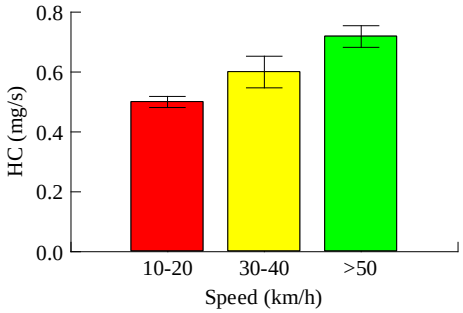
Calculation Method:

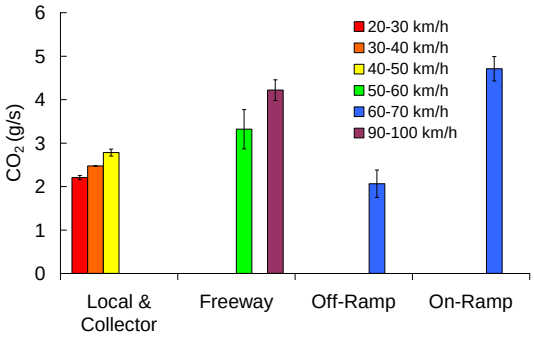
Top 4 graphs for arterials, other facilities below

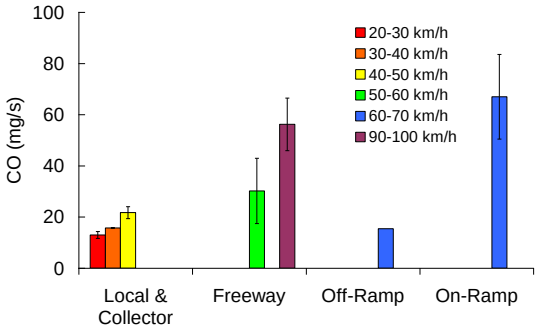


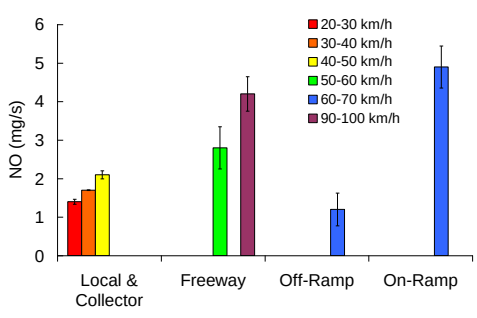


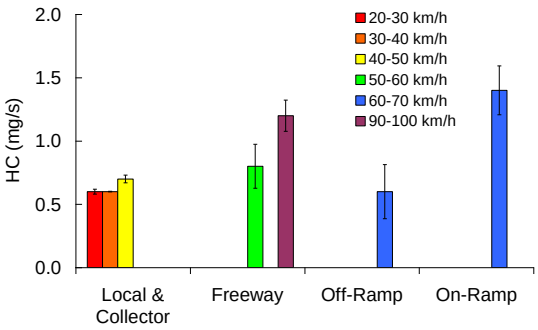












The data is from measurements taken in the Triangle area. Need to convert speed to mph, and generate rate tables by pollutant, speed and facility class. Have the option to report combined emissions, or by pollutant.

Potential Data Sources:

Rates vary by facility type, and could be directly estimated (roughly) from link speeds and travel times. Similar to other measures, need to identify both the temporal as well as the spatial dimensions of the measure. Also, the data is averaged per vehicles, so if total emissions are needed, then link volumes must be known as well. The data required to determine the emissions rates can be provided by the reported link speeds from sources such as RITIS, loop detectors, Traffic.com, microwave radar, and other technologies, which collect and archive speed data. Segment length data will come from predefined segments determined by the individual source. Volume data can be acquired through NCDOT AADTs. If route emissions are needed it simply the sum of link emissions.

Application Example:

An arterial link 1 mile long is operating at 20 mph over a 15 minute period. The link serves a flow rate of 900 vph. What are the emissions per vehicle, and overall emissions during those 15 min?
Speed fits in the 30-40 kph category, yielding the following emission rates in mgs/sec

Co2= 2,400; Co=19; HC=0.6; NO=1.6. Next multiply by link travel time = 1x 60/20= 3min, which yields the total link emissions per vehicle (in mgs/veh)
Co2= 432,000; Co= 3,420 ; HC=108; NO=288. Finally multiply by the vehicle count (900/4=225) to produce total emissions for that link in the 15 minute period (in kgs)
Co2= 97.2 ; Co=0.77; HC=0.024; and NO=0.065

Justification:

Emissions rates is a performance measure that can be calculated for statewide, regional, or corridor specific evaluation. ATMS implementation is aimed toward decreasing the total delay, which will bring about a reduction in emissions. The reduction in emissions can be converted into a monetary savings for HC, CO, NO, and CO_2.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
CHART	Reductions in vehicle emissions for HC, CO, NO, and CO2.	• Total Delay Reduction
Florida DOT	The quantity of the pollutants resulting from transportation systems, including hydrocarbon (HC) and reactive organic gases (ROG), carbon monoxide (CO), and nitrogen oxides (NOx).	• Segment Average Travel Speed

References:

Agency or Institution	Performance Measure Category	Source Document
CHART	Direct Benefits to Highway Users	Performance Evaluation and Benefit Analysis for CHART in Year 2011
Florida DOT	Benefit-Cost Analysis Measures	Operation Data For Evaluating Benefits and Costs of Advanced Traffic Management Components
University of Utah	Environmental	Real Time Measures of Effectiveness

Wasted Fuel

Proposed Definition:

The amount of fuel wasted statewide by factors such as delay.

Calculation Method:

The parameters for calculating wasted fuel are similar to those displayed in the method for calculating emissions.

Potential Data Sources:

The data required to determine the emissions rates can be provided by the previously calculated delay. Parameters such as delay can be used as an input to calculate the fuel wasted.

Application Example:

Parameters the same as for Emissions calculation.

Justification:

Wasted fuel is a performance measure that can be calculated for statewide, regional, or corridor specific evaluation. Smartlink implementation is aimed toward decreasing the total delay, which will bring about a reduction in wasted fuel. The reduction in wasted fuel can be converted into a monetary savings.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
CHART	Reduction in fuel consumption	• Total Delay Reduction
Florida DOT	Reduction in fuel consumption	• Segment Average Travel Speed

References:

Agency or Institution	Performance Measure Category	Source Document
CHART	Direct Benefits to Highway Users	Performance Evaluation and Benefit Analysis for CHART in Year 2011
Florida DOT	Benefit-Cost Analysis Measures	Operation Data For Evaluating Benefits and Costs of Advanced Traffic Management Components
Oregon DOT	Economic Development, Quality of Life, Environmental and Resource Conservation	Generating Performance Measures From Portland's Archived Advanced Traffic Management System Data

Average Incident Clearance Time

Proposed Definition:

The average time between the first recordable awareness of the incident and the last responder to leave the scene of the incident.

Calculation Method:

$$AICT(T) = \frac{\sum_{n=1}^{N}\left(t_{c_n} - t_{d_n}\right)}{N}$$

where:

$AICT(T)$ is the Average Incident Clearance Time in reporting time period T

t_{d_n} is the timestamp of incident detection for incident $n, n = 1, ..., N$ defined by the first recordable awareness

t_{c_n} is the timestamp of incident clearance for incident $n, n = 1, ..., N$ defined by when last responder departs the scene

N is the number of incidents in reporting time period T

Potential Data Sources:

Performance metric inputs will come from the NCDOT incident management log database. The incident management log database will draw event timestamp information from multiple sources, such as travelers, public safety agencies, and automatic incident detection algorithms.

Justification:

Average incident clearance time provides a measurable value for evaluation of the Smartlink ATMS post-implementation. Smartlink implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in incident response. A decrease in average incident clearance time would provide a representation of the improvements due to Smartlink implementation. Average incident clearance time can be displayed in a variety of ways in order to evaluate incident management in more details. Average incident clearance time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average incident clearance time can be analyzed by factors to compare values by day vs. night, incident nature, lane blockage, pavement condition, heavy vehicle involvement, etc.

Literature

Definitions:

Agency or Institution	Definition	Data Requirements
FHWA	a) Time between first recordable awareness of incident by a responsible agency and time at which all evidence of incident is removed. b) Time between first recordable and the time at which the last responder has left the scene.	• First Recordable Time • Last Responder Departure Time
Florida DOT	The average number of minutes between the last responder departure time and FDOT or FHP notified time.	• FDOT or FHP Notified Time • Last Responder Departure
North Carolina DOT	Time between first recordable awareness of incident by a responsible agency and time at which the last responder has left the scene.	• First Recordable Time • Last Responder Departure Time

References:

Agency or Institution	Performance Measure Category	Source Document
CHART (Maryland)	Analysis of Clearance Time	Performance Evaluation and Benefit Analysis for CHART in Year 2011
Michigan DOT	Incident Management	Michigan Department of Transportation ATMS Performance Measures Report
NaviGAtor (Georgia)	-	Georgia NaviGAtor Business Plan
TransStar (Texas)	Incident Management	Houston TranStar 2010 Annual Report
Washington DOT	Congestion Performance Measures	WSDOT Congestion Report
Florida DOT	-	SunGuide Report Information: Annual Incident Duration Performance Report
FHWA	TIM PM FSI Program-Level Performance Measure	Traffic Incident Management Handbook
North Carolina DOT	-	DRAFT North Carolina Department of Transportation Traffic Incident Management Performance Measures

Average Incident Response Time

Proposed Definition:

The average time for the first qualified responder to arrive on the incident scene.

Calculation Method:

$$AIRT(T) = \frac{\sum_{n=1}^{N}(t_{a_n} - t_{d_n})}{N}$$

where:

$AIRT(T)$ is the Average Incident Response Time in reporting time period T

t_{d_n} is the timestamp of incident detection for incident $n, n = 1, ..., N$
defined by the first recordable awareness

t_{a_n} is the timestamp of arrival for incident $n, n = 1, ..., N$
defined by the arrival of the first qualified responder

N is the number of incidents in reporting time period T

Potential Data Sources:

Performance metric inputs will come from the NCDOT incident management log database. The incident management log database will draw event timestamp information from multiple sources, such as travelers, public safety agencies, and automatic incident detection algorithms.

Justification:

Average incident response time provides a measurable value for evaluation of the Smartlink ATMS post-implementation. Smartlink implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in incident response. Studies have also shown that longer incident response times may produce more secondary incidents. A decrease in average incident response time would provide a representation of the improvements due to Smartlink implementation. Average incident response time can be displayed in a variety of ways in order to evaluate incident management in more details. Average incident response time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average incident response time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

Literature

Definitions:

Source	Definition	Data Requirements
FHWA	Time between notification and arrival of first qualified response person to arrive on incident scene.	• Notification Time • First Responder Arrival Time
Florida DOT	Average number of minutes between the time verified by the TMC and the time the first responder arrives.	• TMC Verification Time • First Responder Arrival Time
North Carolina DOT	The time to respond with proper temporary traffic control.	• Traffic Control Time

References:

Source	Category	Document
CHART (Maryland)	Analysis of Response Efficiency	Performance Evaluation and Benefit Analysis for CHART in Year 2011
Michigan DOT	Freeway Courtesy Patrol	Michigan Department of Transportation ATMS Performance Measures Report
NaviGAtor (Georgia)	-	Georgia NaviGAtor Business Plan
UVA-HRSTC (Virginia)	Incident Management	The Role of Smart Traffic Centers in Regional System Operations: A Hampton Roads Case Study
Washington DOT	Congestion Performance Measures	WSDOT Congestion Report
Florida DOT	-	SunGuide Report Information: Annual Incident Duration Performance Report
North Carolina DOT	-	DRAFT North Carolina Department of Transportation Traffic Incident Management Performance Measures
U.S. DOT FHWA	Candidate Program-Level TIM Performance Measures	Traffic Incident Management Handbook

Average Incident Notification Time

Proposed Definition:

The average time from the first recordable awareness of an incident to the time when the first responding agency is notified.

Calculation Method:

$$AINT(T) = \frac{\sum_{n=1}^{n_T} t_{n_n} - t_{d_n}}{N}$$

where:

$AINT(T)$ is the Average Incident Notification Time in reporting time period T

t_{d_n} is the timestamp of incident detection for incident $n, n = 1,..., N$
defined by the first recordable awareness

t_{n_n} is the timestamp of notification for incident $n, n = 1,..., N$
defined by when the proper agency is notified

N is the number of incidents in reporting time period T

Potential Data Sources:

Performance metric inputs will come from the NCDOT incident management log database. The incident management log database will draw event timestamp information from multiple sources, such as travelers, public safety agencies, and automatic incident detection algorithms.

Justification:

Average incident notification time provides a measurable value for evaluation of the Smartlink ATMS post-implementation. Smartlink implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in incident notification. A decrease in average incident notification time would provide a representation of the improvements due to Smartlink implementation. Average incident notification time can be displayed in a variety of ways in order to evaluate incident management in more details. Average incident notification time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average incident notification time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

Literature

Definitions:

Source	Definition	Data Requirements
FHWA	The time between the first agency's awareness of an incident, and the time to notify needed response agencies.	• Initial Awareness Time • Agency Notification Time
Florida DOT	The time the TMC is notified minus the time of the first notification.	• Initial Notification • TMC Notification Time

References:

Source	Category	Document
Michigan DOT	Incident Management	Michigan Department of Transportation ATMS Performance Measures Report
Florida DOT	-	SunGuide Report Information: Annual Incident Duration Performance Report
U.S. DOT FHWA	Candidate Program-Level TIM Performance Measures	Traffic Incident Management Handbook

Average Roadway Clearance Time

Proposed Definition:

The average time from the first recordable awareness of an incident to the time when all travel lanes are cleared.

Calculation Method:

$$ARCT(T) = \frac{\sum_{n=1}^{N}(t_{rc_n} - t_{d_n})}{N}$$

where:

$ARCT(T)$ is the Average Roadway Clearance Time in reporting time period T

t_{d_n} is the timestamp of incident detection for incident $n, n = 1, ..., N$ defined by the first recordable awareness

t_{rc_n} is the timestamp of roadway clearance for incident $n, n = 1, ..., N$ defined by the clearance of all travel lanes

N is the number of incidents in reporting time period T

Potential Data Sources:

Performance metric inputs will come from the NCDOT incident management log database. The incident management log database will draw event timestamp information from multiple sources, such as travelers, public safety agencies, and automatic incident detection algorithms.

Justification:

Average roadway clearance time provides a measurable value for evaluation of the Smartlink ATMS post-implementation. Smartlink implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies involved in roadway clearance. A decrease in average roadway clearance time would provide a representation of the improvements due to Smartlink implementation. Average roadway clearance time can be displayed in a variety of ways in order to evaluate incident management in more details. Average roadway clearance time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average roadway clearance time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

Literature

Definitions:

Source	Definition	Data Requirements
FHWA	The time between first recordable awareness of incident by a responsible agency and first confirmation that all lanes are available for traffic flow.	• First Recordable Time • Lanes Cleared Time
Florida DOT	The time between the first notification and the time the travel lanes are cleared.	• First Notified Time • Travel Lanes Cleared Time
North Carolina DOT	The time between first recordable awareness of incident by a responsible agency and first confirmation that all lanes are available for traffic flow.	• First Recordable Time • Lanes Cleared Time

References:

Source	Category	Document
U.S. DOT FHWA	Candidate Program-Level TIM Performance Measures	Traffic Incident Management Handbook
Florida DOT	-	SunGuide Report Information: Annual Incident Duration Performance Report
North Carolina DOT	-	DRAFT North Carolina Department of Transportation Traffic Incident Management Performance Measures

Average Recovery Time

Proposed Definition:

The average time from the first recordable awareness of an incident to the time when the incident occurrence no longer influences roadway conditions.

Calculation Method:

$$ART(T) = \frac{\sum_{n=1}^{N}(t_{o_n} - t_{d_n})}{N}$$

where:

$ART(T)$ is the Average Recovery Time in reporting time period T

t_{d_n} is the timestamp of incident detection for incident $n, n = 1, ..., N$ defined by the first recordable awareness)

t_{c_n} is the timestamp of recovery for incident $n, n = 1, ..., N$ defined by when traffic operation return to normal)

N is the number of incidents in reporting time period T

Potential Data Sources:

Performance metric inputs will come from the NCDOT incident management log database. The incident management system database will draw event timestamp information from multiple sources, such as travelers, public safety agencies, and automatic incident detection algorithms.

Justification:

Average recovery time provides a measurable value for evaluation of the Smartlink ATMS post-implementation. Smartlink implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies. A decrease in average recovery time would provide a representation of the improvements due to Smartlink implementation. Average recovery time can be displayed in a variety of ways in order to evaluate incident management in more details. Average roadway clearance time can be displayed graphically as a distribution with bins representing periods of time in minutes on the x-axis and the number of incidents which fall in those corresponding bins on the y-axis. Average roadway clearance time can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

Literature

Definitions:

Source	Definition	Data Requirements
FHWA	Time between awareness of an incident and restoration of impacted roadway/roadways to "normal" conditions.	• First Awareness Time • Restoration Time
North Carolina DOT	Time between awareness of an incident and restoration of impacted roadway/roadways to "normal" conditions.	• First Awareness Time • Restoration Time

References:

Source	Category	Document
U.S. DOT FHWA	Candidate Program-Level TIM Performance Measures	Traffic Incident Management Handbook
North Carolina DOT	-	DRAFT North Carolina Department of Transportation Traffic Incident Management Performance Measures

Secondary Incidents

Proposed Definition:

The number of incidents that occur between primary incident detection and the time for roadway conditions to return to recover.

Calculation Method:

Secondary incidents would be calculated based on multiple factors that must be determined. Because secondary factors are those which occur after a primary incident at some location influenced by the incident, it must be determined what range of time and location values are acceptable. Once an agreed upon threshold is determined to denote the end of the incident influence, perhaps the recovery time, all incidents within that time frame within a certain distance or under a certain traffic condition such that it is brought upon by the primary incident, will be classified as secondary incidents. Ranges of distance for incident influence may also vary by traffic direction.

Potential Data Sources:

Performance metric inputs will come from the NCDOT incident management log database. The incident management log database will draw event timestamp information from multiple sources, such as travelers, public safety agencies, and automatic incident detection algorithms. This timestamped incident information will assist in classifying incidents as secondary incidents. The incident management log database also provides the necessary location information for incident classification.

Justification:

The number of secondary incidents that occur provide a measurable value for evaluation of the Smartlink ATMS post-implementation. Smartlink implementation should bring about improved incident management performance through improved data sharing and communication among multiple agencies. Primary incidents are known to cause secondary incidents due to queues, changes in traffic speeds, and rubbernecking. A decrease in the number of secondary incidents would provide a representation of the improvements due to Smartlink implementation. The number of secondary incidents can be displayed in a variety of ways in order to evaluate incident management in more details. Secondary incidents can be displayed graphically as a distribution with bins representing the number of secondary incidents that occurred during an incident on the x-axis and the number of times each number of secondary incidents occurred which fall in those corresponding bins on the y-axis. Secondary incidents can be analyzed by factors to compare values by time of day, incident nature, pavement condition, lane blockage, heavy vehicle involvement, region, etc.

Literature

Definitions:

Source	Definition	Data Requirements
FHWA	The number of unplanned incidents beginning with the time of detection of the primary incident where a collision occurs either a) within the incident scene or b) within the queue, including the opposite direction, resulting from the original incident.	• Number of secondary incidents • Primary Incident Detection Time
CHART	a) Incidents that occur within two hours from the onset of a primary incident and also within two miles downstream of the location of the primary incident. b) Incidents that happen half a mile either downstream or upstream of the primary incident location in the opposite direction, occurring within half an hour from the onset of the primary incident.	• Primary Incident Time • Number of secondary incidents
North Carolina DOT	The number of secondary crashes beginning with the time of detection of the primary incident where a collision occurs either a) within the incident scene or b) within the queue, including the opposite direction, resulting from the original incident.	• Number of secondary crashes • Primary Incident Detection Time

References:

Source	Category	Document
CHART	Reduction in Secondary Incidents	Performance Evaluation and Benefit Analysis for CHART in Year 2011
FHWA	Candidate Program-Level TIM Performance Measures	Traffic Incident Management Handbook
North Carolina DOT	-	DRAFT North Carolina Department of Transportation Traffic Incident Management Performance Measures

Appendix C. SAMPLE QUARTERLY PERFORMANCE REPORTS

I-40, Exit 283 to Exit 289, Q1 2014 to Q2 2015

Q1 2014:

	Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289				
	Westbound January 2014 through March 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.04	6.9	0	0	0
Tuesday	0.4	4.47	0	0.04	0.38
Wednesday	0.18	3.79	0	7.98	0.4
Thursday	0.31	2.74	0	0.68	0
Friday	0.17	1.37	0	2.26	0
Saturday	0.1	0	0	0	0
Sunday	0.17	0	0	0.01	0
Weekends	0.14	0	0	0	0
Weekdays	0.2	3.17	0	0.46	0.02
All Days	0.2	1.95	0	0.12	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	1.12	0	0	0
Tuesday	0.07	0.72	0	0.01	0.06
Wednesday	0.03	0.61	0	1.3	0.06
Thursday	0.05	0.44	0	0.11	0
Friday	0.03	0.22	0	0.36	0
Saturday	0.02	0	0	0	0
Sunday	0.03	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.03	0.51	0	0.07	0
All Days	0.03	0.32	0	0.02	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.15	13.08	6.01	6.12	6.35
Tuesday	6.51	10.67	6	6.21	6.63
Wednesday	6.29	9.95	6.12	14.13	6.58
Thursday	6.42	8.9	6	6.88	6.26
Friday	6.28	7.51	6.12	8.51	6.26
Saturday	6.23	6.04	5.99	6.06	6.25
Sunday	6.3	6.13	6.06	6.15	6.25
Weekends	6.26	6.11	6.03	6.09	6.25
Weekdays	6.31	9.34	6.05	6.64	6.36
All Days	6.31	8.12	6.02	6.31	6.32

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound January 2014 through March 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	2.14	0.98	1	1.04
Tuesday	1.07	1.75	0.98	1.02	1.09
Wednesday	1.03	1.63	1	2.31	1.08
Thursday	1.05	1.46	0.98	1.13	1.02
Friday	1.03	1.23	1	1.39	1.02
Saturday	1.02	0.99	0.98	0.99	1.02
Sunday	1.03	1	0.99	1.01	1.02
Weekends	1.03	1	0.99	1	1.02
Weekdays	1.03	1.53	0.99	1.09	1.04
All Days	1.03	1.33	0.99	1.03	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.68	53.12	69.16	67.73	67.7
Tuesday	66.45	54.94	69.3	68.68	66.33
Wednesday	66.82	60.22	63.55	59.39	65.66
Thursday	66.65	61.84	69.57	66.03	67.9
Friday	67.13	66.2	69.19	63.35	66.38
Saturday	67.09	69.93	70.43	69.99	68.38
Sunday	67.18	68.98	70.15	69.76	68.22
Weekends	67.13	69.45	70.29	69.87	68.3
Weekdays	66.95	58.95	68.06	64.79	66.79
All Days	67	61.65	68.69	66.19	67.22

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	5.87	7.48	5.74	5.86	5.87
Tuesday	5.98	7.23	5.73	5.78	5.99
Wednesday	5.94	6.59	6.25	6.69	6.05
Thursday	5.96	6.42	5.71	6.01	5.85
Friday	5.91	6	5.74	6.27	5.98
Saturday	5.92	5.68	5.64	5.67	5.81
Sunday	5.91	5.76	5.66	5.69	5.82
Weekends	5.91	5.72	5.65	5.68	5.81
Weekdays	5.93	6.74	5.83	6.13	5.95
All Days	5.93	6.44	5.78	6	5.91

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.22	0.94	0.96	0.96
Tuesday	0.98	1.18	0.94	0.95	0.98
Wednesday	0.97	1.08	1.02	1.09	0.99
Thursday	0.97	1.05	0.93	0.98	0.96
Friday	0.97	0.98	0.94	1.03	0.98
Saturday	0.97	0.93	0.92	0.93	0.95
Sunday	0.97	0.94	0.93	0.93	0.95
Weekends	0.97	0.94	0.93	0.93	0.95
Weekdays	0.97	1.1	0.95	1	0.97
All Days	0.97	1.05	0.95	0.98	0.97

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound January 2014 through March 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.14	0	0	4.86	0.44
Tuesday	0.43	0.27	0	6	0.4
Wednesday	0.3	0.38	0	9.27	0
Thursday	0.19	0.3	0	2.02	0
Friday	0.21	0.15	0	0.98	0
Saturday	0.26	0	0	0	0
Sunday	0.19	0	0	0	0
Weekends	0.24	0	0	0	0
Weekdays	0.24	0.19	0	3.61	0
All Days	0.26	0.06	0	2.89	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0	0	0.58	0.07
Tuesday	0.07	0.04	0	0.67	0.06
Wednesday	0.05	0.06	0	1.01	0
Thursday	0.03	0.05	0	0.19	0
Friday	0.03	0.02	0	0.08	0
Saturday	0.04	0	0	0	0
Sunday	0.03	0	0	0	0
Weekends	0.04	0	0	0	0
Weekdays	0.04	0.03	0	0.37	0
All Days	0.04	0.01	0	0.33	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.41	6.27	6.21	13.27	6.83
Tuesday	6.7	6.56	6.13	14.94	6.94
Wednesday	6.57	6.66	6.28	18.49	6.54
Thursday	6.46	6.58	6.2	12.63	6.42
Friday	6.48	6.43	6.29	13.14	6.43
Saturday	6.55	6.27	6.12	6.2	6.43
Sunday	6.51	6.39	6.25	6.27	6.34
Weekends	6.55	6.34	6.2	6.25	6.37
Weekdays	6.51	6.49	6.21	13.47	6.56
All Days	6.54	6.4	6.22	11.76	6.5

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound January 2014 through March 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1	0.99	2.12	1.09
Tuesday	1.07	1.05	0.98	2.38	1.11
Wednesday	1.05	1.06	1	2.95	1.04
Thursday	1.03	1.05	0.99	2.02	1.02
Friday	1.03	1.03	1	2.1	1.03
Saturday	1.05	1	0.98	0.99	1.03
Sunday	1.04	1.02	1	1	1.01
Weekends	1.04	1.01	0.99	1	1.02
Weekdays	1.04	1.04	0.99	2.15	1.05
All Days	1.04	1.02	0.99	1.88	1.04

Speed (mph)

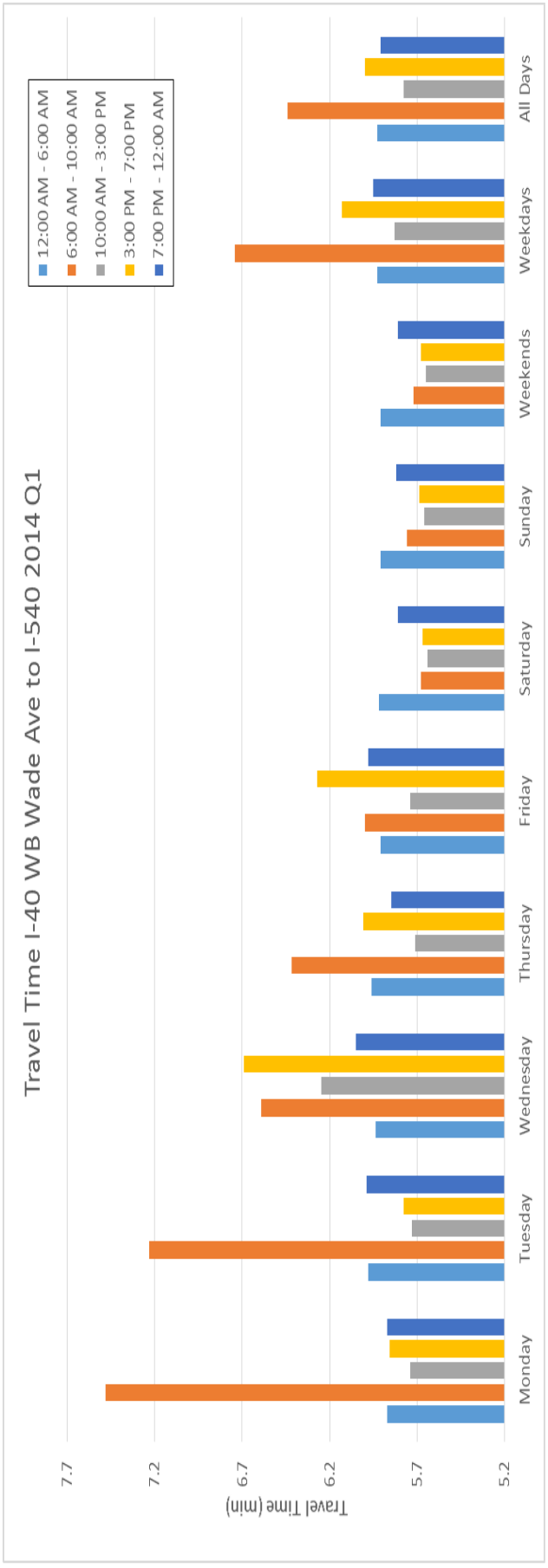
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.58	67.9	69.53	57.55	67.1
Tuesday	66.37	67.78	69.46	55.4	65.98
Wednesday	66.28	67.44	61.67	50.74	66.05
Thursday	66.75	67.08	69.52	57.54	67.47
Friday	66.92	68.35	69.16	56.95	68.03
Saturday	66.64	69.81	70.75	70.37	68.78
Sunday	66.89	68.47	70.37	69.96	68.92
Weekends	66.77	69.13	70.56	70.16	68.85
Weekdays	66.79	67.71	67.69	55.51	66.93
All Days	66.78	68.12	68.5	59.1	67.48

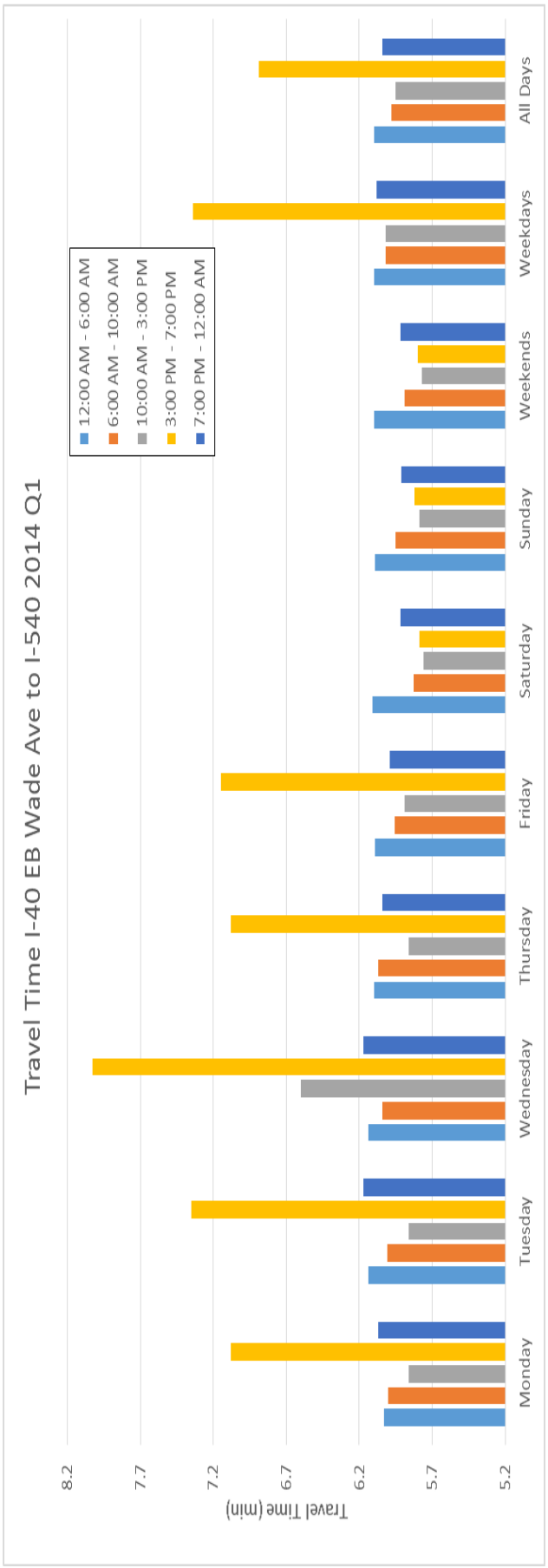
Travel time (minutes)

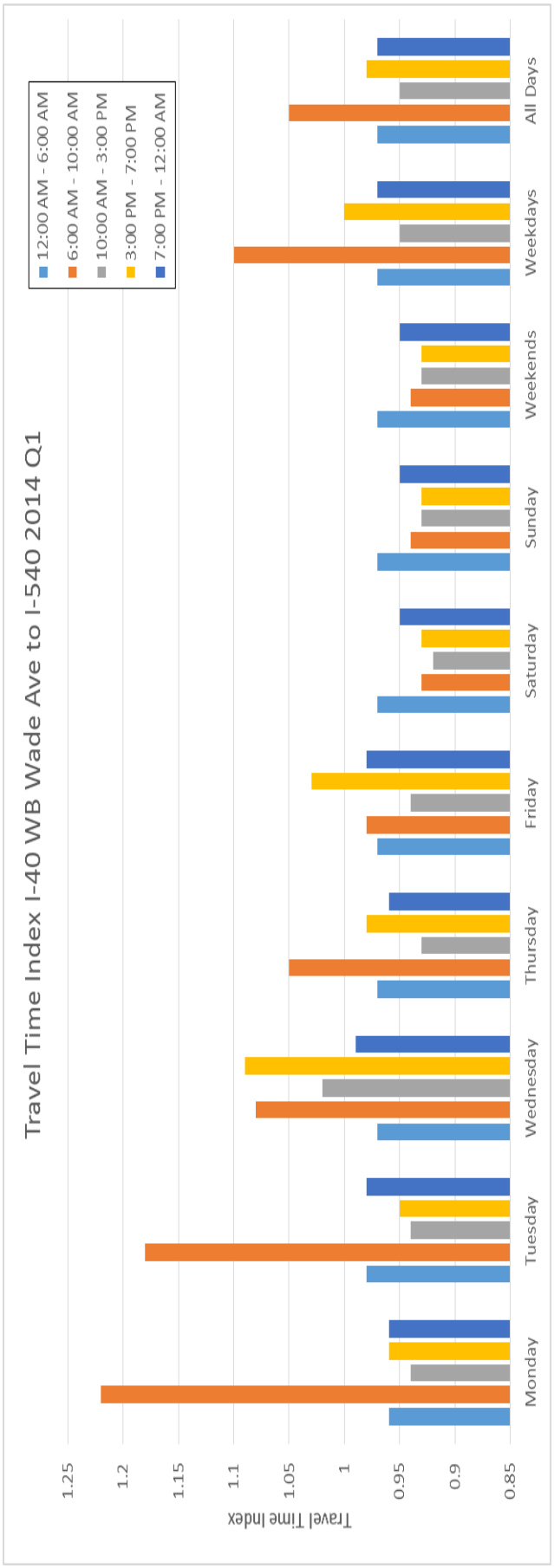
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.03	6	5.86	7.08	6.07
Tuesday	6.14	6.01	5.86	7.35	6.17
Wednesday	6.14	6.04	6.6	8.03	6.17
Thursday	6.1	6.07	5.86	7.08	6.04
Friday	6.09	5.96	5.89	7.15	5.99
Saturday	6.11	5.83	5.76	5.79	5.92
Sunday	6.09	5.95	5.79	5.82	5.91
Weekends	6.1	5.89	5.77	5.8	5.92
Weekdays	6.1	6.02	6.02	7.34	6.08
All Days	6.1	5.98	5.95	6.89	6.04

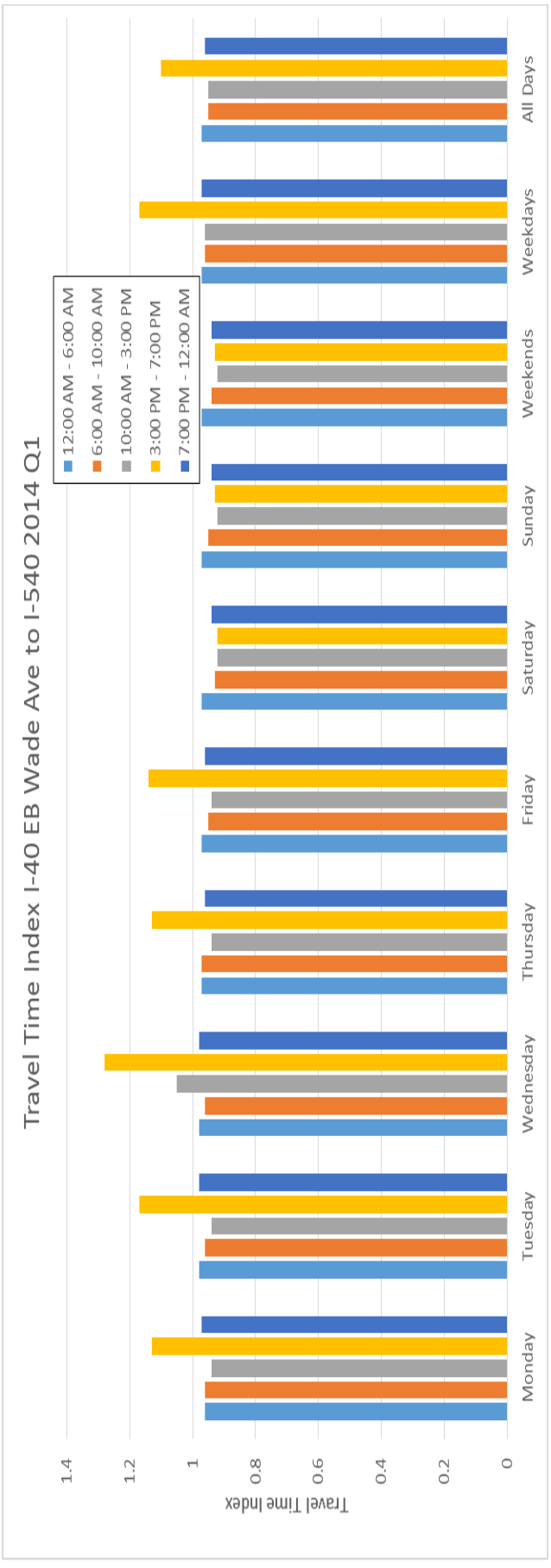
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	0.96	0.94	1.13	0.97
Tuesday	0.98	0.96	0.94	1.17	0.98
Wednesday	0.98	0.96	1.05	1.28	0.98
Thursday	0.97	0.97	0.94	1.13	0.96
Friday	0.97	0.95	0.94	1.14	0.96
Saturday	0.97	0.93	0.92	0.92	0.94
Sunday	0.97	0.95	0.92	0.93	0.94
Weekends	0.97	0.94	0.92	0.93	0.94
Weekdays	0.97	0.96	0.96	1.17	0.97
All Days	0.97	0.95	0.95	1.1	0.96


Travel Time I-40 WB Wade Ave to I-540 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wade Ave to I-540 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
8.2
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wade Ave to I-540 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wade Ave to I-540 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q2 2014:

	Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289				
	Westbound April 2014 through June 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.05	3.73	0	0	0
Tuesday	0.04	5.76	0	3.01	0
Wednesday	0.02	4.56	0	0.72	0.02
Thursday	0.04	3.13	0.05	0.49	0
Friday	0.06	0.58	0	0.17	0
Saturday	0.08	0	0	0	0
Sunday	0.2	0	0	0	0
Weekends	0.1	0	0	0	0
Weekdays	0.04	3.28	0	0.3	0
All Days	0.08	2.26	0	0	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.58	0	0	0
Tuesday	0.01	0.9	0	0.47	0
Wednesday	0	0.71	0	0.11	0
Thursday	0.01	0.49	0.01	0.08	0
Friday	0.01	0.09	0	0.03	0
Saturday	0.01	0	0	0	0
Sunday	0.03	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.01	0.51	0	0.05	0
All Days	0.01	0.36	0	0	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.27	10.14	6.07	6.06	6.28
Tuesday	6.26	12.15	6.03	9.35	6.3
Wednesday	6.24	10.95	6.08	7.02	6.33
Thursday	6.26	9.51	6.33	6.82	6.28
Friday	6.29	6.9	6.09	6.53	6.29
Saturday	6.34	6.04	6.03	6.02	6.37
Sunday	6.44	6.21	6.08	6.09	6.3
Weekends	6.35	6.13	6.07	6.05	6.34
Weekdays	6.26	9.66	6.08	6.62	6.29
All Days	6.31	8.63	6.08	6.31	6.29

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound April 2014 through June 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1.63	0.98	0.97	1.01
Tuesday	1.01	1.95	0.97	1.5	1.01
Wednesday	1	1.76	0.98	1.13	1.02
Thursday	1.01	1.53	1.02	1.1	1.01
Friday	1.01	1.11	0.98	1.05	1.01
Saturday	1.02	0.97	0.97	0.97	1.02
Sunday	1.03	1	0.98	0.98	1.01
Weekends	1.02	0.99	0.98	0.97	1.02
Weekdays	1.01	1.55	0.98	1.06	1.01
All Days	1.01	1.39	0.98	1.01	1.01

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.46	62.45	69.74	70.03	68.62
Tuesday	67.7	59.27	69.7	62.27	68.47
Wednesday	68.11	59.27	69.68	65.93	69.21
Thursday	67.93	63.19	68.01	67.6	68.87
Friday	67.93	65.63	69.62	68.32	68.98
Saturday	67.79	71.11	70.55	70.93	68.62
Sunday	67.01	69.95	70.55	71.06	69.07
Weekends	67.4	70.53	70.55	71	68.85
Weekdays	67.83	61.87	69.34	66.72	68.82
All Days	67.7	64.13	69.69	67.9	68.83

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	5.99	6.47	5.8	5.77	5.89
Tuesday	5.97	6.82	5.8	6.49	5.9
Wednesday	5.94	6.82	5.8	6.13	5.84
Thursday	5.95	6.4	5.94	5.98	5.87
Friday	5.95	6.16	5.81	5.92	5.86
Saturday	5.96	5.69	5.73	5.7	5.89
Sunday	6.03	5.78	5.73	5.69	5.85
Weekends	6	5.73	5.73	5.69	5.87
Weekdays	5.96	6.54	5.83	6.06	5.87
All Days	5.97	6.3	5.8	5.95	5.87

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.04	0.93	0.93	0.95
Tuesday	0.96	1.1	0.93	1.04	0.95
Wednesday	0.95	1.1	0.93	0.99	0.94
Thursday	0.96	1.03	0.96	0.96	0.94
Friday	0.96	0.99	0.93	0.95	0.94
Saturday	0.96	0.91	0.92	0.92	0.95
Sunday	0.97	0.93	0.92	0.92	0.94
Weekends	0.96	0.92	0.92	0.92	0.94
Weekdays	0.96	1.05	0.94	0.97	0.94
All Days	0.96	1.01	0.93	0.96	0.94

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound April 2014 through June 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.04	0	0	3.38	0
Tuesday	0.08	8.61	0	2.95	0
Wednesday	0.09	0	0	4.16	1.25
Thursday	0.07	0.14	0.13	11.78	0.21
Friday	0.26	0	0	0	0
Saturday	0.06	0	0	0	0
Sunday	0.1	0	0	0	0
Weekends	0.09	0	0	0	0
Weekdays	0.13	0.03	0	2.88	0
All Days	0.12	0	0	3.15	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0	0	0.37	0
Tuesday	0.01	1.34	0	0.3	0
Wednesday	0.01	0	0	0.41	0.18
Thursday	0.01	0.02	0.02	1.03	0.03
Friday	0.04	0	0	0	0
Saturday	0.01	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.01	0	0	0	0
Weekdays	0.02	0	0	0.27	0
All Days	0.02	0	0	0.33	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.45	6.47	6.23	12.6	6.42
Tuesday	6.49	15.05	6.21	12.75	6.49
Wednesday	6.49	6.27	6.26	14.23	8.07
Thursday	6.49	6.57	6.57	23.16	7.03
Friday	6.66	6.3	6.23	11.86	6.55
Saturday	6.53	6.34	6.16	6.17	6.46
Sunday	6.57	6.46	6.26	6.19	6.4
Weekends	6.56	6.41	6.19	6.19	6.43
Weekdays	6.54	6.48	6.28	13.57	6.56
All Days	6.54	6.41	6.23	12.65	6.5

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289
Eastbound April 2014 through June 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1.01	0.97	1.97	1
Tuesday	1.01	2.35	0.97	1.99	1.01
Wednesday	1.01	0.98	0.98	2.22	1.26
Thursday	1.01	1.03	1.03	3.62	1.1
Friday	1.04	0.98	0.97	1.85	1.02
Saturday	1.02	0.99	0.96	0.96	1.01
Sunday	1.03	1.01	0.98	0.97	1
Weekends	1.02	1	0.97	0.97	1
Weekdays	1.02	1.01	0.98	2.12	1.02
All Days	1.02	1	0.97	1.98	1.02

Speed (mph)

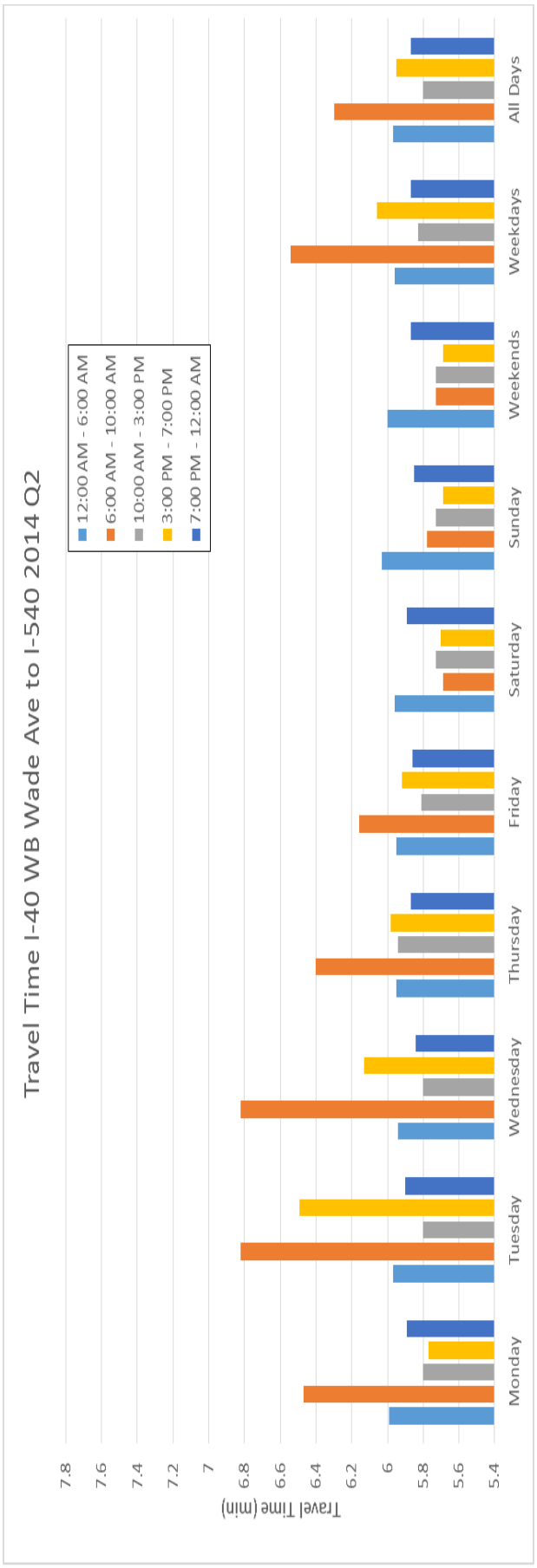
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.88	68.75	69.68	56.33	68.76
Tuesday	67.46	50.51	68.19	54.73	68.67
Wednesday	67.64	69.47	69.17	50.5	68.48
Thursday	67.78	65.21	67.25	40.54	61.9
Friday	66.65	66.58	69.49	57.02	68.81
Saturday	67.5	70.35	70.89	71	69.26
Sunday	67.23	69.19	70.63	71.07	69.44
Weekends	67.37	69.76	70.76	71.03	69.35
Weekdays	67.48	63.19	68.74	51.01	67.2
All Days	67.45	64.95	69.31	55.51	67.8

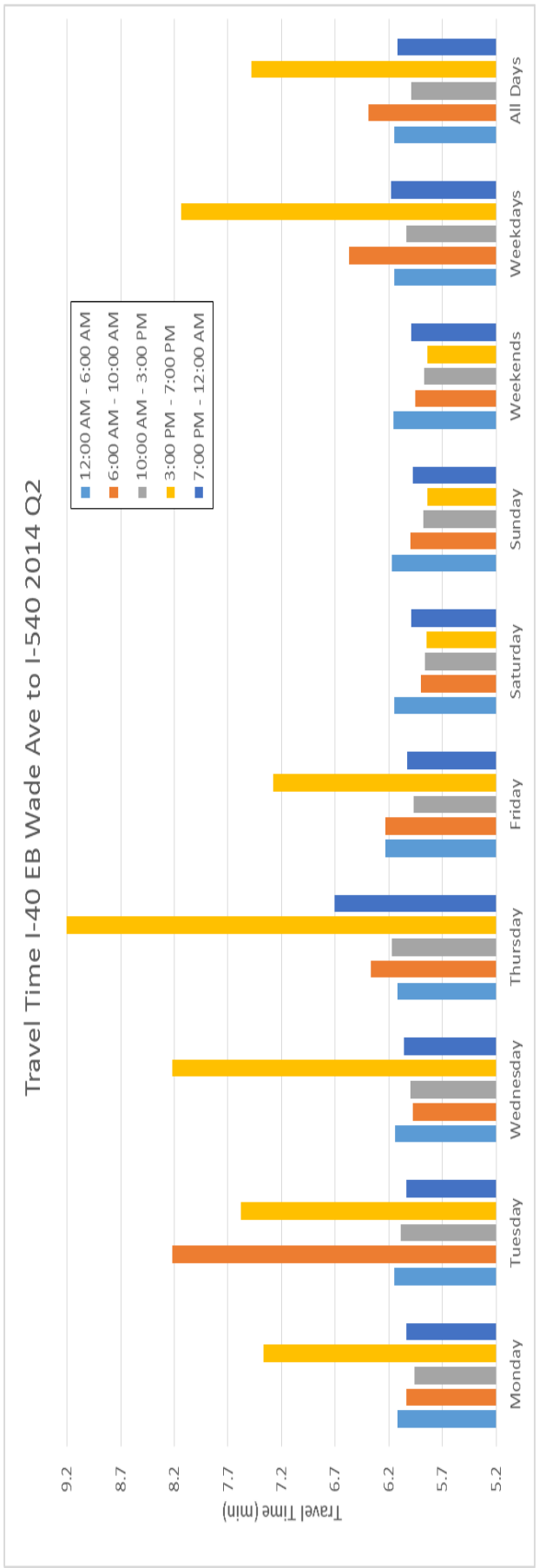
Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.12	6.04	5.96	7.37	6.04
Tuesday	6.15	8.22	6.09	7.58	6.04
Wednesday	6.14	5.98	6	8.22	6.06
Thursday	6.12	6.37	6.17	10.24	6.71
Friday	6.23	6.23	5.97	7.28	6.03
Saturday	6.15	5.9	5.86	5.85	5.99
Sunday	6.17	6	5.88	5.84	5.98
Weekends	6.16	5.95	5.87	5.84	5.99
Weekdays	6.15	6.57	6.04	8.14	6.18
All Days	6.15	6.39	5.99	7.48	6.12

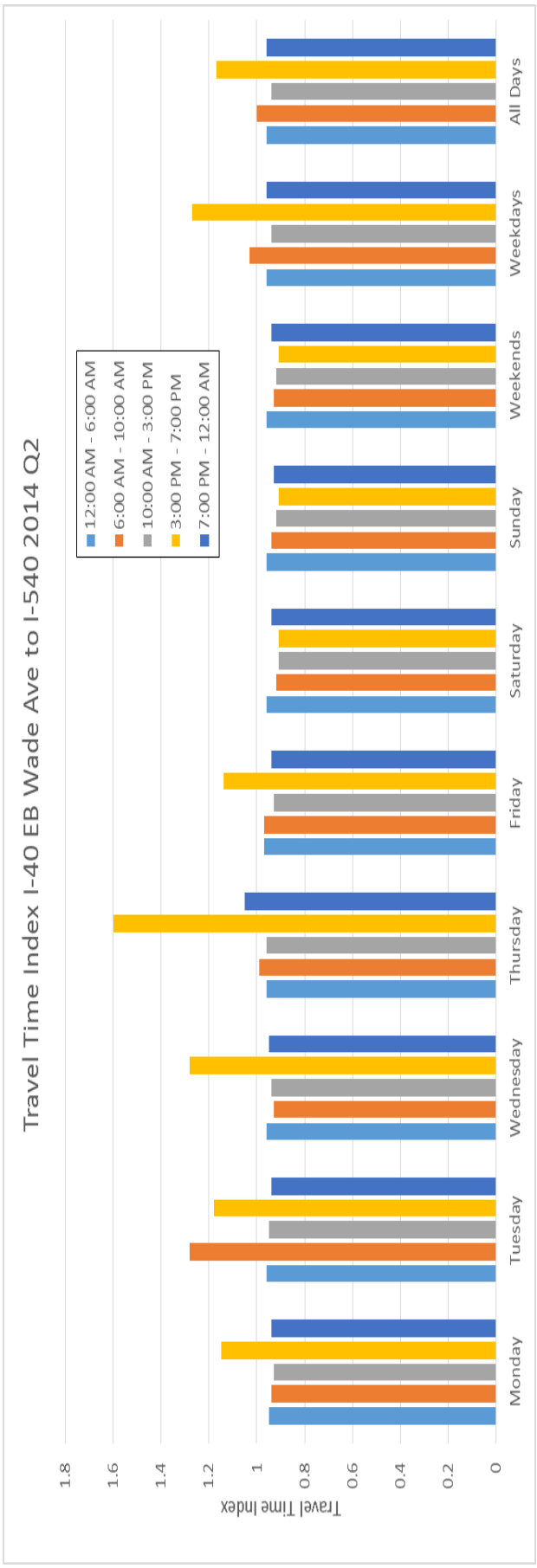
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.95	0.94	0.93	1.15	0.94
Tuesday	0.96	1.28	0.95	1.18	0.94
Wednesday	0.96	0.93	0.94	1.28	0.95
Thursday	0.96	0.99	0.96	1.6	1.05
Friday	0.97	0.97	0.93	1.14	0.94
Saturday	0.96	0.92	0.91	0.91	0.94
Sunday	0.96	0.94	0.92	0.91	0.93
Weekends	0.96	0.93	0.92	0.91	0.94
Weekdays	0.96	1.03	0.94	1.27	0.96
All Days	0.96	1	0.94	1.17	0.96


Travel Time I-40 WB Wade Ave to I-540 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wade Ave to I-540 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
9.2
8.7
8.2
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wade Ave to I-540 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wade Ave to I-540 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q3 2014:

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289
Westbound July 2014 through September 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.05	6.11	0	0.06	0
Tuesday	0.03	3.05	0	0.77	0
Wednesday	0.04	4.29	0	2.1	0
Thursday	0.04	3.1	0	0.61	0
Friday	0.15	0.44	0	6.69	0
Saturday	0.16	0	0	0	0
Sunday	0.19	0	0	0	0
Weekends	0.15	0	0	0	0
Weekdays	0.11	3.3	0	1.71	0
All Days	0.11	2.35	0	0.62	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.99	0	0.01	0
Tuesday	0	0.49	0	0.12	0
Wednesday	0.01	0.7	0	0.34	0
Thursday	0.01	0.5	0	0.1	0
Friday	0.02	0.07	0	1.07	0
Saturday	0.03	0	0	0	0
Sunday	0.03	0	0	0	0
Weekends	0.03	0	0	0	0
Weekdays	0.02	0.53	0	0.28	0
All Days	0.02	0.38	0	0.1	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.16	12.29	6	6.19	6.19
Tuesday	6.14	9.24	5.94	6.94	6.22
Wednesday	6.15	10.45	6.03	8.25	6.1
Thursday	6.15	9.26	5.92	6.81	6.28
Friday	6.26	6.58	5.94	12.95	6.26
Saturday	6.29	6	5.96	6.07	6.37
Sunday	6.32	6.13	5.97	5.99	6.35
Weekends	6.28	6.1	5.97	6.05	6.35
Weekdays	6.22	9.46	5.98	7.89	6.23
All Days	6.22	8.52	5.99	6.8	6.26

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound July 2014 through September 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	2.01	0.98	1.01	1.01
Tuesday	1	1.51	0.97	1.14	1.02
Wednesday	1.01	1.71	0.99	1.35	1
Thursday	1.01	1.52	0.97	1.12	1.03
Friday	1.03	1.08	0.97	2.12	1.02
Saturday	1.03	0.98	0.98	0.99	1.04
Sunday	1.03	1	0.98	0.98	1.04
Weekends	1.03	1	0.98	0.99	1.04
Weekdays	1.02	1.55	0.98	1.29	1.02
All Days	1.02	1.4	0.98	1.11	1.02

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.66	58.44	69.33	69.07	68.35
Tuesday	67.95	62.86	69.62	65.18	68.23
Wednesday	68	61.9	67.53	64.98	68.84
Thursday	68.04	60.72	69.78	66.26	68.24
Friday	67.7	66.22	69.72	59.92	68.65
Saturday	67.4	70.65	70.73	70.08	68.15
Sunday	66.92	69.29	69.38	70.59	68.15
Weekends	67.15	69.96	70.04	70.34	68.15
Weekdays	67.87	61.94	69.19	64.99	68.45
All Days	67.67	64	69.43	66.43	68.36

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	5.87	6.79	5.73	5.75	5.81
Tuesday	5.84	6.32	5.7	6.09	5.82
Wednesday	5.84	6.42	5.88	6.11	5.77
Thursday	5.84	6.54	5.69	5.99	5.82
Friday	5.87	6	5.7	6.63	5.78
Saturday	5.89	5.62	5.61	5.67	5.83
Sunday	5.93	5.73	5.72	5.63	5.83
Weekends	5.91	5.68	5.67	5.65	5.83
Weekdays	5.85	6.41	5.74	6.11	5.8
All Days	5.87	6.2	5.72	5.98	5.81

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.11	0.94	0.94	0.95
Tuesday	0.96	1.03	0.93	1	0.95
Wednesday	0.96	1.05	0.96	1	0.94
Thursday	0.95	1.07	0.93	0.98	0.95
Friday	0.96	0.98	0.93	1.08	0.95
Saturday	0.96	0.92	0.92	0.93	0.95
Sunday	0.97	0.94	0.94	0.92	0.95
Weekends	0.97	0.93	0.93	0.92	0.95
Weekdays	0.96	1.05	0.94	1	0.95
All Days	0.96	1.02	0.94	0.98	0.95

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound July 2014 through September 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.07	0	0	4.82	0
Tuesday	0.08	0	0	4.82	0
Wednesday	0.05	0.14	0	8.83	0
Thursday	0.09	0	0	3.39	0
Friday	0.26	0	0	0.27	0
Saturday	0.09	0	0	0	0
Sunday	0.14	0	0	0	0
Weekends	0.11	0	0	0	0
Weekdays	0.14	0	0	4.67	0
All Days	0.14	0	0	4.75	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0	0	0.57	0
Tuesday	0.01	0	0	0.54	0
Wednesday	0.01	0.02	0	0.96	0
Thursday	0.01	0	0	0.32	0
Friday	0.04	0	0	0.02	0
Saturday	0.01	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.02	0	0	0.47	0
All Days	0.02	0	0	0.54	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.34	6.29	6.2	13.22	6.33
Tuesday	6.35	6.25	6.07	13.75	6.53
Wednesday	6.32	6.42	6.15	18.05	6.45
Thursday	6.36	6.16	6.07	14	6.55
Friday	6.53	6.14	6.08	12.42	6.38
Saturday	6.38	6.22	6.09	6.2	6.42
Sunday	6.46	6.35	6.17	6.11	6.31
Weekends	6.42	6.31	6.12	6.14	6.39
Weekdays	6.41	6.23	6.12	14.54	6.44
All Days	6.42	6.24	6.12	13.62	6.41

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound July 2014 through September 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1	0.99	2.11	1.01
Tuesday	1.01	1	0.97	2.19	1.04
Wednesday	1.01	1.02	0.98	2.88	1.03
Thursday	1.02	0.98	0.97	2.23	1.05
Friday	1.04	0.98	0.97	1.98	1.02
Saturday	1.02	0.99	0.97	0.99	1.03
Sunday	1.03	1.01	0.99	0.97	1.01
Weekends	1.02	1.01	0.98	0.98	1.02
Weekdays	1.02	0.99	0.98	2.32	1.03
All Days	1.02	1	0.98	2.17	1.02

Speed (mph)

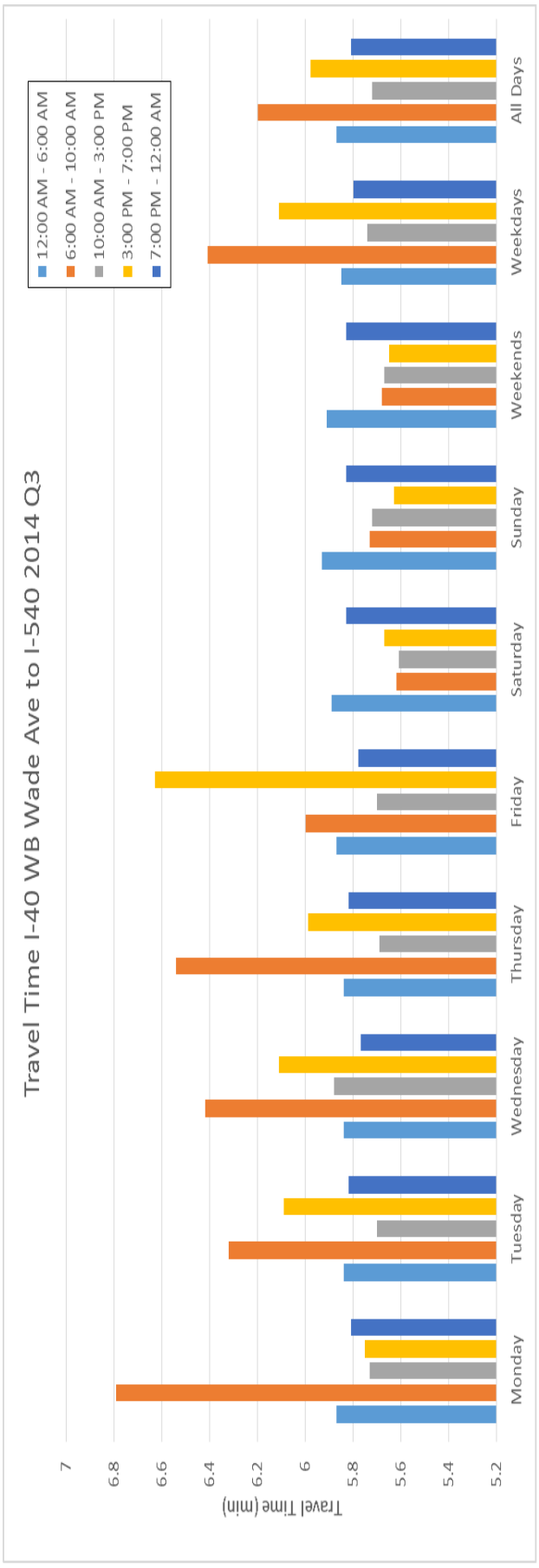
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.74	68.48	69.62	56.41	68.82
Tuesday	68.01	68.03	69.95	51.14	67.95
Wednesday	68.06	67.3	69.48	44.91	67.97
Thursday	67.92	68.78	69.95	51.43	67.91
Friday	67.56	69.77	69.74	56.4	69.1
Saturday	67.72	70.29	70.81	70.42	68.99
Sunday	67.23	69.47	70.58	70.95	69.46
Weekends	67.46	69.88	70.69	70.69	69.22
Weekdays	67.86	68.46	69.75	51.66	68.33
All Days	67.75	68.85	70.01	55.94	68.58

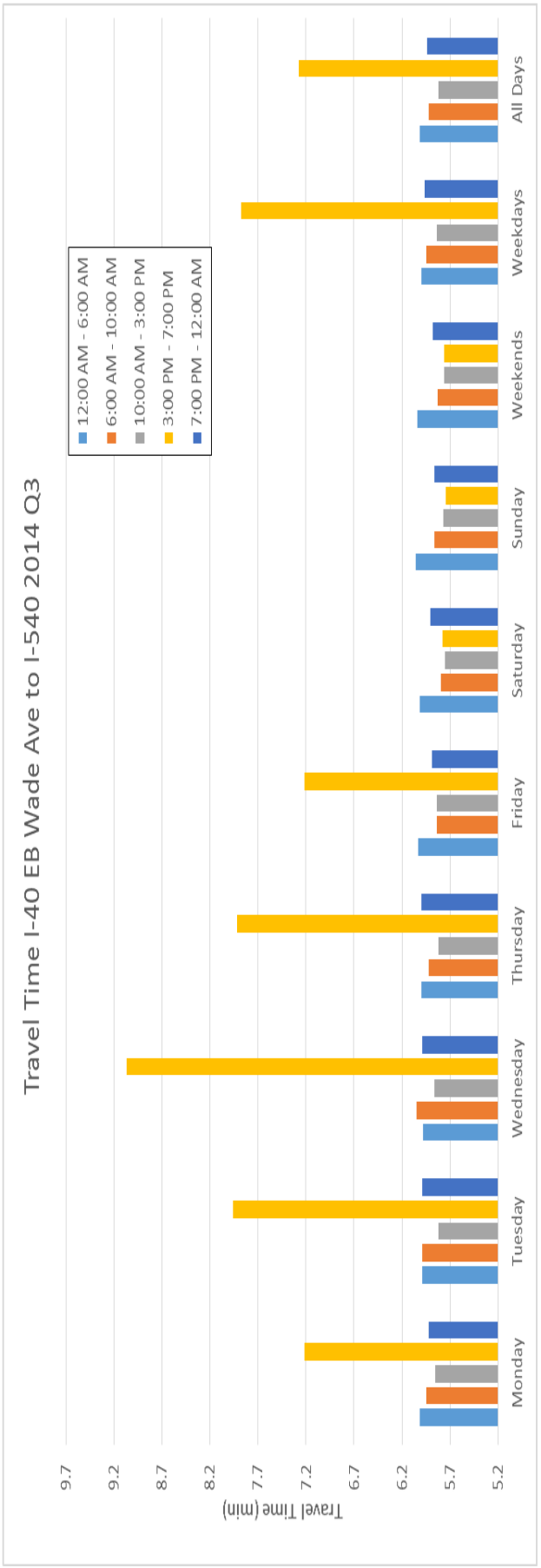
Travel time (minutes)

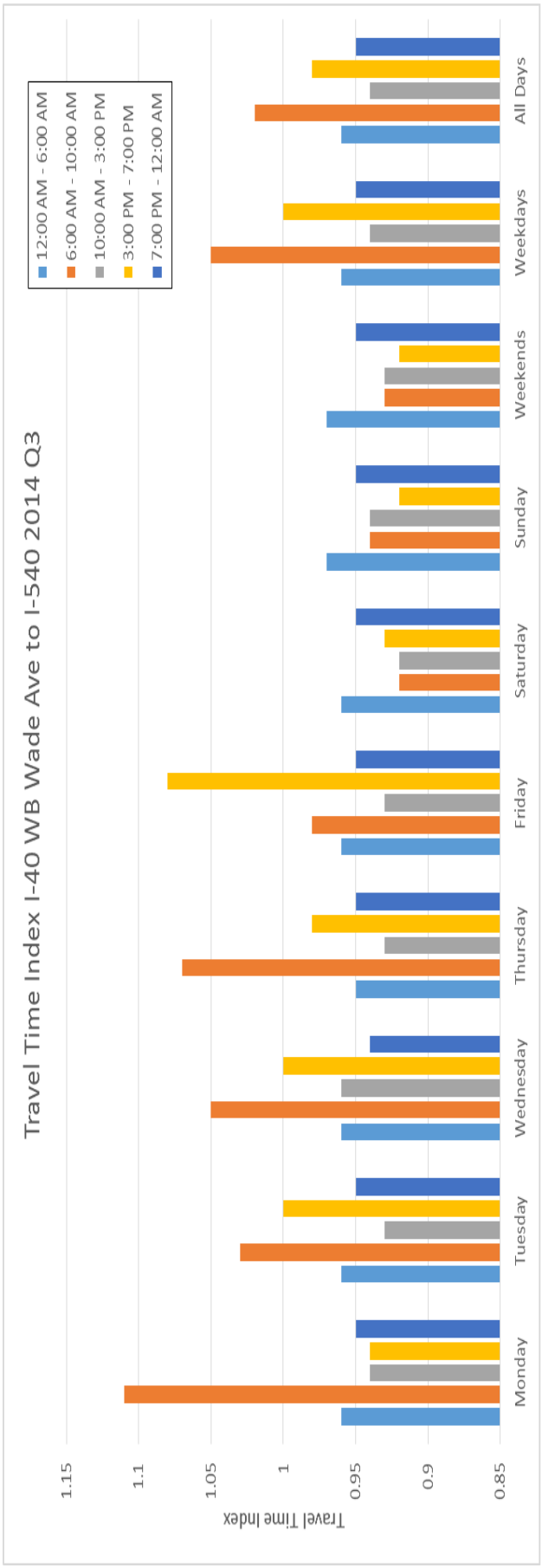
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.01	5.95	5.85	7.22	5.92
Tuesday	5.99	5.99	5.82	7.96	5.99
Wednesday	5.98	6.05	5.86	9.07	5.99
Thursday	6	5.92	5.82	7.92	6
Friday	6.03	5.84	5.84	7.22	5.89
Saturday	6.01	5.79	5.75	5.78	5.9
Sunday	6.06	5.86	5.77	5.74	5.86
Weekends	6.04	5.83	5.76	5.76	5.88
Weekdays	6	5.95	5.84	7.88	5.96
All Days	6.01	5.92	5.82	7.28	5.94

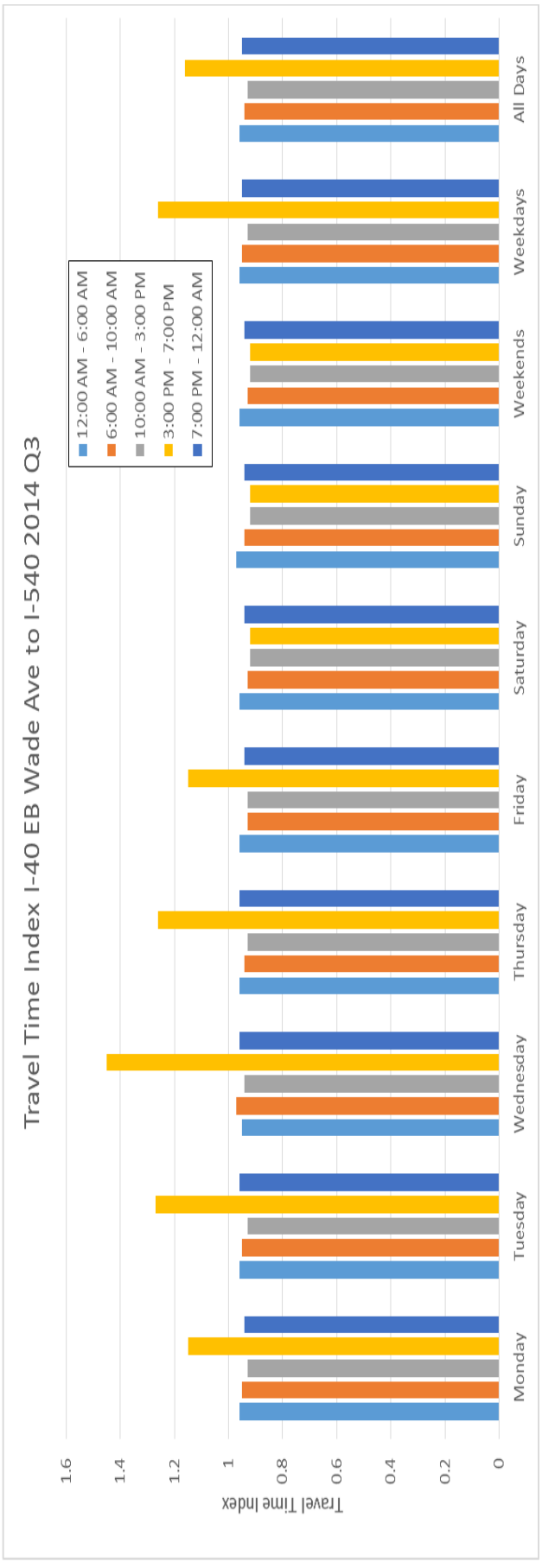
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	0.95	0.93	1.15	0.94
Tuesday	0.96	0.95	0.93	1.27	0.96
Wednesday	0.95	0.97	0.94	1.45	0.96
Thursday	0.96	0.94	0.93	1.26	0.96
Friday	0.96	0.93	0.93	1.15	0.94
Saturday	0.96	0.93	0.92	0.92	0.94
Sunday	0.97	0.94	0.92	0.92	0.94
Weekends	0.96	0.93	0.92	0.92	0.94
Weekdays	0.96	0.95	0.93	1.26	0.95
All Days	0.96	0.94	0.93	1.16	0.95


Travel Time I-40 WB Wade Ave to I-540 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wade Ave to I-540 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
9.7
9.2
8.7
8.2
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wade Ave to I-540 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.15
1.1
1.05
1
0.95
0.9
0.85
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wade Ave to I-540 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q4 2014:

	Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289				
	Westbound October 2014 through December 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.09	3.05	0	0	0
Tuesday	0.12	3.24	0	0.22	0
Wednesday	0.11	4.87	0	1.32	0.01
Thursday	0.11	1.73	0	0.62	0
Friday	0.09	3.74	0	8.4	1.24
Saturday	0.11	0	0	0	0
Sunday	0.13	0	0	0	0
Weekends	0.1	0	0	0	0
Weekdays	0.11	3.09	0	2.2	0
All Days	0.11	2.34	0	0.65	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.48	0	0	0
Tuesday	0.02	0.51	0	0.04	0
Wednesday	0.02	0.76	0	0.21	0
Thursday	0.02	0.27	0	0.1	0
Friday	0.01	0.59	0	1.32	0.18
Saturday	0.02	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.02	0.48	0	0.35	0
All Days	0.02	0.37	0	0.1	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.31	9.47	6.16	6.27	6.31
Tuesday	6.34	9.63	6.21	6.56	6.4
Wednesday	6.33	11.26	6.17	7.62	6.32
Thursday	6.33	8.12	6.2	6.95	6.31
Friday	6.31	10.06	6.14	14.77	8
Saturday	6.37	6.21	6.13	6.3	6.37
Sunday	6.37	6.25	6.18	6.28	6.37
Weekends	6.35	6.22	6.14	6.28	6.35
Weekdays	6.33	9.47	6.19	8.52	6.38
All Days	6.34	8.7	6.19	6.97	6.36

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound October 2014 through December 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1.52	0.99	1.01	1.01
Tuesday	1.02	1.55	1	1.06	1.03
Wednesday	1.02	1.81	0.99	1.23	1.02
Thursday	1.02	1.3	1	1.12	1.01
Friday	1.01	1.62	0.99	2.37	1.29
Saturday	1.02	1	0.99	1.01	1.02
Sunday	1.02	1.01	0.99	1.01	1.02
Weekends	1.02	1	0.99	1.01	1.02
Weekdays	1.02	1.52	0.99	1.37	1.03
All Days	1.02	1.4	0.99	1.12	1.02

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.97	62.27	69.47	68.54	68.04
Tuesday	67.85	62.76	69	65.26	67.68
Wednesday	67.06	58.35	69.15	66.34	67.84
Thursday	67.8	65.4	69.23	66.38	68.25
Friday	68.2	61.47	69.42	54.44	58.29
Saturday	67.9	69.99	70.56	68.44	68.65
Sunday	67.96	69.63	69.08	69.67	68.5
Weekends	67.93	69.8	69.79	69.07	68.57
Weekdays	67.76	61.91	69.25	63.8	65.81
All Days	67.81	63.89	69.4	65.18	66.56

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	5.95	6.49	5.82	5.9	5.94
Tuesday	5.96	6.44	5.86	6.2	5.97
Wednesday	6.03	6.93	5.85	6.09	5.96
Thursday	5.96	6.18	5.84	6.09	5.92
Friday	5.93	6.58	5.82	7.43	6.94
Saturday	5.95	5.78	5.73	5.91	5.89
Sunday	5.95	5.81	5.85	5.8	5.9
Weekends	5.95	5.79	5.79	5.85	5.9
Weekdays	5.97	6.53	5.84	6.34	6.14
All Days	5.96	6.33	5.83	6.2	6.07

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.04	0.94	0.95	0.95
Tuesday	0.96	1.04	0.94	1	0.96
Wednesday	0.97	1.11	0.94	0.98	0.96
Thursday	0.96	0.99	0.94	0.98	0.95
Friday	0.95	1.06	0.94	1.19	1.11
Saturday	0.96	0.93	0.92	0.95	0.95
Sunday	0.96	0.93	0.94	0.93	0.95
Weekends	0.96	0.93	0.93	0.94	0.95
Weekdays	0.96	1.05	0.94	1.02	0.99
All Days	0.96	1.02	0.94	1	0.98

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound October 2014 through December 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.13	1.51	0	5.76	0
Tuesday	0.13	0.18	0	6.23	0
Wednesday	0.14	2.02	0	3.01	0
Thursday	0.11	1.88	0	4.4	0
Friday	0.14	0.1	0	0	0
Saturday	0.11	0	0	0	0
Sunday	0.1	0	0	0	0
Weekends	0.1	0	0	0	0
Weekdays	0.14	0.95	0	3.82	0
All Days	0.13	0.5	0	3.7	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.23	0	0.62	0
Tuesday	0.02	0.03	0	0.64	0
Wednesday	0.02	0.31	0	0.3	0
Thursday	0.02	0.29	0	0.39	0
Friday	0.02	0.02	0	0	0
Saturday	0.02	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.02	0.15	0	0.36	0
All Days	0.02	0.08	0	0.39	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.54	8.04	6.33	14.99	6.5
Tuesday	6.54	6.62	6.39	16.03	6.69
Wednesday	6.55	8.47	6.37	13.08	6.52
Thursday	6.52	8.31	6.35	15.78	6.59
Friday	6.54	6.52	6.3	12.72	6.99
Saturday	6.58	6.39	6.32	6.43	6.5
Sunday	6.57	6.46	6.27	6.4	6.53
Weekends	6.57	6.45	6.3	6.43	6.53
Weekdays	6.55	7.4	6.34	14.51	6.58
All Days	6.55	7.03	6.33	13.2	6.56

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289
Eastbound October 2014 through December 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.25	0.99	2.34	1.02
Tuesday	1.02	1.03	1	2.5	1.05
Wednesday	1.02	1.32	1	2.04	1.02
Thursday	1.02	1.3	0.99	2.46	1.03
Friday	1.02	1.02	0.98	1.99	1.09
Saturday	1.03	1	0.99	1	1.02
Sunday	1.03	1.01	0.98	1	1.02
Weekends	1.03	1.01	0.98	1	1.02
Weekdays	1.02	1.16	0.99	2.27	1.03
All Days	1.02	1.1	0.99	2.06	1.02

Speed (mph)

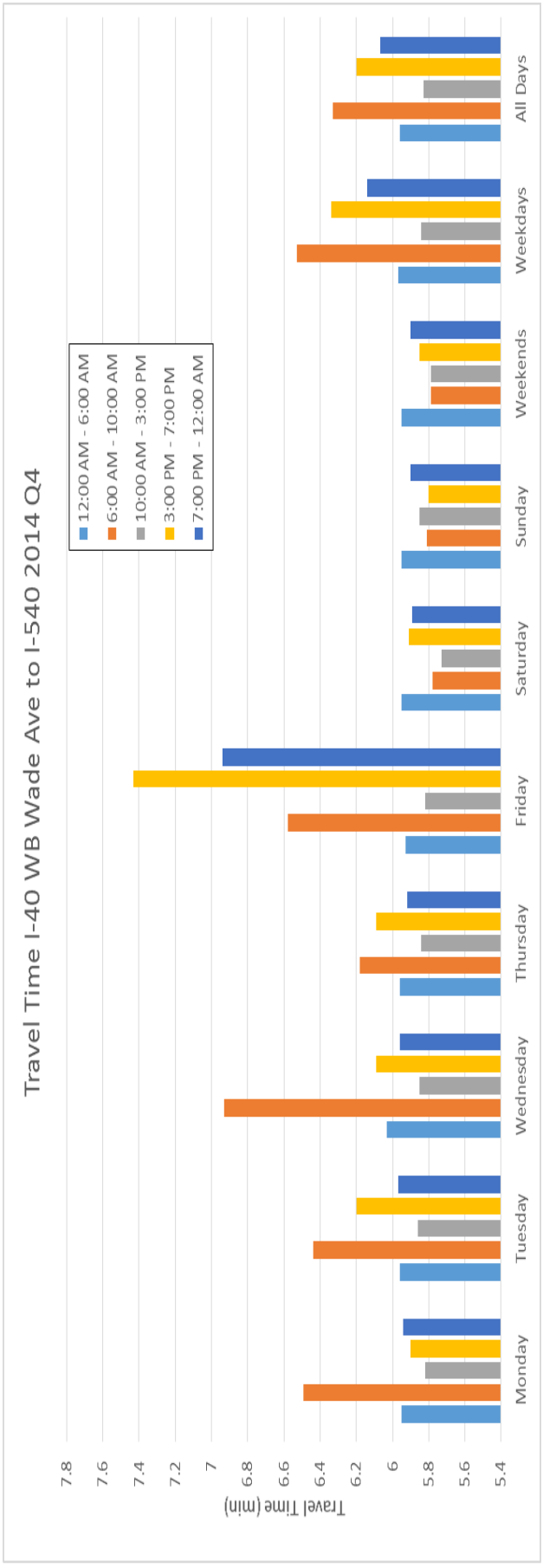
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.05	65.36	69.4	52.16	68.07
Tuesday	67.2	67.9	69.05	51.4	67.12
Wednesday	66.6	64.93	69.19	54.66	68.07
Thursday	67.33	64.25	69.48	50.11	67.51
Friday	67.87	68.35	69.74	56.81	68.23
Saturday	67.36	69.55	70.43	69.6	68.8
Sunday	67.6	68.78	70.73	69.26	68.34
Weekends	67.49	69.14	70.59	69.42	68.57
Weekdays	67.2	66.1	69.37	52.95	67.8
All Days	67.28	66.91	69.7	56.67	68.01

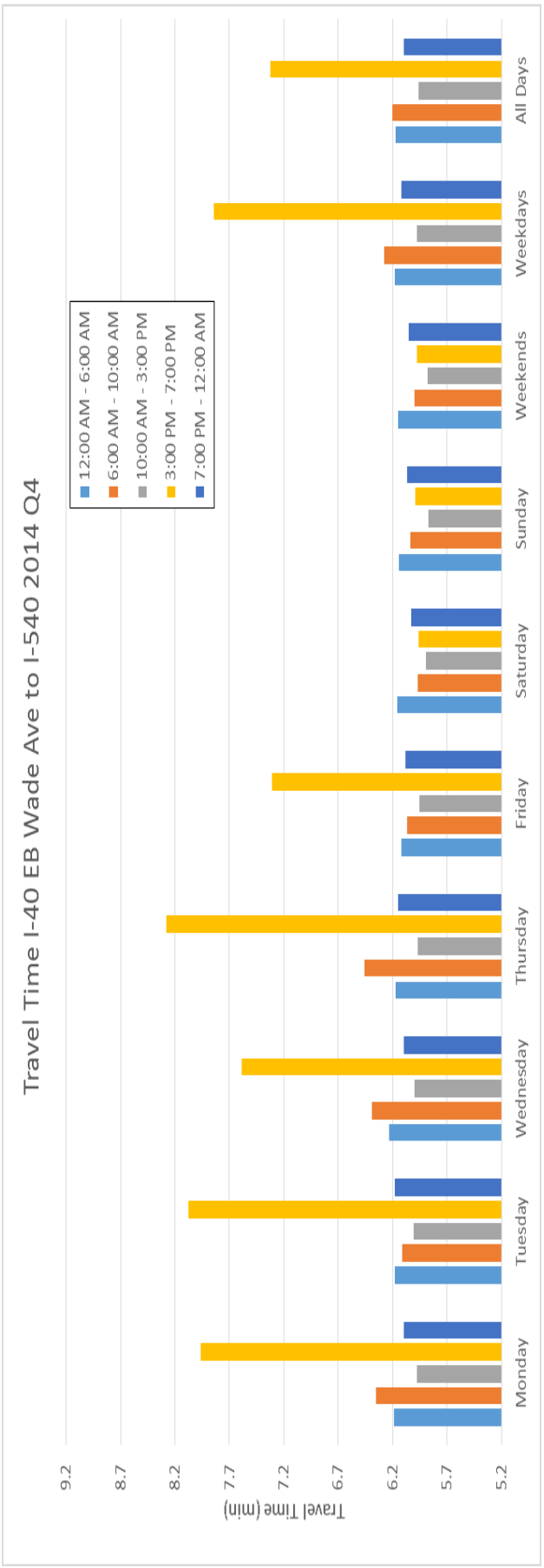
Travel time (minutes)

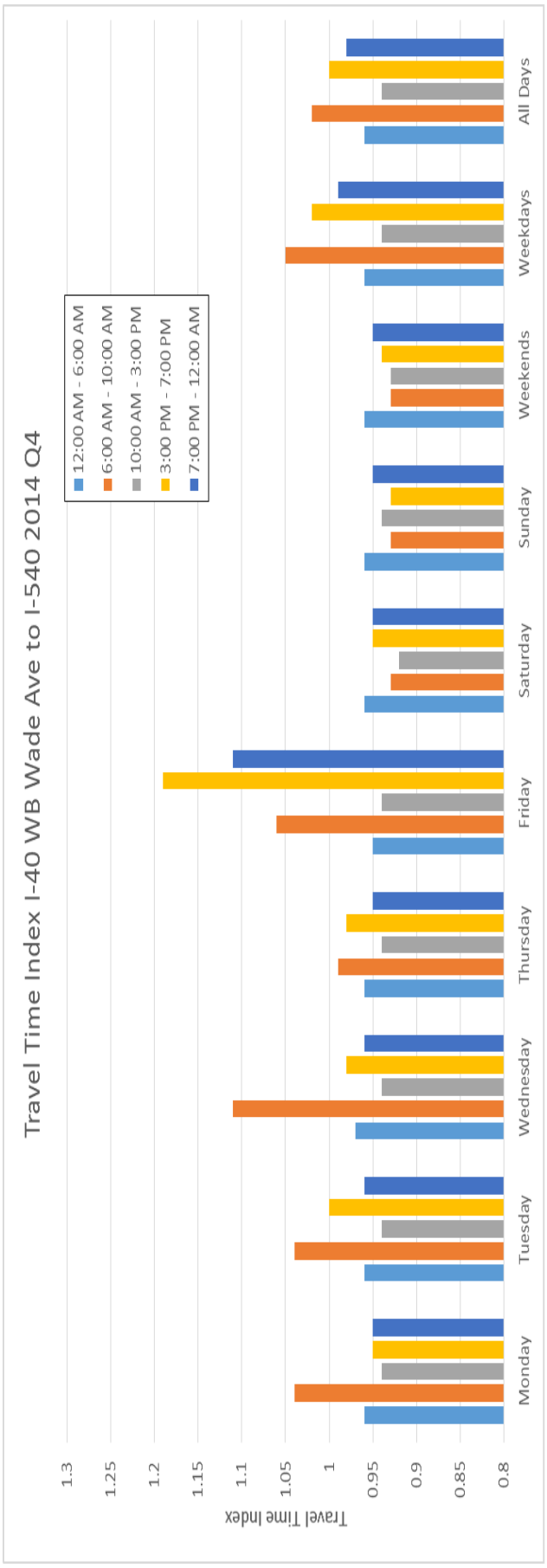
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.19	6.35	5.98	7.96	6.1
Tuesday	6.18	6.11	6.01	8.08	6.18
Wednesday	6.23	6.39	6	7.59	6.1
Thursday	6.17	6.46	5.97	8.28	6.15
Friday	6.12	6.07	5.95	7.31	6.08
Saturday	6.16	5.97	5.89	5.96	6.03
Sunday	6.14	6.04	5.87	5.99	6.07
Weekends	6.15	6	5.88	5.98	6.05
Weekdays	6.18	6.28	5.98	7.84	6.12
All Days	6.17	6.2	5.96	7.32	6.1

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.99	0.93	1.24	0.95
Tuesday	0.96	0.95	0.94	1.26	0.97
Wednesday	0.97	1	0.94	1.19	0.95
Thursday	0.96	1.01	0.93	1.29	0.96
Friday	0.95	0.95	0.93	1.14	0.95
Saturday	0.96	0.93	0.92	0.93	0.94
Sunday	0.96	0.94	0.92	0.94	0.95
Weekends	0.96	0.94	0.92	0.93	0.94
Weekdays	0.96	0.98	0.94	1.22	0.96
All Days	0.96	0.97	0.93	1.14	0.95


Travel Time I-40 WB Wade Ave to I-540 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wade Ave to I-540 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
9.2
8.7
8.2
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wade Ave to I-540 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wade Ave to I-540 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q1 2015:

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289
Westbound January 2015 through March 2015

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0	3.49	0	0.37	0
Tuesday	0.03	7.81	1.54	0.37	0.15
Wednesday	0.07	2.68	0	0.1	0.11
Thursday	0.1	1.96	0.05	0.53	0
Friday	0.01	0.71	0	4.75	0
Saturday	0.03	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.03	0	0	0	0
Weekdays	0.04	3.09	0.02	0.88	0
All Days	0.04	2.28	0	0.36	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0	0.56	0	0.06	0
Tuesday	0	1.26	0.25	0.06	0.02
Wednesday	0.01	0.43	0	0.02	0.02
Thursday	0.02	0.32	0.01	0.09	0
Friday	0	0.12	0	0.76	0
Saturday	0	0	0	0	0
Sunday	0	0	0	0	0
Weekends	0	0	0	0	0
Weekdays	0.01	0.5	0	0.14	0
All Days	0.01	0.37	0	0.06	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.11	9.66	6.02	6.5	6.26
Tuesday	6.14	14	7.66	6.55	6.4
Wednesday	6.18	8.85	6.06	6.25	6.29
Thursday	6.21	8.12	6.18	6.73	6.19
Friday	6.12	6.85	6.07	11	6.21
Saturday	6.15	6.05	6.09	6.08	6.15
Sunday	6.15	6.18	6.07	6.08	6.12
Weekends	6.15	6.1	6.07	6.09	6.13
Weekdays	6.15	9.26	6.15	7.06	6.25
All Days	6.15	8.44	6.1	6.54	6.22

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound January 2015 through March 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1	1.58	0.99	1.06	1.02
Tuesday	1	2.29	1.25	1.07	1.05
Wednesday	1.01	1.45	0.99	1.02	1.03
Thursday	1.02	1.33	1.01	1.1	1.01
Friday	1	1.12	0.99	1.8	1.02
Saturday	1.01	0.99	1	1	1.01
Sunday	1.01	1.01	0.99	1	1
Weekends	1.01	1	0.99	1	1
Weekdays	1.01	1.52	1.01	1.16	1.02
All Days	1.01	1.38	1	1.07	1.02

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	68.57	61.18	69.32	66.52	67.56
Tuesday	68.02	51.82	62.8	66.52	67.61
Wednesday	67.79	61.95	69.19	67.49	67.27
Thursday	66.66	64.05	68.82	65.21	68.03
Friday	68.18	66.01	67.59	60.47	68.08
Saturday	68.45	69.83	69.93	69.15	68.97
Sunday	68.65	68.96	70.35	70.03	69.4
Weekends	68.55	69.39	70.14	69.59	69.19
Weekdays	67.84	60.55	67.42	65.11	67.71
All Days	68.04	62.86	68.18	66.34	68.14

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	5.79	6.49	5.73	5.97	5.88
Tuesday	5.84	7.66	6.32	5.97	5.87
Wednesday	5.86	6.41	5.74	5.88	5.9
Thursday	5.96	6.2	5.77	6.09	5.84
Friday	5.82	6.02	5.87	6.57	5.83
Saturday	5.8	5.69	5.68	5.74	5.76
Sunday	5.78	5.76	5.64	5.67	5.72
Weekends	5.79	5.72	5.66	5.71	5.74
Weekdays	5.85	6.56	5.89	6.1	5.86
All Days	5.84	6.32	5.82	5.99	5.83

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.95	1.06	0.94	0.98	0.96
Tuesday	0.96	1.25	1.03	0.98	0.96
Wednesday	0.96	1.05	0.94	0.96	0.97
Thursday	0.97	1.01	0.94	1	0.96
Friday	0.95	0.98	0.96	1.07	0.95
Saturday	0.95	0.93	0.93	0.94	0.94
Sunday	0.95	0.94	0.92	0.93	0.94
Weekends	0.95	0.94	0.93	0.93	0.94
Weekdays	0.96	1.07	0.96	1	0.96
All Days	0.95	1.03	0.95	0.98	0.95

	Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289				
	Eastbound January 2015 through March 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.09	1.4	0	5.54	0.14
Tuesday	0.1	4.18	6.12	6.49	0
Wednesday	0.07	2.64	0	3.66	0
Thursday	0.11	0.74	0.12	4.46	0
Friday	0.09	0.54	0	1.77	0
Saturday	0.05	0	0	0	0
Sunday	0	0	0	0	0
Weekends	0.05	0	0	0	0
Weekdays	0.09	1.58	0.03	4.49	0
All Days	0.08	0.84	0	4.29	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.22	0	0.66	0.02
Tuesday	0.02	0.66	0.97	0.73	0
Wednesday	0.01	0.42	0	0.4	0
Thursday	0.02	0.12	0.02	0.42	0
Friday	0.01	0.09	0	0.15	0
Saturday	0.01	0	0	0	0
Sunday	0	0	0	0	0
Weekends	0.01	0	0	0	0
Weekdays	0.01	0.25	0	0.45	0
All Days	0.01	0.13	0	0.48	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.36	7.77	6.2	13.94	6.53
Tuesday	6.37	10.46	12.39	15.42	6.43
Wednesday	6.34	8.92	6.23	12.88	6.49
Thursday	6.38	7.01	6.4	15.07	6.41
Friday	6.36	6.82	6.25	13.92	6.44
Saturday	6.35	6.26	6.2	6.17	6.32
Sunday	6.32	6.4	6.28	6.18	6.29
Weekends	6.35	6.33	6.25	6.18	6.29
Weekdays	6.36	7.89	6.33	14.35	6.46
All Days	6.36	7.19	6.29	13.16	6.38

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound January 2015 through March 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1.24	0.99	2.23	1.04
Tuesday	1.02	1.67	1.98	2.46	1.03
Wednesday	1.01	1.42	0.99	2.06	1.04
Thursday	1.02	1.12	1.02	2.4	1.02
Friday	1.01	1.09	1	2.22	1.03
Saturday	1.01	1	0.99	0.99	1.01
Sunday	1.01	1.02	1	0.99	1
Weekends	1.01	1.01	1	0.99	1
Weekdays	1.01	1.26	1.01	2.29	1.03
All Days	1.01	1.15	1	2.1	1.02

Speed (mph)

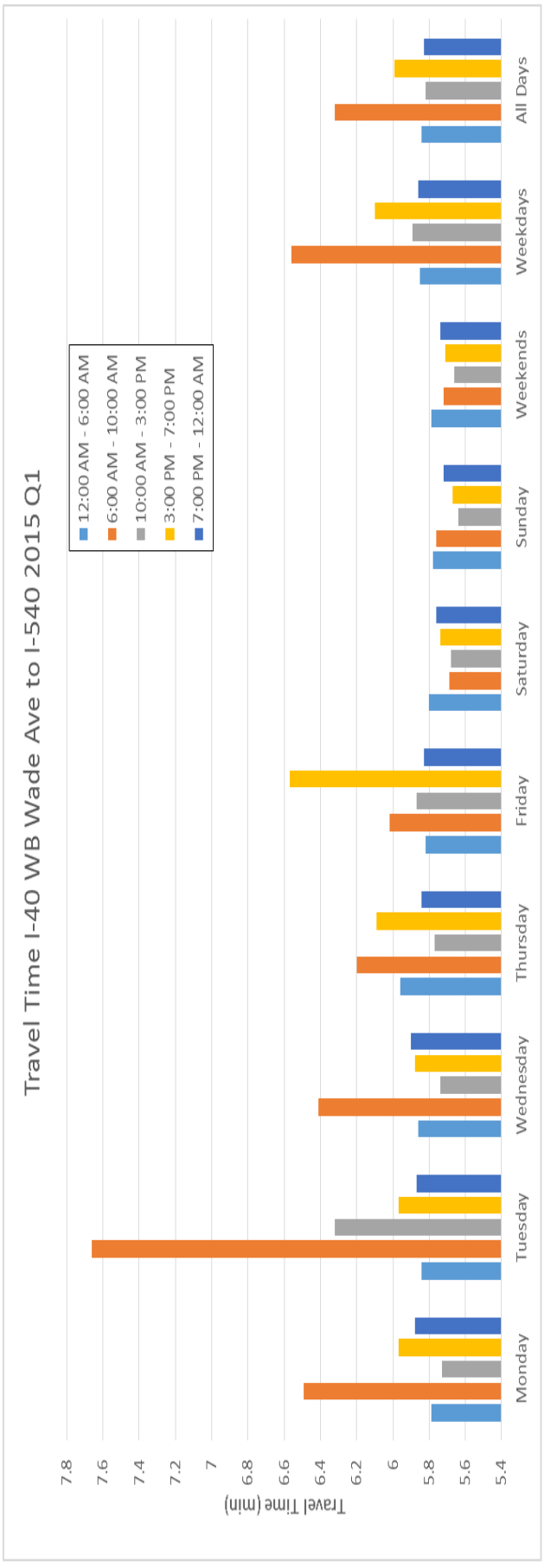
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.54	65.45	69.22	56.46	67.58
Tuesday	67.15	56.82	53.86	52.67	67.38
Wednesday	67.67	64.04	68.85	55.26	65.98
Thursday	65.8	66.63	68.73	51.04	67.61
Friday	67.64	67.32	68.81	54	68.14
Saturday	67.85	69.66	70.23	70.2	68.9
Sunday	68.16	68.19	68.04	70.44	68.96
Weekends	68	68.92	69.12	70.32	68.93
Weekdays	67.15	63.81	65.2	53.8	67.36
All Days	67.39	65.2	66.28	57.72	67.8

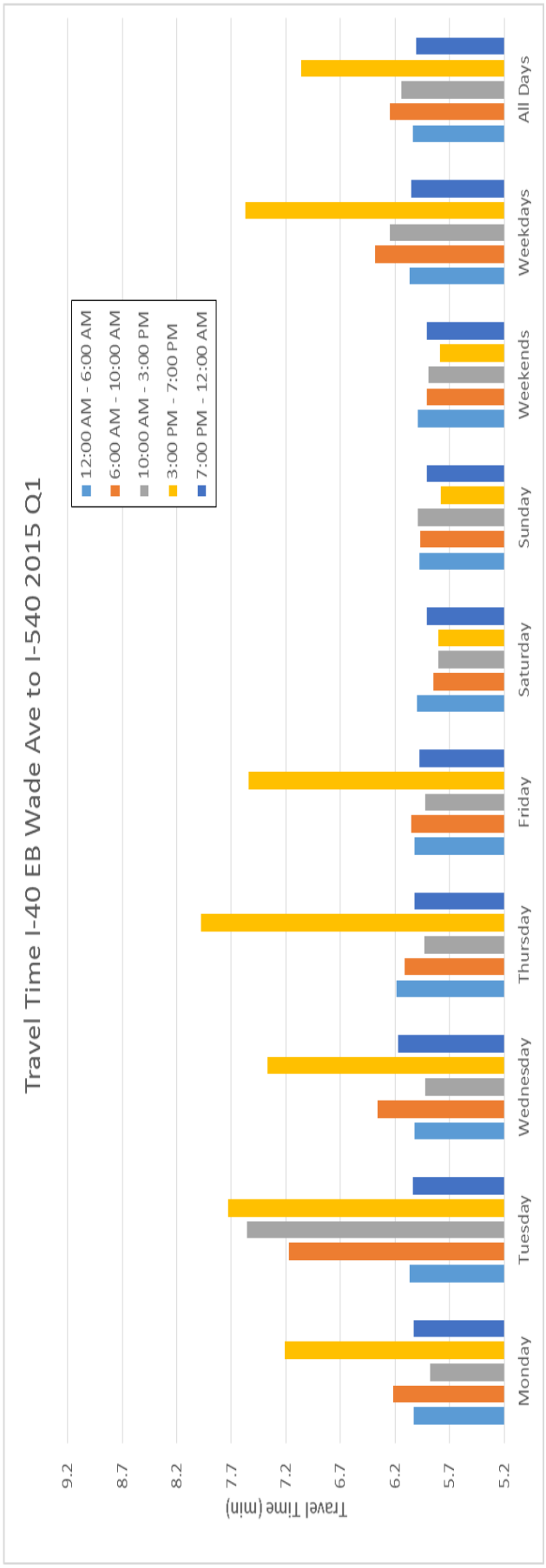
Travel time (minutes)

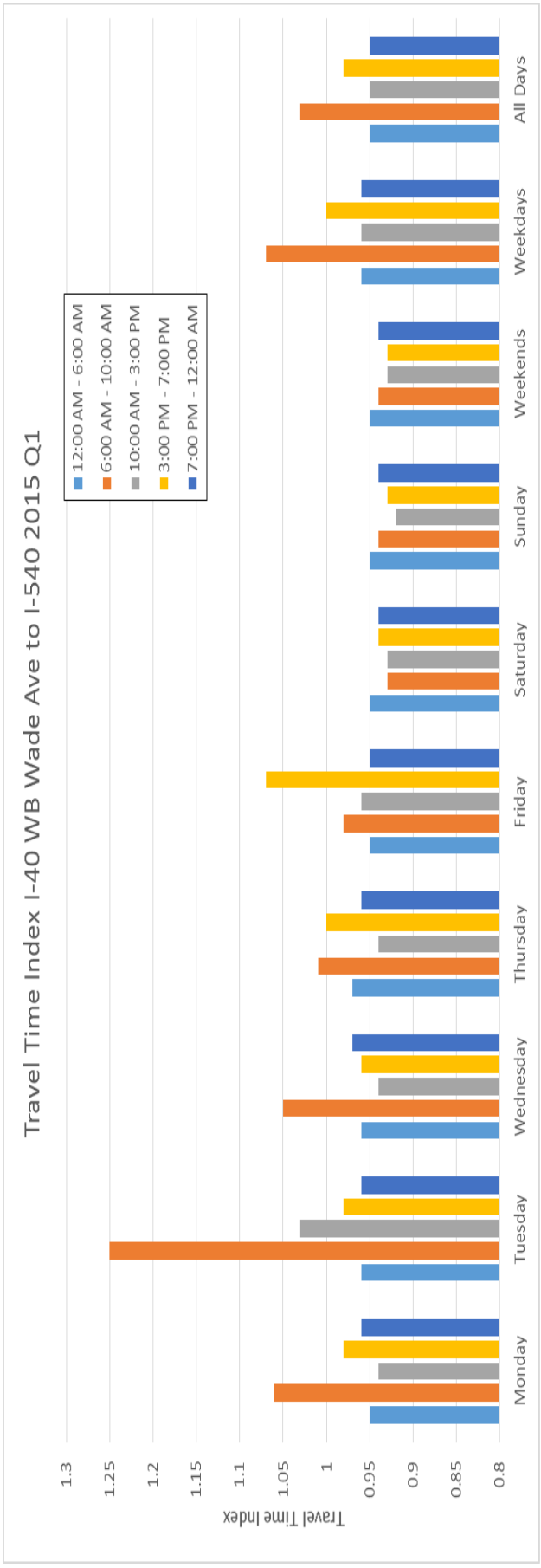
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.03	6.22	5.88	7.21	6.03
Tuesday	6.07	7.17	7.56	7.73	6.04
Wednesday	6.02	6.36	5.92	7.37	6.17
Thursday	6.19	6.11	5.93	7.98	6.02
Friday	6.02	6.05	5.92	7.54	5.98
Saturday	6	5.85	5.8	5.8	5.91
Sunday	5.98	5.97	5.99	5.78	5.91
Weekends	5.99	5.91	5.89	5.79	5.91
Weekdays	6.07	6.38	6.25	7.57	6.05
All Days	6.04	6.25	6.14	7.06	6.01

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	0.99	0.94	1.15	0.96
Tuesday	0.97	1.14	1.21	1.23	0.96
Wednesday	0.96	1.01	0.94	1.18	0.98
Thursday	0.99	0.98	0.95	1.27	0.96
Friday	0.96	0.97	0.94	1.2	0.95
Saturday	0.96	0.93	0.93	0.93	0.94
Sunday	0.95	0.95	0.95	0.92	0.94
Weekends	0.96	0.94	0.94	0.92	0.94
Weekdays	0.97	1.02	1	1.21	0.96
All Days	0.96	1	0.98	1.13	0.96


Travel Time I-40 WB Wade Ave to I-540 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wade Ave to I-540 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
9.2
8.7
8.2
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wade Ave to I-540 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wade Ave to I-540 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q2 2015:

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound April 2015 through June 2015

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.09	1.72	0	0	0
Tuesday	0.04	1.76	0	2.38	0
Wednesday	0.04	4.72	0	4	0
Thursday	0.07	2.97	0	3.37	0
Friday	0.03	0.56	0	2.85	0
Saturday	0.04	0	0	0	0
Sunday	0.12	0	0	0	0
Weekends	0.07	0	0	0	0
Weekdays	0.04	2.39	0	1.93	0
All Days	0.06	1.57	0	0.73	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.27	0	0	0
Tuesday	0.01	0.28	0	0.38	0
Wednesday	0.01	0.74	0	0.63	0
Thursday	0.01	0.47	0	0.53	0
Friday	0	0.09	0	0.45	0
Saturday	0.01	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.01	0	0	0	0
Weekdays	0.01	0.37	0	0.31	0
All Days	0.01	0.25	0	0.12	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.31	8.13	6.06	6.25	6.17
Tuesday	6.26	8.16	6.1	8.72	6.2
Wednesday	6.26	11.11	6.06	10.3	6.21
Thursday	6.29	9.35	6.06	9.7	6.32
Friday	6.25	6.88	6.1	9.22	6.18
Saturday	6.3	6.07	6.07	6.1	6.26
Sunday	6.36	6.15	6.06	6.12	6.33
Weekends	6.32	6.14	6.06	6.12	6.3
Weekdays	6.26	8.77	6.07	8.25	6.22
All Days	6.29	7.94	6.06	7.06	6.24

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Westbound April 2015 through June 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1.31	0.97	1	0.99
Tuesday	1.01	1.31	0.98	1.4	1
Wednesday	1.01	1.79	0.97	1.66	1
Thursday	1.01	1.5	0.97	1.56	1.02
Friday	1.01	1.11	0.98	1.48	0.99
Saturday	1.01	0.98	0.98	0.98	1.01
Sunday	1.02	0.99	0.97	0.98	1.02
Weekends	1.02	0.99	0.97	0.98	1.01
Weekdays	1.01	1.41	0.98	1.33	1
All Days	1.01	1.28	0.97	1.13	1

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	68.11	64.58	70.04	68.85	69.18
Tuesday	68.26	64.39	69.48	65.13	68.81
Wednesday	67.86	56.42	69.68	61.33	68.64
Thursday	67.74	62.87	69.79	58.91	68.35
Friday	68.31	67.32	69.57	64.6	69.39
Saturday	68.16	70.9	70.57	70.58	69.28
Sunday	68.37	70.32	71.11	71.14	69.17
Weekends	68.26	70.61	70.84	70.86	69.22
Weekdays	68.06	62.92	69.72	63.57	68.87
All Days	68.11	64.96	70.04	65.52	68.97

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	5.94	6.26	5.77	5.87	5.84
Tuesday	5.92	6.28	5.82	6.21	5.88
Wednesday	5.96	7.17	5.8	6.59	5.89
Thursday	5.97	6.43	5.79	6.86	5.92
Friday	5.92	6.01	5.81	6.26	5.83
Saturday	5.93	5.7	5.73	5.73	5.84
Sunday	5.91	5.75	5.69	5.68	5.85
Weekends	5.92	5.73	5.71	5.71	5.84
Weekdays	5.94	6.43	5.8	6.36	5.87
All Days	5.94	6.22	5.77	6.17	5.86

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.95	1.01	0.93	0.94	0.94
Tuesday	0.95	1.01	0.94	1	0.94
Wednesday	0.96	1.15	0.93	1.06	0.95
Thursday	0.96	1.03	0.93	1.1	0.95
Friday	0.95	0.97	0.93	1.01	0.94
Saturday	0.95	0.92	0.92	0.92	0.94
Sunday	0.95	0.92	0.91	0.91	0.94
Weekends	0.95	0.92	0.92	0.92	0.94
Weekdays	0.95	1.03	0.93	1.02	0.94
All Days	0.95	1	0.93	0.99	0.94

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289

Eastbound April 2015 through June 2015

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.11	0	0	3.99	0
Tuesday	0.07	0.15	0	5.34	0
Wednesday	0.03	0.18	0	7.86	0
Thursday	0.04	0.55	0	2.44	0
Friday	0.02	0	0	0	0
Saturday	0.04	0	0	0	0
Sunday	0	0	0	0	0
Weekends	0.03	0	0	0	0
Weekdays	0.04	0.16	0	3.85	0
All Days	0.03	0	0	3.91	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0	0	0.43	0
Tuesday	0.01	0.02	0	0.54	0
Wednesday	0.01	0.03	0	0.78	0
Thursday	0.01	0.09	0	0.21	0
Friday	0	0	0	0	0
Saturday	0.01	0	0	0	0
Sunday	0	0	0	0	0
Weekends	0	0	0	0	0
Weekdays	0.01	0.02	0	0.36	0
All Days	0.01	0	0	0.41	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.51	6.39	6.23	13.22	6.41
Tuesday	6.48	6.59	6.27	15.13	6.43
Wednesday	6.44	6.63	6.3	17.93	6.55
Thursday	6.45	6.98	6.28	13.83	6.78
Friday	6.43	6.37	6.3	12.29	6.39
Saturday	6.51	6.34	6.25	6.29	6.41
Sunday	6.46	6.39	6.24	6.28	6.46
Weekends	6.5	6.37	6.24	6.28	6.43
Weekdays	6.45	6.61	6.29	14.54	6.49
All Days	6.46	6.46	6.28	13.41	6.48

Performance Summaries for I-40 between I-540/Exit 283 and Raleigh Chapel Hill Expy/Exit 289
Eastbound April 2015 through June 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1	0.97	2.06	1
Tuesday	1.01	1.03	0.98	2.36	1
Wednesday	1.01	1.03	0.98	2.8	1.02
Thursday	1.01	1.09	0.98	2.16	1.06
Friday	1	0.99	0.98	1.92	1
Saturday	1.02	0.99	0.98	0.98	1
Sunday	1.01	1	0.98	0.98	1.01
Weekends	1.01	0.99	0.97	0.98	1
Weekdays	1.01	1.03	0.98	2.27	1.01
All Days	1.01	1.01	0.98	2.09	1.01

Speed (mph)

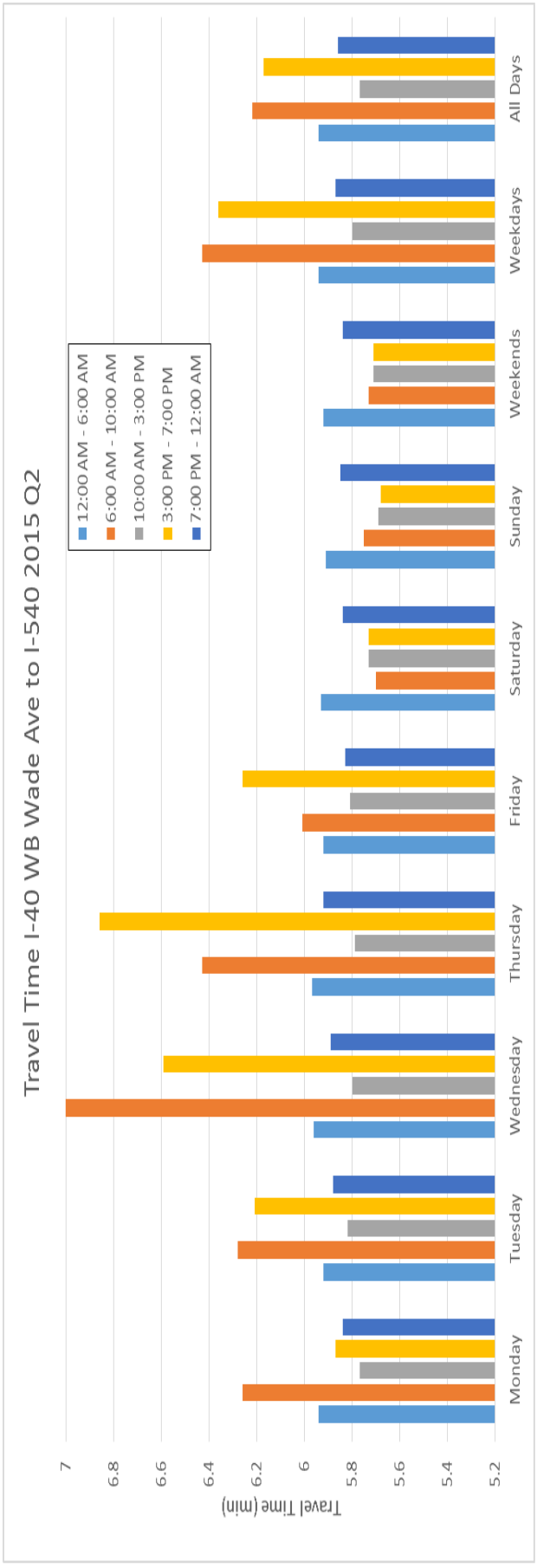
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.54	67.99	69.79	53.06	68.79
Tuesday	67.71	67.17	69.35	49.74	68.69
Wednesday	67.68	65.67	68.97	42.44	67.22
Thursday	67.28	67.53	68.85	48.66	67.16
Friday	67.66	68.48	69.25	55.19	69.51
Saturday	67.59	69.99	70.27	70.48	69.37
Sunday	68.15	68.93	70.65	70.77	69.01
Weekends	67.87	69.46	70.46	70.63	69.19
Weekdays	67.57	67.36	69.24	49.4	68.26
All Days	67.66	67.95	69.59	54.1	68.52

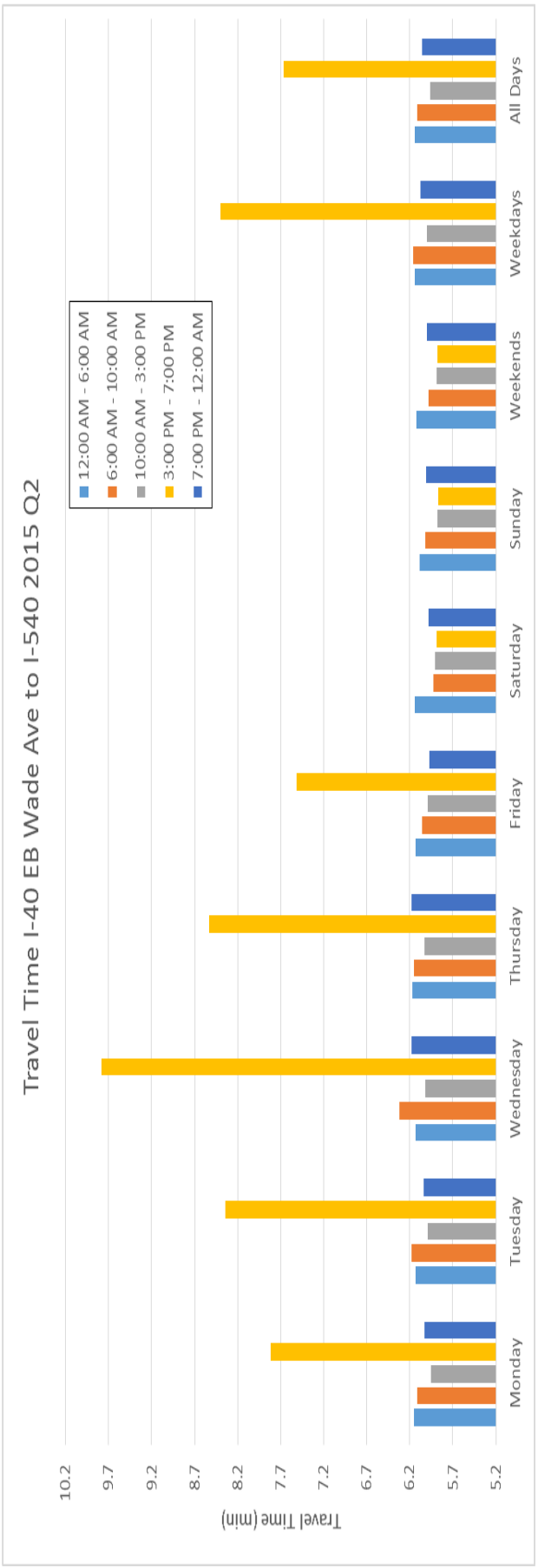
Travel time (minutes)

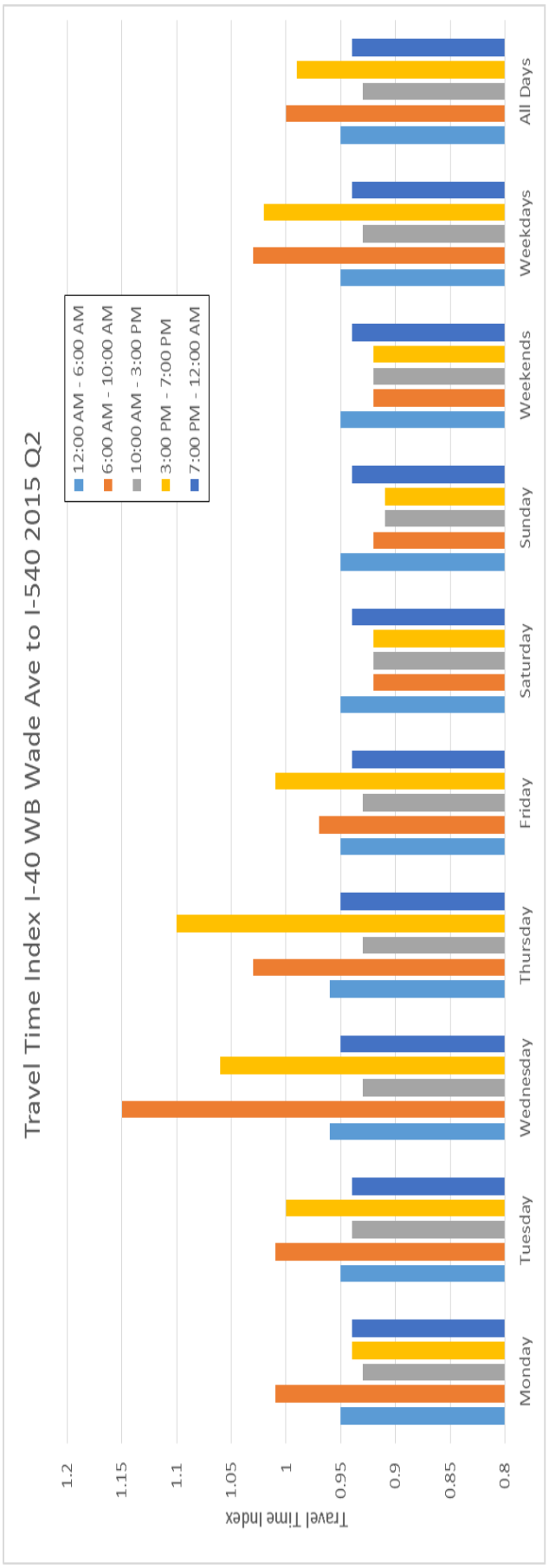
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	6.15	6.11	5.95	7.82	6.03
Tuesday	6.13	6.18	5.99	8.34	6.04
Wednesday	6.13	6.32	6.02	9.78	6.18
Thursday	6.17	6.15	6.03	8.53	6.18
Friday	6.13	6.06	5.99	7.52	5.97
Saturday	6.14	5.93	5.91	5.89	5.98
Sunday	6.09	6.02	5.88	5.87	6.01
Weekends	6.12	5.98	5.89	5.88	6
Weekdays	6.14	6.16	6	8.4	6.08
All Days	6.14	6.11	5.96	7.67	6.06

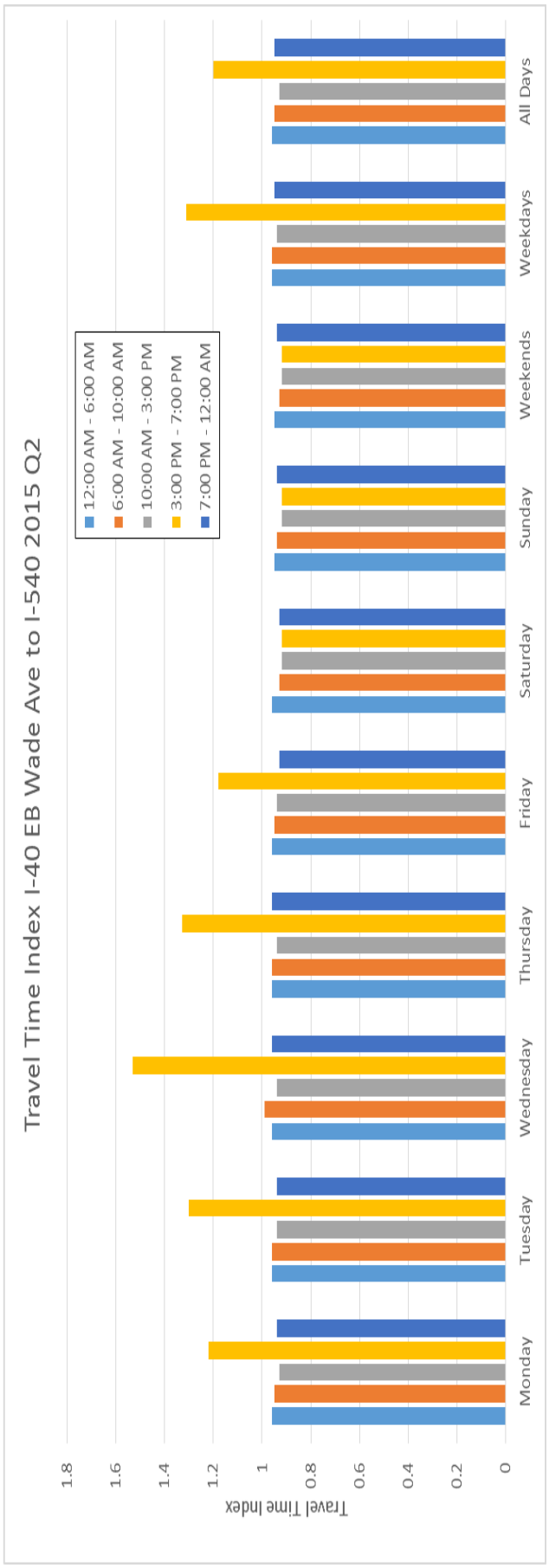
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	0.95	0.93	1.22	0.94
Tuesday	0.96	0.96	0.94	1.3	0.94
Wednesday	0.96	0.99	0.94	1.53	0.96
Thursday	0.96	0.96	0.94	1.33	0.96
Friday	0.96	0.95	0.94	1.18	0.93
Saturday	0.96	0.93	0.92	0.92	0.93
Sunday	0.95	0.94	0.92	0.92	0.94
Weekends	0.95	0.93	0.92	0.92	0.94
Weekdays	0.96	0.96	0.94	1.31	0.95
All Days	0.96	0.95	0.93	1.2	0.95


Travel Time I-40 WB Wade Ave to I-540 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wade Ave to I-540 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
10.2
9.7
9.2
8.7
8.2
7.7
7.2
6.7
6.2
5.7
5.2
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wade Ave to I-540 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wade Ave to I-540 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

I-40, Wake County, Q1 2014 to Q2 2015

Q1 2014:

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Westbound January 2014 through March 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.32	21.46	0	0.32	0.93
Tuesday	1.26	20.35	0.02	1.28	2.07
Wednesday	0.62	19.8	0.95	28.07	1.28
Thursday	0.8	10.69	0	1.41	0.05
Friday	0.84	6.86	0	1.5	0
Saturday	0.55	0	0	0	0
Sunday	0.56	0	0	0.08	0
Weekends	0.58	0	0	0	0
Weekdays	0.71	13.64	0	1.82	0.3
All Days	0.7	10.27	0	0.8	0.03
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.67	0	0.01	0.04
Tuesday	0.05	0.66	0	0.05	0.08
Wednesday	0.02	0.64	0.04	1.06	0.05
Thursday	0.03	0.34	0	0.05	0
Friday	0.03	0.25	0	0.05	0
Saturday	0.02	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.03	0.44	0	0.07	0.01
All Days	0.03	0.35	0	0.03	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	26.98	55.74	26.08	27.25	28.41
Tuesday	27.91	53.59	26.75	28.44	29.65
Wednesday	27.28	56.23	27.66	55.13	28.53
Thursday	27.47	44.85	26.18	29.03	27.46
Friday	27.51	35.25	26.53	31.15	27.48
Saturday	27.31	26.56	26.28	26.45	27.46
Sunday	27.3	26.94	26.58	28.65	27.18
Weekends	27.33	26.93	26.53	27.97	27.35
Weekdays	27.37	46.86	26.31	29.34	27.84
All Days	27.39	41.97	26.32	28.38	27.61

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound January 2014 through March 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	2.11	0.99	1.03	1.08
Tuesday	1.06	2.03	1.01	1.08	1.12
Wednesday	1.03	2.13	1.05	2.09	1.08
Thursday	1.04	1.7	0.99	1.1	1.04
Friday	1.04	1.33	1	1.18	1.04
Saturday	1.03	1.01	0.99	1	1.04
Sunday	1.03	1.02	1.01	1.08	1.03
Weekends	1.03	1.02	1	1.06	1.04
Weekdays	1.04	1.77	1	1.11	1.05
All Days	1.04	1.59	1	1.07	1.04

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.15	55.43	69.15	68.21	66.87
Tuesday	66.41	53.69	65.22	67.73	66.05
Wednesday	66.53	54.87	64.92	60.5	65.92
Thursday	66.23	58.38	68.98	67.33	67.49
Friday	66.77	64.24	68.79	66.29	67.47
Saturday	66.49	69.29	69.75	69.58	67.94
Sunday	66.38	68.4	69.71	68.03	67.44
Weekends	66.43	68.84	69.73	68.8	67.69
Weekdays	66.62	57.14	67.4	65.85	66.77
All Days	66.57	60.1	68.06	66.68	67.03

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	25.56	30.97	24.83	25.17	25.67
Tuesday	25.85	31.98	26.32	25.35	25.99
Wednesday	25.81	31.29	26.45	28.38	26.04
Thursday	25.92	29.41	24.89	25.5	25.44
Friday	25.71	26.72	24.96	25.9	25.45
Saturday	25.82	24.78	24.61	24.67	25.27
Sunday	25.86	25.1	24.63	25.23	25.46
Weekends	25.84	24.94	24.62	24.95	25.36
Weekdays	25.77	30.04	25.47	26.07	25.71
All Days	25.79	28.56	25.23	25.75	25.61

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.17	0.94	0.95	0.97
Tuesday	0.98	1.21	1	0.96	0.98
Wednesday	0.98	1.18	1	1.07	0.99
Thursday	0.98	1.11	0.94	0.96	0.96
Friday	0.97	1.01	0.94	0.98	0.96
Saturday	0.98	0.94	0.93	0.93	0.96
Sunday	0.98	0.95	0.93	0.95	0.96
Weekends	0.98	0.94	0.93	0.94	0.96
Weekdays	0.97	1.14	0.96	0.99	0.97
All Days	0.98	1.08	0.95	0.97	0.97

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Eastbound January 2014 through March 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.39	0	0	9.16	2.36
Tuesday	1.91	1.16	0	9.46	3.78
Wednesday	1.75	0.77	2.06	42.54	0.39
Thursday	0.78	0.37	0	7.43	0
Friday	0.78	0.41	0	17.08	0
Saturday	0.53	0	0	0	0
Sunday	0.34	0	0	0	0
Weekends	0.49	0	0	0	0
Weekdays	1	0.35	0	15.75	0.1
All Days	0.85	0	0	11.55	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0	0	0.33	0.1
Tuesday	0.08	0.05	0	0.33	0.16
Wednesday	0.08	0.03	0.09	1.48	0.02
Thursday	0.03	0.02	0	0.24	0
Friday	0.03	0.02	0	0.48	0
Saturday	0.02	0	0	0	0
Sunday	0.01	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.04	0.01	0	0.52	0
All Days	0.04	0	0	0.41	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	28.05	26.23	26.21	41.45	30.48
Tuesday	29.59	27.95	26.06	42.08	32.21
Wednesday	29.41	27.41	28.83	75.08	29.02
Thursday	28.47	26.99	26.3	42.52	27.49
Friday	28.46	27.13	26.67	57.36	28.47
Saturday	28.4	27.45	26.37	26.3	28.42
Sunday	28.18	27.92	27.62	26.63	27.88
Weekends	28.34	27.89	26.65	26.47	28.06
Weekdays	28.68	27.04	26.32	50.45	28.86
All Days	28.57	27.29	26.36	44.28	28.54

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Eastbound January 2014 through March 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.05	0.99	0.99	1.56	1.15
Tuesday	1.11	1.05	0.98	1.58	1.21
Wednesday	1.11	1.03	1.08	2.82	1.09
Thursday	1.07	1.01	0.99	1.6	1.03
Friday	1.07	1.02	1	2.16	1.07
Saturday	1.07	1.03	0.99	0.99	1.07
Sunday	1.06	1.05	1.04	1	1.05
Weekends	1.07	1.05	1	0.99	1.05
Weekdays	1.08	1.02	0.99	1.9	1.08
All Days	1.07	1.03	0.99	1.66	1.07

Speed (mph)

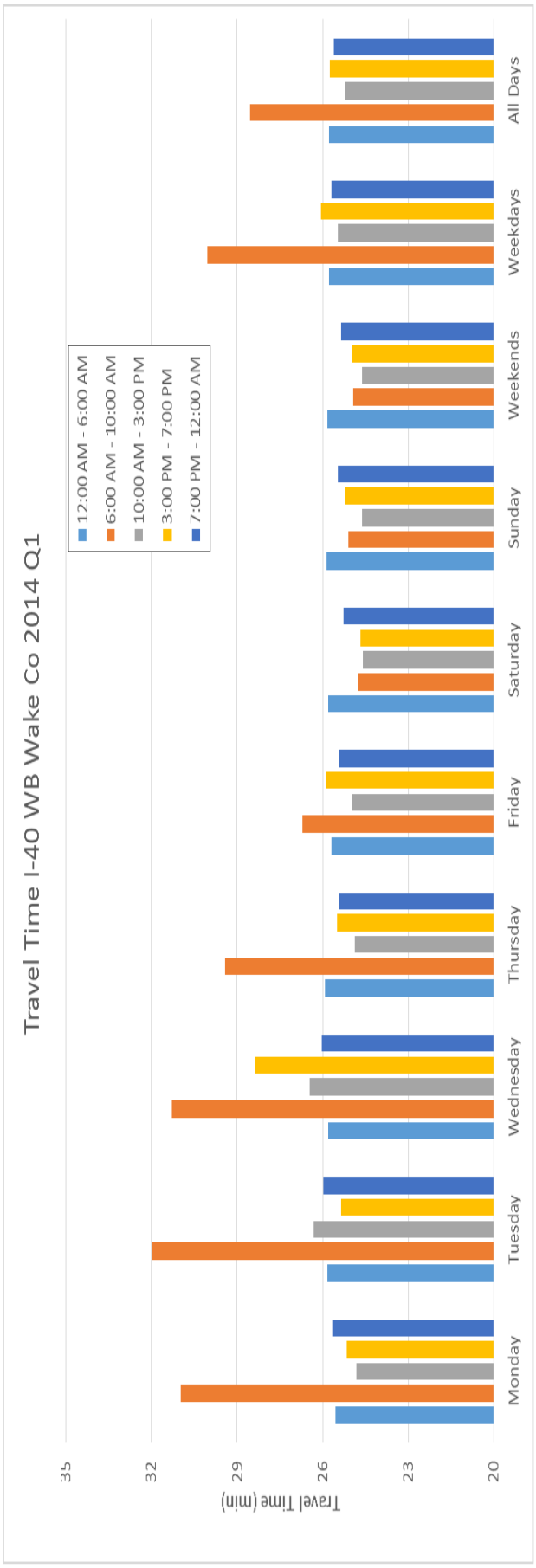
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.78	68.84	69.15	61.87	66.37
Tuesday	65.6	67.79	69.14	61.36	65.81
Wednesday	65.37	67.14	61.46	53.87	66.22
Thursday	66.04	68.32	69.15	61.73	67.61
Friday	66.12	68.19	68.55	51.72	67.14
Saturday	65.92	69.01	69.74	69.97	67.73
Sunday	66.48	67.39	69.54	69.33	68.37
Weekends	66.19	68.19	69.64	69.65	68.05
Weekdays	65.99	68.06	67.32	57.68	66.64
All Days	66.05	68.09	67.98	60.71	67.04

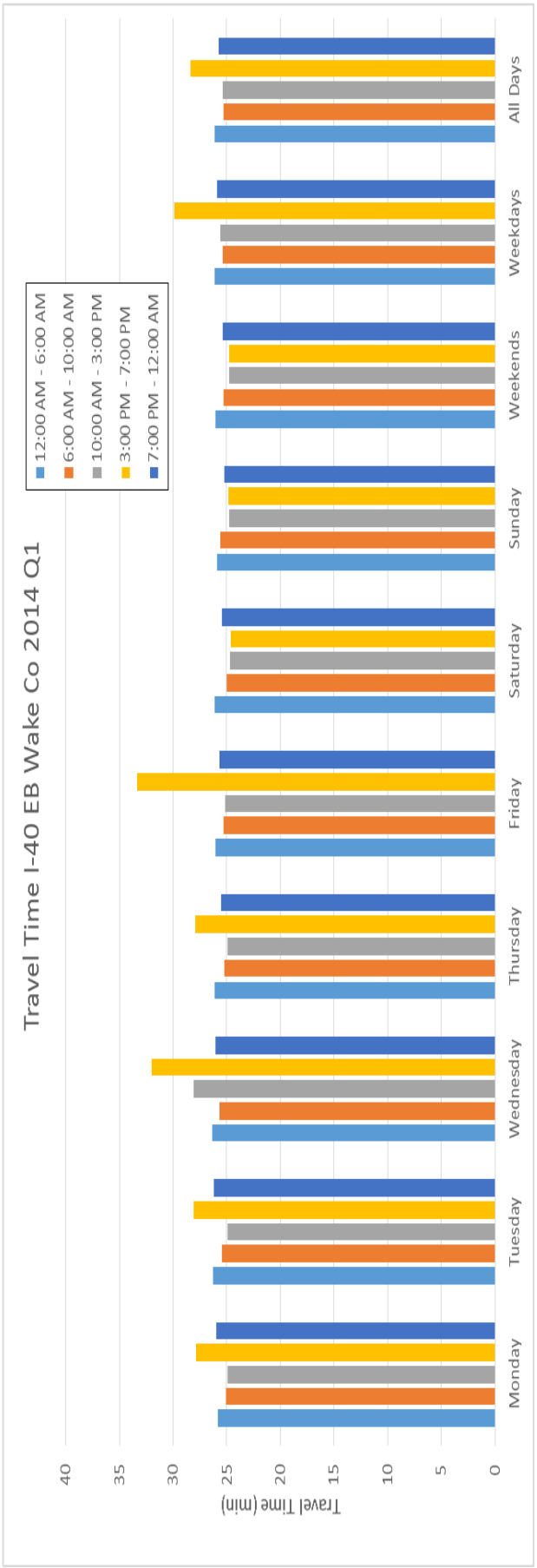
Travel time (minutes)

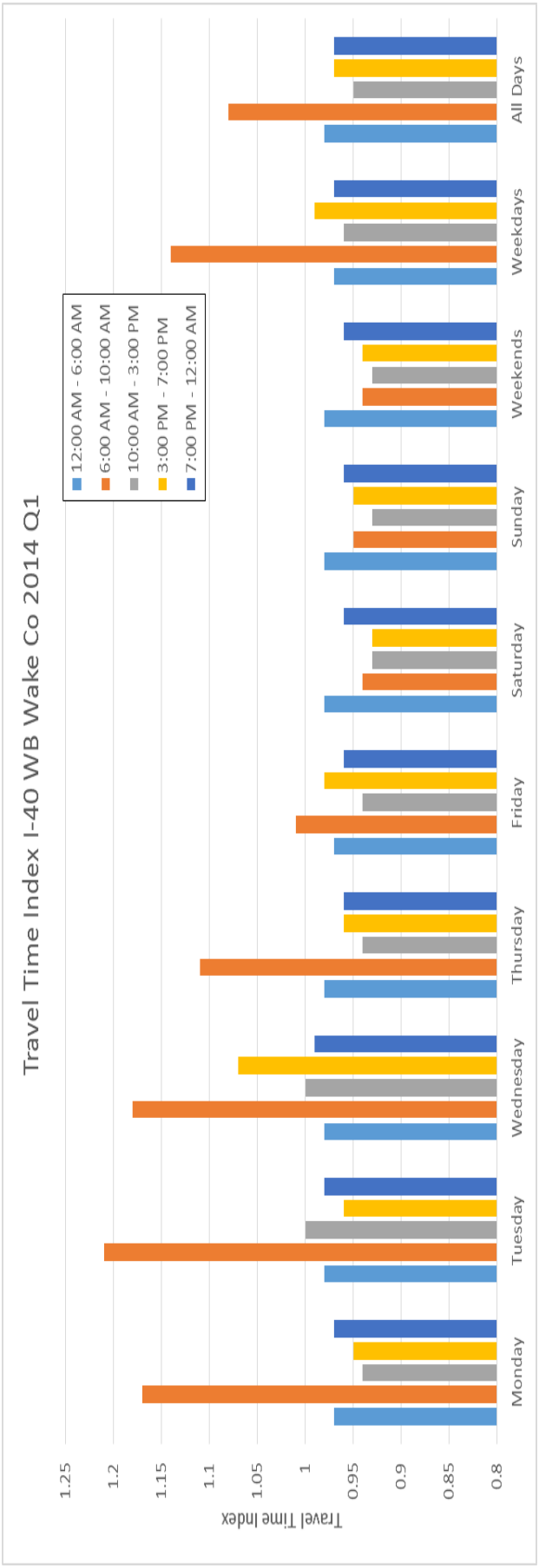
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	25.82	25.05	24.94	27.87	25.98
Tuesday	26.29	25.44	24.94	28.1	26.2
Wednesday	26.38	25.68	28.06	32.01	26.04
Thursday	26.11	25.24	24.94	27.93	25.51
Friday	26.08	25.29	25.15	33.34	25.69
Saturday	26.16	24.99	24.73	24.65	25.46
Sunday	25.94	25.59	24.8	24.87	25.22
Weekends	26.05	25.29	24.76	24.76	25.34
Weekdays	26.13	25.34	25.61	29.9	25.88
All Days	26.11	25.32	25.37	28.4	25.72

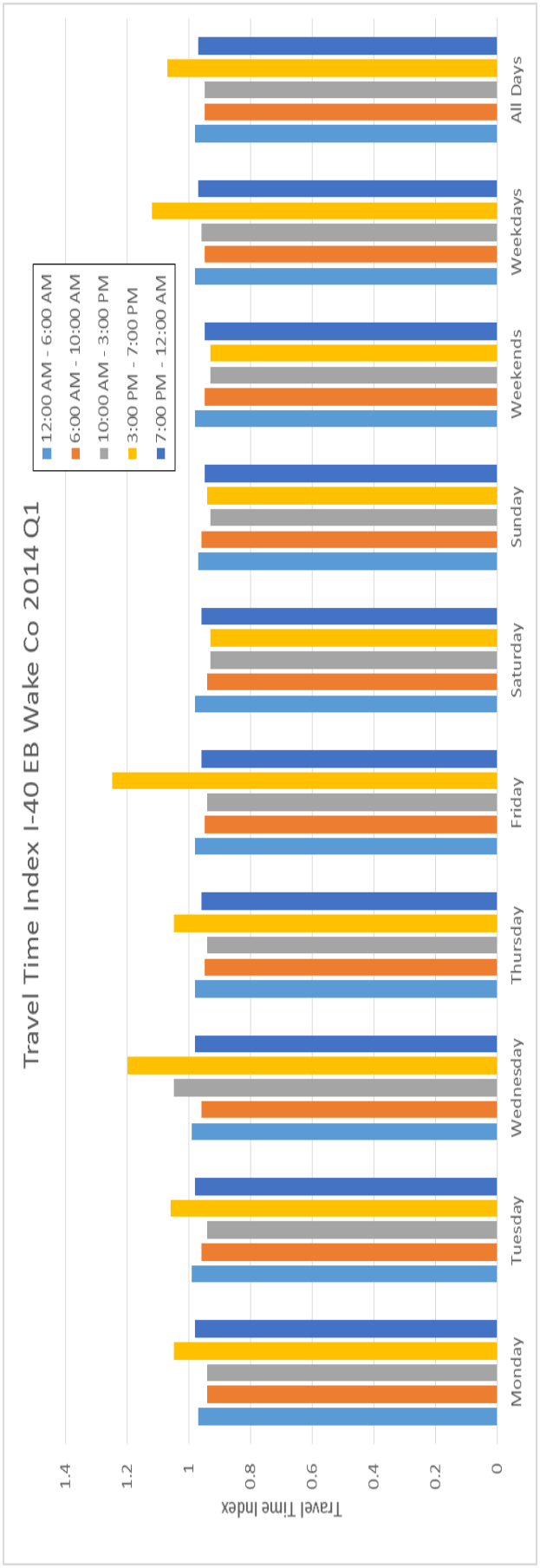
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.94	0.94	1.05	0.98
Tuesday	0.99	0.96	0.94	1.06	0.98
Wednesday	0.99	0.96	1.05	1.2	0.98
Thursday	0.98	0.95	0.94	1.05	0.96
Friday	0.98	0.95	0.94	1.25	0.96
Saturday	0.98	0.94	0.93	0.93	0.96
Sunday	0.97	0.96	0.93	0.94	0.95
Weekends	0.98	0.95	0.93	0.93	0.95
Weekdays	0.98	0.95	0.96	1.12	0.97
All Days	0.98	0.95	0.95	1.07	0.97


Travel Time I-40 WB Wake Co 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
32
29
26
23
20
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wake Co 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
40
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wake Co 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wake Co 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q2 2014:

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Westbound April 2014 through June 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.37	13.13	0	1.14	0
Tuesday	0.41	23.63	0	5.13	0
Wednesday	0.43	12.45	0	3.39	0.09
Thursday	0.5	11.34	0	2.22	0
Friday	1.22	5.92	0	3.12	0.4
Saturday	0.69	0	0	0	0
Sunday	1.08	0	0	2.28	0
Weekends	0.64	0	0	0.48	0
Weekdays	0.5	13.2	0	2.01	0
All Days	0.56	10.43	0	1.28	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.45	0	0.05	0
Tuesday	0.02	0.82	0	0.2	0
Wednesday	0.02	0.43	0	0.13	0
Thursday	0.02	0.39	0	0.09	0
Friday	0.05	0.23	0	0.12	0.02
Saturday	0.03	0	0	0	0
Sunday	0.04	0	0	0.09	0
Weekends	0.03	0	0	0.02	0
Weekdays	0.02	0.46	0	0.08	0
All Days	0.02	0.38	0	0.05	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	25.95	45.48	24.95	28.41	26.05
Tuesday	26	55.27	24.82	31.14	26.2
Wednesday	26.02	43.68	24.97	29.33	26.17
Thursday	26.09	43.54	25.38	28.65	26.18
Friday	26.81	32.69	25.01	31.72	27.25
Saturday	26.38	25	25.56	24.99	26.47
Sunday	26.74	25.79	25.42	30.91	26.32
Weekends	26.31	25.61	25.52	28.32	26.33
Weekdays	26.09	44.27	24.99	28.33	26.25
All Days	26.17	40.37	25.06	28.72	26.23

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound April 2014 through June 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.79	0.98	1.12	1.03
Tuesday	1.03	2.18	0.98	1.23	1.03
Wednesday	1.03	1.72	0.98	1.16	1.03
Thursday	1.03	1.72	1	1.13	1.03
Friday	1.06	1.29	0.99	1.25	1.07
Saturday	1.04	0.99	1.01	0.99	1.04
Sunday	1.05	1.02	1	1.22	1.04
Weekends	1.04	1.01	1.01	1.12	1.04
Weekdays	1.03	1.75	0.99	1.12	1.04
All Days	1.03	1.59	0.99	1.13	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.22	58.7	69.23	68.1	68.04
Tuesday	67.25	54.45	69.21	66.37	67.84
Wednesday	67.06	59.31	69.13	66.45	68
Thursday	67.22	59.86	68.53	67.32	68.05
Friday	66.61	64.88	68.44	64.52	66.26
Saturday	66.33	70.51	69.27	69.36	68.07
Sunday	66.33	69.23	69.83	66.92	68.22
Weekends	66.33	69.86	69.55	68.12	68.15
Weekdays	67.07	59.26	68.91	66.53	67.63
All Days	66.86	61.96	69.09	66.98	67.78

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.5	28.06	23.79	24.19	24.21
Tuesday	24.49	30.25	23.8	24.81	24.28
Wednesday	24.56	27.77	23.82	24.79	24.22
Thursday	24.5	27.52	24.03	24.46	24.2
Friday	24.73	25.39	24.07	25.53	24.86
Saturday	24.83	23.36	23.78	23.75	24.19
Sunday	24.83	23.79	23.59	24.61	24.14
Weekends	24.83	23.58	23.68	24.18	24.17
Weekdays	24.56	27.79	23.9	24.76	24.35
All Days	24.64	26.58	23.84	24.59	24.3

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.11	0.94	0.95	0.95
Tuesday	0.97	1.19	0.94	0.98	0.96
Wednesday	0.97	1.09	0.94	0.98	0.95
Thursday	0.97	1.08	0.95	0.96	0.95
Friday	0.97	1	0.95	1.01	0.98
Saturday	0.98	0.92	0.94	0.94	0.95
Sunday	0.98	0.94	0.93	0.97	0.95
Weekends	0.98	0.93	0.93	0.95	0.95
Weekdays	0.97	1.1	0.94	0.98	0.96
All Days	0.97	1.05	0.94	0.97	0.96

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Eastbound April 2014 through June 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.54	0	0	5.54	0
Tuesday	0.47	8.93	0	5.82	0
Wednesday	0.5	0	0	9.6	1.09
Thursday	0.43	0	0.03	25.25	0.34
Friday	1.34	0	0	23.67	0
Saturday	0.69	0	0	0	0
Sunday	0.53	0	0	0	0
Weekends	0.61	0	0	0	0
Weekdays	0.54	0	0	17.64	0
All Days	0.54	0	0	14.69	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0	0	0.21	0
Tuesday	0.02	0.4	0	0.21	0
Wednesday	0.02	0	0	0.35	0.05
Thursday	0.02	0	0	0.86	0.01
Friday	0.06	0	0	0.69	0
Saturday	0.03	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.03	0	0	0	0
Weekdays	0.02	0	0	0.61	0
All Days	0.02	0	0	0.54	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	27.17	25.45	25.07	36.33	26.88
Tuesday	27.11	34.48	25.01	37.67	26.98
Wednesday	27.12	24.99	25.16	41.36	28.64
Thursday	27.08	25.32	25.66	59.59	27.91
Friday	27.98	25.27	25.36	63.05	28.08
Saturday	27.49	25.7	26.08	25.21	27.35
Sunday	27.31	26.98	25.44	25.48	27.06
Weekends	27.4	26.93	25.51	25.32	27.19
Weekdays	27.18	25.4	25.24	51.32	27.23
All Days	27.22	25.57	25.26	46.32	27.24

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Eastbound April 2014 through June 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.06	1	0.98	1.42	1.05
Tuesday	1.06	1.35	0.98	1.47	1.06
Wednesday	1.06	0.98	0.98	1.62	1.12
Thursday	1.06	0.99	1	2.33	1.09
Friday	1.09	0.99	0.99	2.47	1.1
Saturday	1.08	1.01	1.02	0.99	1.07
Sunday	1.07	1.05	0.99	1	1.06
Weekends	1.07	1.05	1	0.99	1.06
Weekdays	1.06	0.99	0.99	2.01	1.06
All Days	1.06	1	0.99	1.81	1.07

Speed (mph)

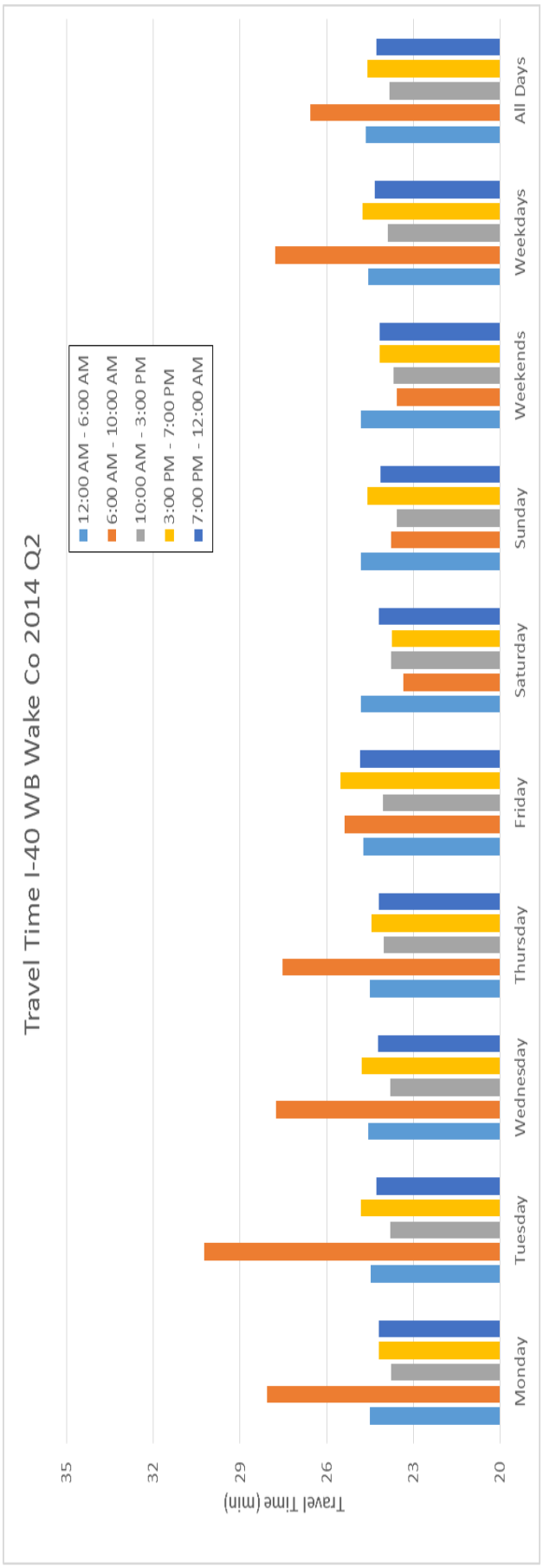
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.63	68.96	69.37	61.57	68.34
Tuesday	66.42	62.53	68.77	62.27	68.27
Wednesday	66.75	69.38	69.01	60.23	68.06
Thursday	66.9	68.29	67.71	51.35	64.79
Friday	66.23	68.55	68.45	47.55	67.48
Saturday	66.47	69.61	68.93	70.13	68.14
Sunday	66.03	68.38	69.94	68.91	68.16
Weekends	66.25	68.99	69.43	69.51	68.15
Weekdays	66.59	67.44	68.65	55.92	67.35
All Days	66.49	67.87	68.88	59.25	67.58

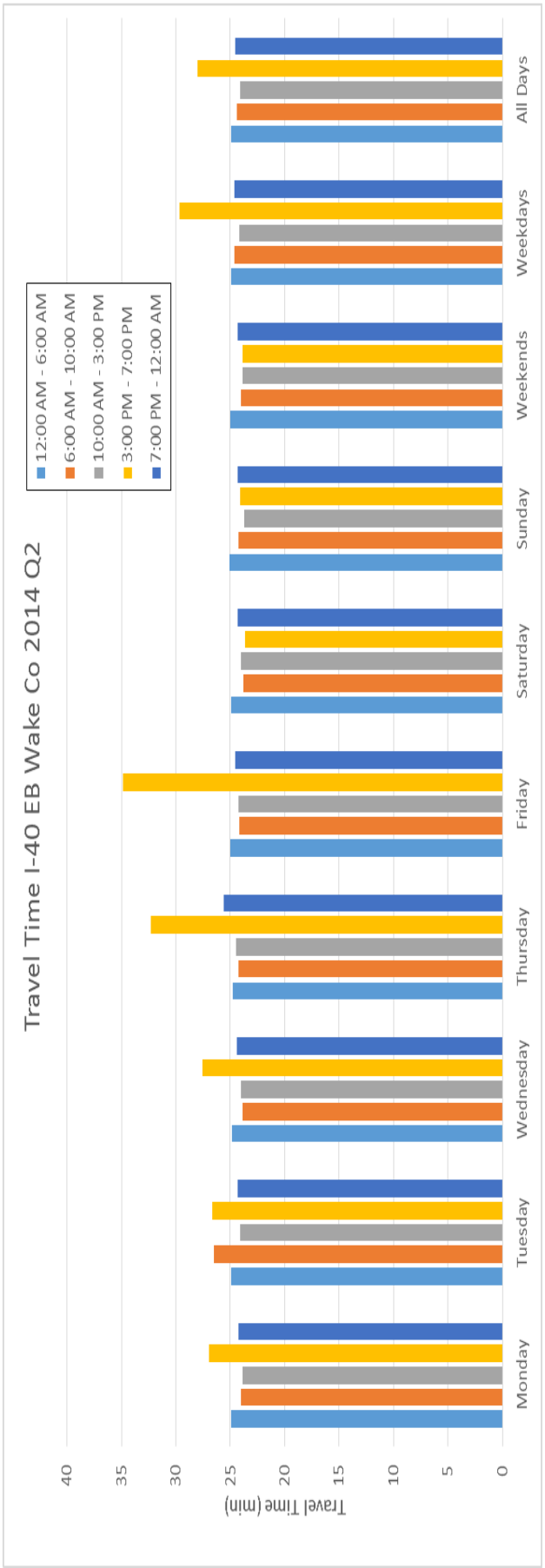
Travel time (minutes)

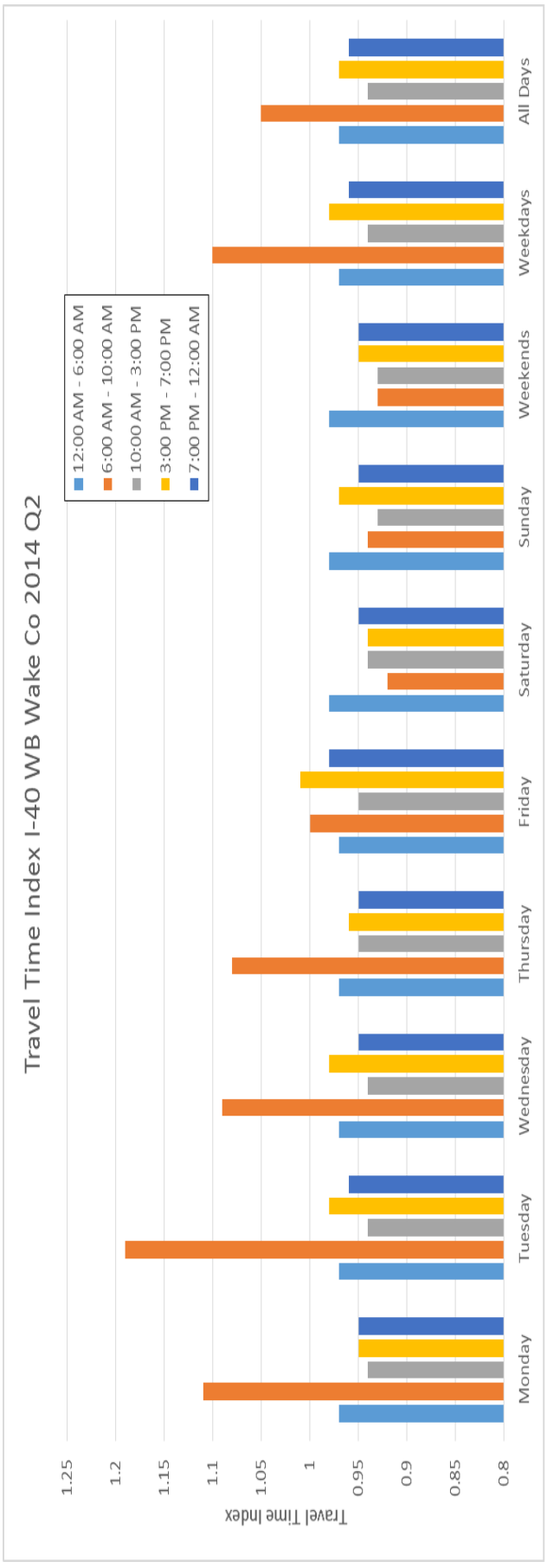
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.89	24.05	23.9	26.93	24.26
Tuesday	24.96	26.51	24.11	26.63	24.29
Wednesday	24.84	23.9	24.03	27.53	24.36
Thursday	24.78	24.28	24.49	32.29	25.59
Friday	25.03	24.19	24.22	34.87	24.57
Saturday	24.95	23.82	24.05	23.64	24.33
Sunday	25.11	24.25	23.71	24.06	24.32
Weekends	25.03	24.03	23.88	23.85	24.33
Weekdays	24.9	24.59	24.15	29.65	24.62
All Days	24.94	24.43	24.07	27.98	24.53

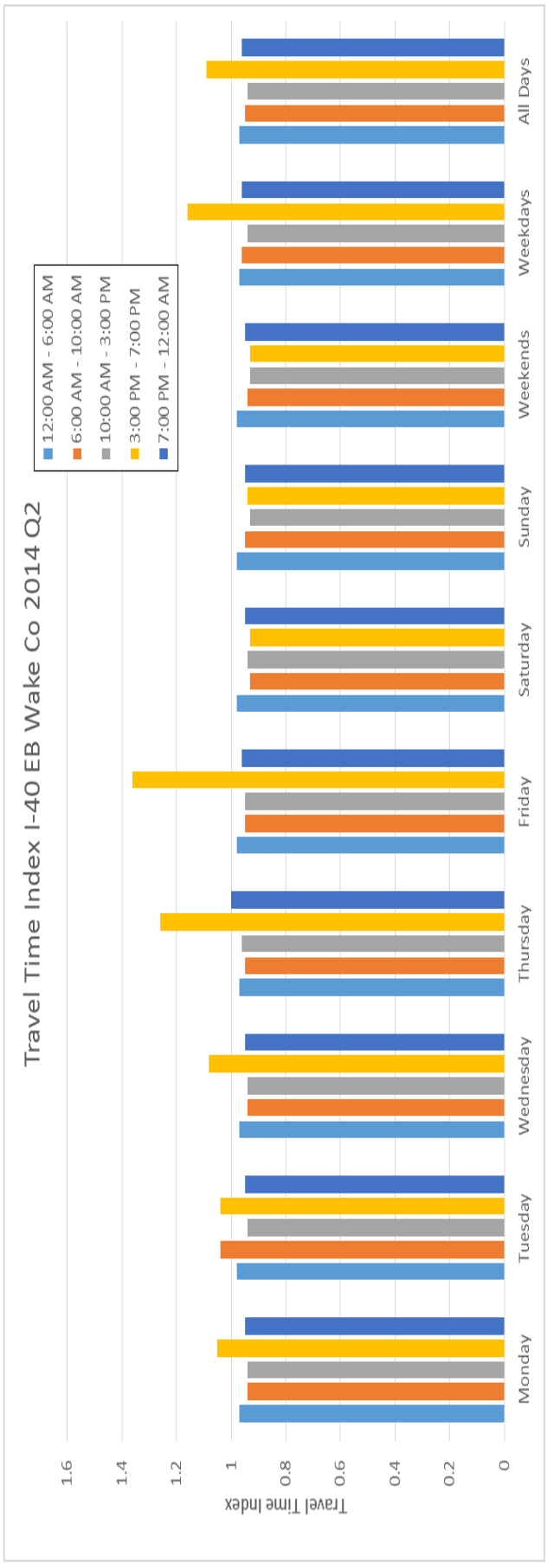
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.94	0.94	1.05	0.95
Tuesday	0.98	1.04	0.94	1.04	0.95
Wednesday	0.97	0.94	0.94	1.08	0.95
Thursday	0.97	0.95	0.96	1.26	1
Friday	0.98	0.95	0.95	1.36	0.96
Saturday	0.98	0.93	0.94	0.93	0.95
Sunday	0.98	0.95	0.93	0.94	0.95
Weekends	0.98	0.94	0.93	0.93	0.95
Weekdays	0.97	0.96	0.94	1.16	0.96
All Days	0.97	0.95	0.94	1.09	0.96


Travel Time I-40 WB Wake Co 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
32
29
26
23
20
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wake Co 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
40
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wake Co 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wake Co 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q3 2014:

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound July 2014 through September 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.73	21.97	0	1.48	0
Tuesday	0.55	16.13	0	1.01	0.31
Wednesday	0.58	18.09	0	1.92	0.05
Thursday	0.68	17.25	0	2.77	0.3
Friday	0.68	4.57	0	8.48	0
Saturday	0.83	0	0.96	3.12	0.19
Sunday	1.47	0	0.35	0.27	0.01
Weekends	0.87	0	0.71	0.71	0.08
Weekdays	0.67	13.73	0	2.61	0.06
All Days	0.7	10.54	0	1.63	0.07

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.74	0	0.06	0
Tuesday	0.02	0.56	0	0.04	0.01
Wednesday	0.02	0.63	0	0.08	0
Thursday	0.03	0.59	0	0.11	0.01
Friday	0.03	0.18	0	0.32	0
Saturday	0.03	0	0.04	0.12	0.01
Sunday	0.06	0	0.01	0.01	0
Weekends	0.04	0	0.03	0.03	0
Weekdays	0.03	0.48	0	0.1	0
All Days	0.03	0.38	0	0.06	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	26.11	54.29	25.24	28.59	26.17
Tuesday	26.14	47.6	24.85	27.01	26.48
Wednesday	26.16	49.68	25.11	27.86	25.9
Thursday	26.06	49.16	25.1	29.21	26.38
Friday	26.11	31.44	25.08	37.62	26.24
Saturday	26.52	25.18	29.24	31.07	26.57
Sunday	27.13	25.83	27.72	28.22	26.48
Weekends	26.55	25.64	28.65	28.58	26.45
Weekdays	26.16	44.8	25.11	28.97	26.24
All Days	26.31	40.49	25.49	29.25	26.3

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound July 2014 through September 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	2.14	1	1.13	1.03
Tuesday	1.03	1.88	0.98	1.07	1.04
Wednesday	1.03	1.96	0.99	1.1	1.02
Thursday	1.03	1.94	0.99	1.15	1.04
Friday	1.03	1.24	0.99	1.48	1.04
Saturday	1.05	0.99	1.15	1.23	1.05
Sunday	1.07	1.02	1.09	1.11	1.04
Weekends	1.05	1.01	1.13	1.13	1.04
Weekdays	1.03	1.77	0.99	1.14	1.03
All Days	1.04	1.6	1.01	1.15	1.04

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.84	56.08	68.58	67.38	67.61
Tuesday	67.19	57.73	69.2	67.34	67.44
Wednesday	67.19	56.99	68.5	66.79	67.91
Thursday	67.18	56.65	68.05	66.73	67.65
Friday	67.41	64.13	69.05	63.35	67.88
Saturday	66.83	70.05	67.12	67.6	67.77
Sunday	66	68.72	68.52	67.13	66.82
Weekends	66.4	69.37	67.81	67.36	67.3
Weekdays	67.16	58.17	68.68	66.32	67.69
All Days	66.95	60.93	68.43	66.61	67.58

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.64	29.37	24.02	24.44	24.36
Tuesday	24.51	28.53	23.8	24.46	24.42
Wednesday	24.51	28.9	24.05	24.66	24.25
Thursday	24.52	29.07	24.2	24.68	24.35
Friday	24.43	25.68	23.85	26	24.27
Saturday	24.65	23.51	24.54	24.36	24.3
Sunday	24.95	23.97	24.04	24.54	24.65
Weekends	24.81	23.74	24.29	24.45	24.47
Weekdays	24.52	28.31	23.98	24.84	24.33
All Days	24.6	27.03	24.07	24.73	24.37

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.16	0.95	0.96	0.96
Tuesday	0.97	1.13	0.94	0.96	0.96
Wednesday	0.97	1.14	0.95	0.97	0.96
Thursday	0.97	1.15	0.95	0.97	0.96
Friday	0.96	1.01	0.94	1.02	0.96
Saturday	0.97	0.93	0.97	0.96	0.96
Sunday	0.98	0.94	0.95	0.97	0.97
Weekends	0.98	0.94	0.96	0.96	0.96
Weekdays	0.97	1.12	0.95	0.98	0.96
All Days	0.97	1.07	0.95	0.97	0.96

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Eastbound July 2014 through September 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.52	0	0	10.44	0
Tuesday	0.69	0	0	9.31	0.25
Wednesday	0.73	0	0	25.88	0
Thursday	0.72	0	0	10.29	0.32
Friday	1.44	0	0	24.32	0
Saturday	0.74	0	0.52	0.01	0
Sunday	0.8	0	0.02	0	0
Weekends	0.76	0	0.03	0	0
Weekdays	0.75	0	0	16.04	0
All Days	0.77	0	0	13.52	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0	0	0.39	0
Tuesday	0.03	0	0	0.34	0.01
Wednesday	0.03	0	0	0.94	0
Thursday	0.03	0	0	0.35	0.01
Friday	0.07	0	0	0.71	0
Saturday	0.03	0	0.02	0	0
Sunday	0.04	0	0	0	0
Weekends	0.03	0	0	0	0
Weekdays	0.03	0	0	0.55	0
All Days	0.03	0	0	0.5	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	27.01	25.42	25.29	42.13	26.12
Tuesday	27.32	25.19	24.99	40.74	26.87
Wednesday	27.36	25.35	25.15	60.39	27.24
Thursday	27.28	25.23	25.18	44.73	26.96
Friday	27.67	25.33	25.48	63.27	27.41
Saturday	27.53	25.83	27.72	26.3	26.63
Sunday	27.58	26.11	25.8	25.56	26.26
Weekends	27.55	25.99	26.59	25.76	26.43
Weekdays	27.36	25.4	25.21	49.9	26.78
All Days	27.45	25.68	25.47	45.32	26.69

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Eastbound July 2014 through September 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.06	0.99	0.99	1.65	1.02
Tuesday	1.07	0.99	0.98	1.59	1.05
Wednesday	1.07	0.99	0.98	2.36	1.07
Thursday	1.07	0.99	0.98	1.75	1.05
Friday	1.08	0.99	1	2.47	1.07
Saturday	1.08	1.01	1.08	1.03	1.04
Sunday	1.08	1.02	1.01	1	1.03
Weekends	1.08	1.02	1.04	1.01	1.03
Weekdays	1.07	0.99	0.99	1.95	1.05
All Days	1.07	1	1	1.77	1.04

Speed (mph)

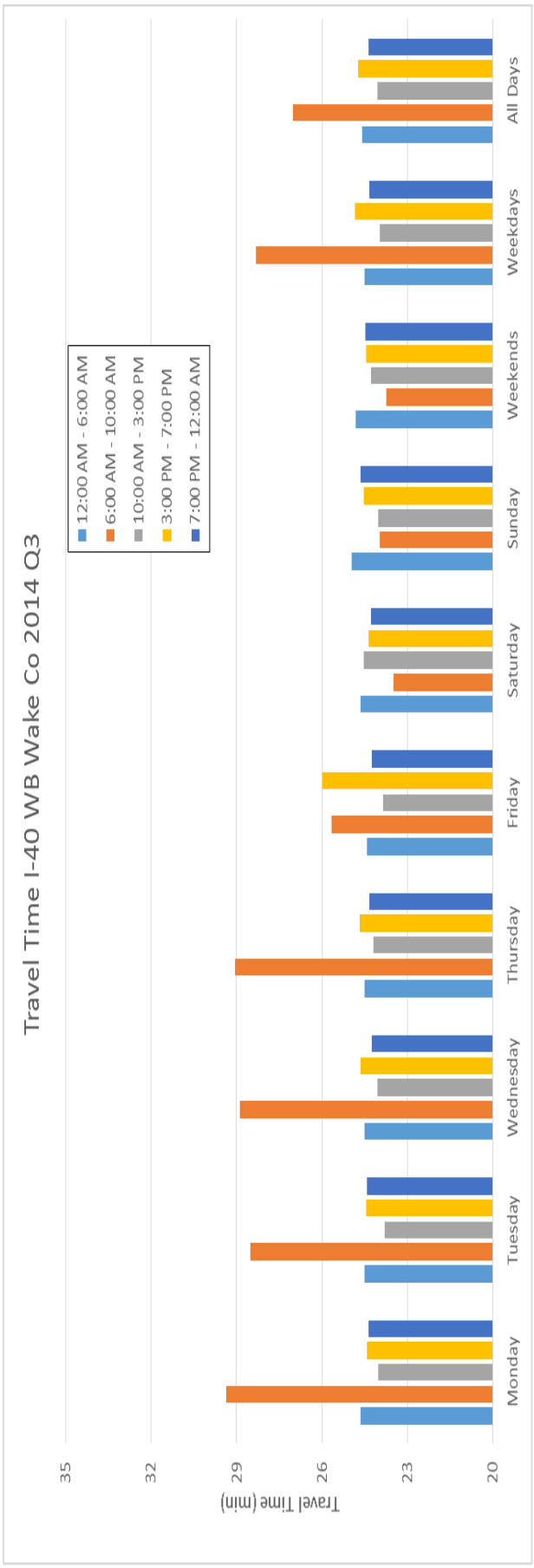
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.72	68.8	69.08	61.24	68.03
Tuesday	66.79	68.83	69.31	60.43	67.5
Wednesday	66.85	68.66	69.12	54.01	67.33
Thursday	66.93	67.58	68.4	57.84	67.33
Friday	66.62	69.13	68.68	50.11	67.09
Saturday	66.35	69.24	68.29	68.65	67.54
Sunday	66.22	68.42	69.4	69.25	68.06
Weekends	66.28	68.82	68.84	68.95	67.79
Weekdays	66.78	68.6	68.92	56.51	67.46
All Days	66.64	68.66	68.9	59.57	67.55

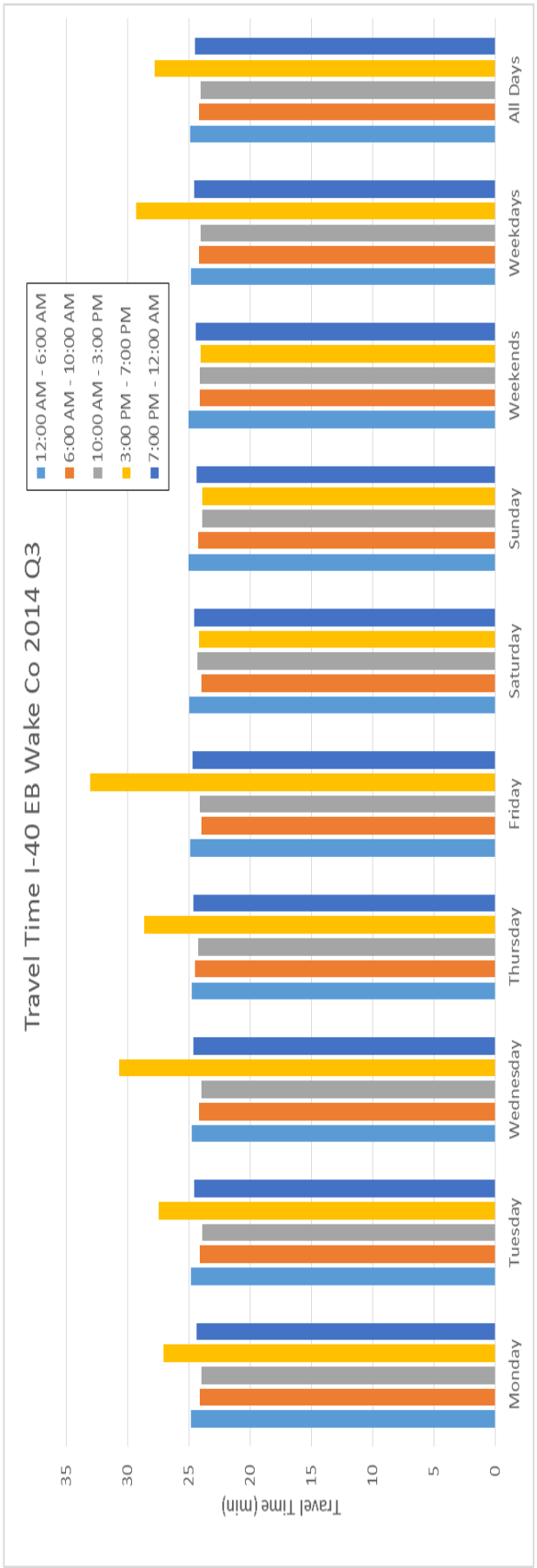
Travel time (minutes)

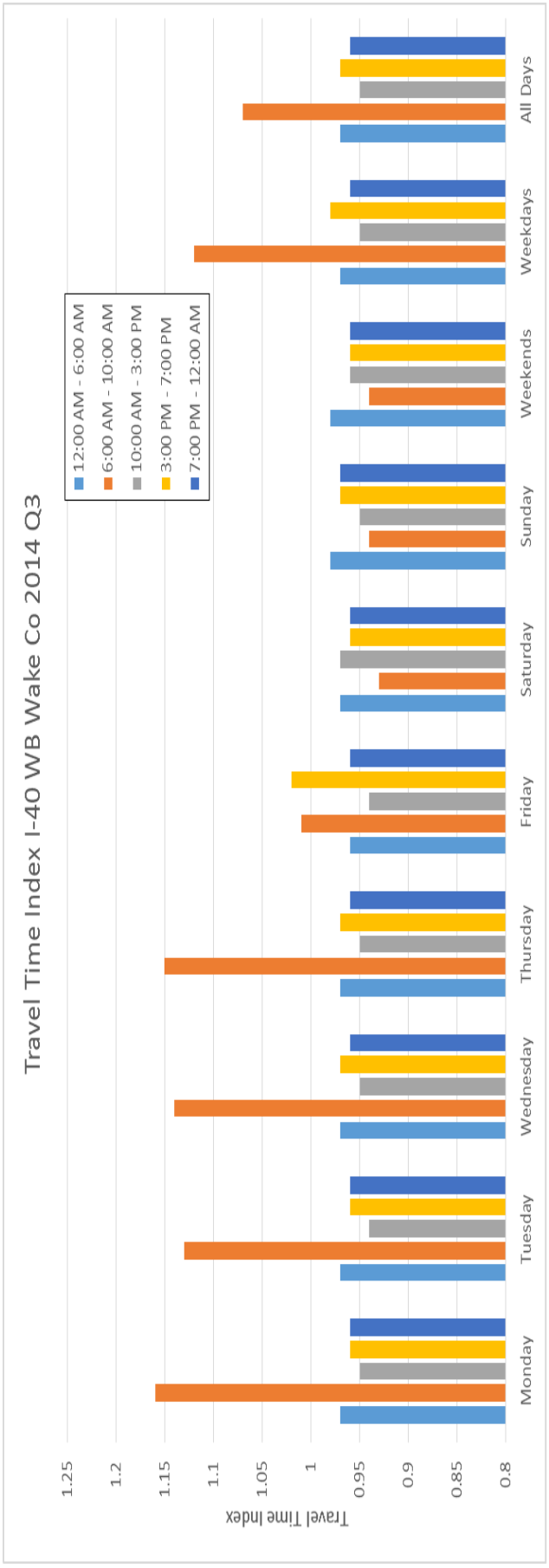
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.85	24.1	24	27.07	24.37
Tuesday	24.83	24.09	23.92	27.44	24.56
Wednesday	24.8	24.15	23.99	30.7	24.63
Thursday	24.77	24.54	24.24	28.67	24.62
Friday	24.89	23.99	24.14	33.09	24.72
Saturday	24.99	23.95	24.28	24.15	24.55
Sunday	25.04	24.24	23.89	23.94	24.36
Weekends	25.02	24.09	24.09	24.05	24.46
Weekdays	24.83	24.17	24.06	29.34	24.58
All Days	24.88	24.15	24.07	27.83	24.54

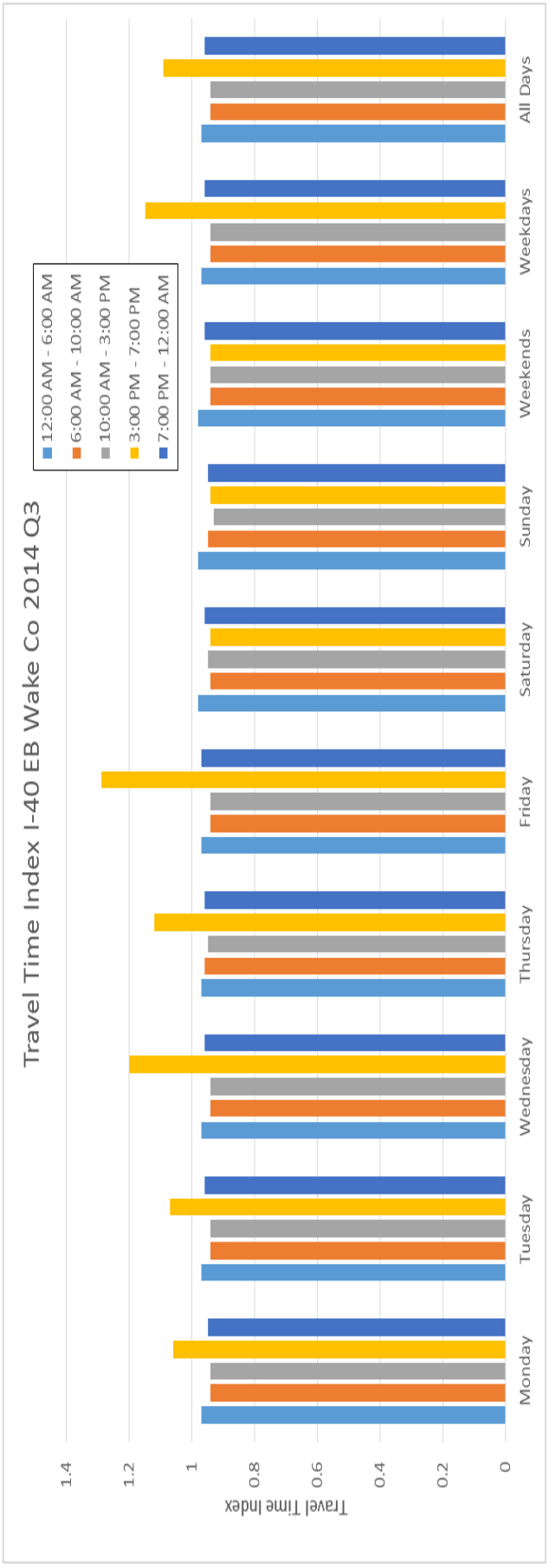
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.94	0.94	1.06	0.95
Tuesday	0.97	0.94	0.94	1.07	0.96
Wednesday	0.97	0.94	0.94	1.2	0.96
Thursday	0.97	0.96	0.95	1.12	0.96
Friday	0.97	0.94	0.94	1.29	0.97
Saturday	0.98	0.94	0.95	0.94	0.96
Sunday	0.98	0.95	0.93	0.94	0.95
Weekends	0.98	0.94	0.94	0.94	0.96
Weekdays	0.97	0.94	0.94	1.15	0.96
All Days	0.97	0.94	0.94	1.09	0.96


Travel Time I-40 WB Wake Co 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
32
29
26
23
20
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wake Co 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wake Co 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wake Co 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q4 2014:

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound October 2014 through December 2014

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.76	14.64	0	1.01	0
Tuesday	0.81	13.87	0.26	5.48	0.22
Wednesday	0.98	16.96	0.02	6	0.38
Thursday	0.83	11.23	0	6.6	0.26
Friday	0.86	10.61	0	12.87	1.47
Saturday	0.79	0	0	0.23	0
Sunday	0.72	0	0	0.82	0
Weekends	0.68	0	0	0.55	0
Weekdays	0.84	13.27	0	6.2	0.13
All Days	0.77	10.93	0	3.52	0.05

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.5	0	0.04	0
Tuesday	0.03	0.48	0.01	0.22	0.01
Wednesday	0.04	0.59	0	0.24	0.02
Thursday	0.03	0.38	0	0.26	0.01
Friday	0.03	0.41	0	0.48	0.06
Saturday	0.03	0	0	0.01	0
Sunday	0.03	0	0	0.03	0
Weekends	0.03	0	0	0.02	0
Weekdays	0.03	0.47	0	0.24	0
All Days	0.03	0.4	0	0.14	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	26.11	47.3	25.47	26.84	26.14
Tuesday	26.18	46.02	25.87	31.5	26.39
Wednesday	26.36	48.53	25.65	31.95	26.24
Thursday	26.2	43	25.57	33.05	26.33
Friday	26.22	37.84	25.45	40.19	28.08
Saturday	26.25	25.7	25.53	26.15	26.33
Sunday	26.16	25.83	25.54	28.46	26.24
Weekends	26.13	25.78	25.46	27.56	26.24
Weekdays	26.21	44.46	25.57	32.51	26.29
All Days	26.16	40.99	25.57	29.75	26.27

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound October 2014 through December 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.87	1	1.06	1.03
Tuesday	1.03	1.82	1.02	1.24	1.04
Wednesday	1.04	1.91	1.01	1.26	1.03
Thursday	1.03	1.7	1.01	1.3	1.04
Friday	1.03	1.49	1	1.59	1.11
Saturday	1.04	1.01	1.01	1.03	1.04
Sunday	1.03	1.02	1.01	1.12	1.03
Weekends	1.03	1.02	1	1.09	1.04
Weekdays	1.03	1.75	1.01	1.28	1.04
All Days	1.03	1.62	1.01	1.17	1.04

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.15	56.19	68.55	67.54	67.41
Tuesday	67.05	57.85	67.24	63.64	66.76
Wednesday	66.65	56.22	68.15	64.05	66.92
Thursday	66.63	58.03	68.5	64.72	67.02
Friday	66.82	61.71	68.62	61.54	64.68
Saturday	66.8	69.17	68.95	67.98	66.98
Sunday	67.26	68.87	69.25	67.86	67.63
Weekends	67.04	69.01	69.1	67.92	67.31
Weekdays	66.86	57.91	68.21	64.24	66.55
All Days	66.91	60.59	68.45	65.22	66.76

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.53	29.31	24.03	24.39	24.43
Tuesday	24.56	28.47	24.49	25.88	24.67
Wednesday	24.71	29.29	24.17	25.71	24.61
Thursday	24.72	28.38	24.04	25.45	24.58
Friday	24.65	26.69	24	26.77	25.46
Saturday	24.66	23.81	23.89	24.23	24.59
Sunday	24.49	23.91	23.78	24.27	24.35
Weekends	24.57	23.87	23.83	24.25	24.47
Weekdays	24.64	28.44	24.15	25.64	24.75
All Days	24.62	27.19	24.06	25.25	24.67

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.16	0.95	0.96	0.96
Tuesday	0.97	1.12	0.97	1.02	0.97
Wednesday	0.97	1.16	0.95	1.01	0.97
Thursday	0.97	1.12	0.95	1	0.97
Friday	0.97	1.05	0.95	1.06	1
Saturday	0.97	0.94	0.94	0.96	0.97
Sunday	0.97	0.94	0.94	0.96	0.96
Weekends	0.97	0.94	0.94	0.96	0.96
Weekdays	0.97	1.12	0.95	1.01	0.98
All Days	0.97	1.07	0.95	1	0.97

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Eastbound October 2014 through December 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.72	2.04	0.07	18.21	0.03
Tuesday	0.71	0.39	0.18	19.95	0.47
Wednesday	0.82	2.58	0.14	13.43	0
Thursday	1.19	2.19	0	14.8	0.14
Friday	0.99	0.24	0	15.33	0.35
Saturday	0.93	0	0	0.34	0
Sunday	0.68	0	0	0.26	0
Weekends	0.76	0	0	0.32	0
Weekdays	0.81	1.29	0	16.41	0.02
All Days	0.77	0.72	0	13.85	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.09	0	0.68	0
Tuesday	0.03	0.02	0.01	0.73	0.02
Wednesday	0.04	0.12	0.01	0.49	0
Thursday	0.05	0.1	0	0.5	0.01
Friday	0.04	0.01	0	0.45	0.01
Saturday	0.04	0	0	0.02	0
Sunday	0.03	0	0	0.01	0
Weekends	0.03	0	0	0.01	0
Weekdays	0.04	0.06	0	0.57	0
All Days	0.03	0.03	0	0.51	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	26.34	27.77	25.75	50.02	26.39
Tuesday	26.35	26.03	25.84	52.45	26.81
Wednesday	26.5	28.31	25.98	45.79	26.48
Thursday	26.85	27.85	25.68	48.97	26.67
Friday	26.63	25.95	25.61	54.71	28.03
Saturday	26.68	25.95	25.77	26.31	26.51
Sunday	26.41	26.11	25.62	26.11	26.39
Weekends	26.5	26.11	25.72	26.26	26.44
Weekdays	26.45	26.98	25.72	50.51	26.68
All Days	26.46	26.64	25.75	45.86	26.63

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Eastbound October 2014 through December 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.09	1.01	1.96	1.03
Tuesday	1.03	1.02	1.01	2.05	1.05
Wednesday	1.04	1.11	1.02	1.79	1.04
Thursday	1.05	1.09	1	1.91	1.04
Friday	1.04	1.02	1	2.14	1.1
Saturday	1.04	1.01	1.01	1.03	1.04
Sunday	1.03	1.02	1	1.02	1.03
Weekends	1.04	1.02	1.01	1.03	1.03
Weekdays	1.03	1.06	1.01	1.98	1.04
All Days	1.03	1.04	1.01	1.79	1.04

Speed (mph)

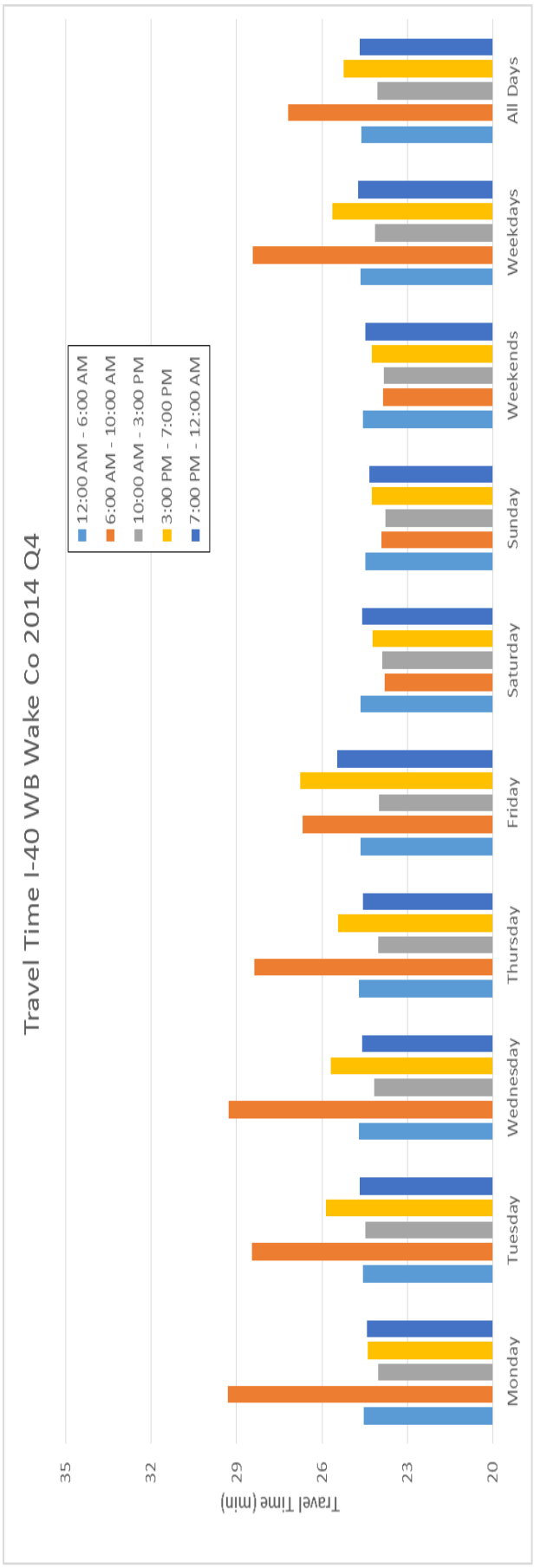
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.82	66.73	68.36	56.27	67.27
Tuesday	66.85	67.98	68.05	55.39	66.46
Wednesday	66.5	66.59	67.7	58.46	67.1
Thursday	66.07	66.95	68.56	56.5	66.82
Friday	66.5	68.33	68.79	52.69	66.59
Saturday	66.65	68.79	69.08	68.48	67.15
Sunday	67.29	68.3	69.87	68.81	67.67
Weekends	66.98	68.53	69.49	68.65	67.42
Weekdays	66.55	67.3	68.28	55.84	66.85
All Days	66.67	67.63	68.61	58.88	67.01

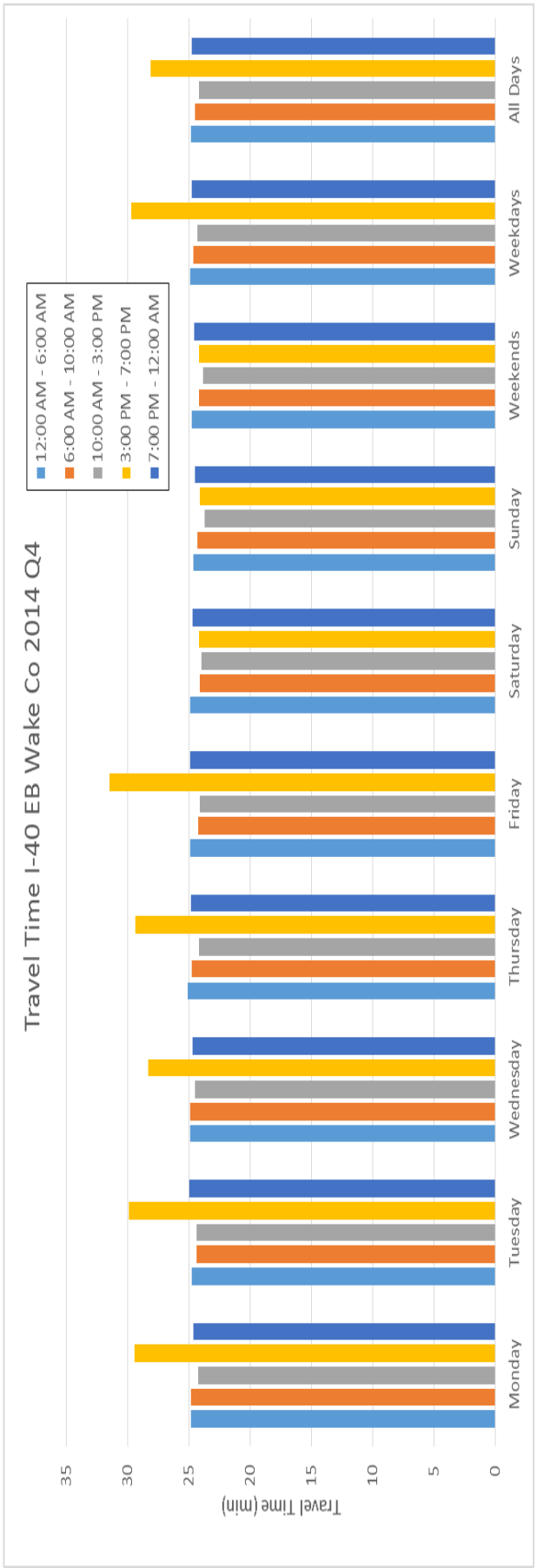
Travel time (minutes)

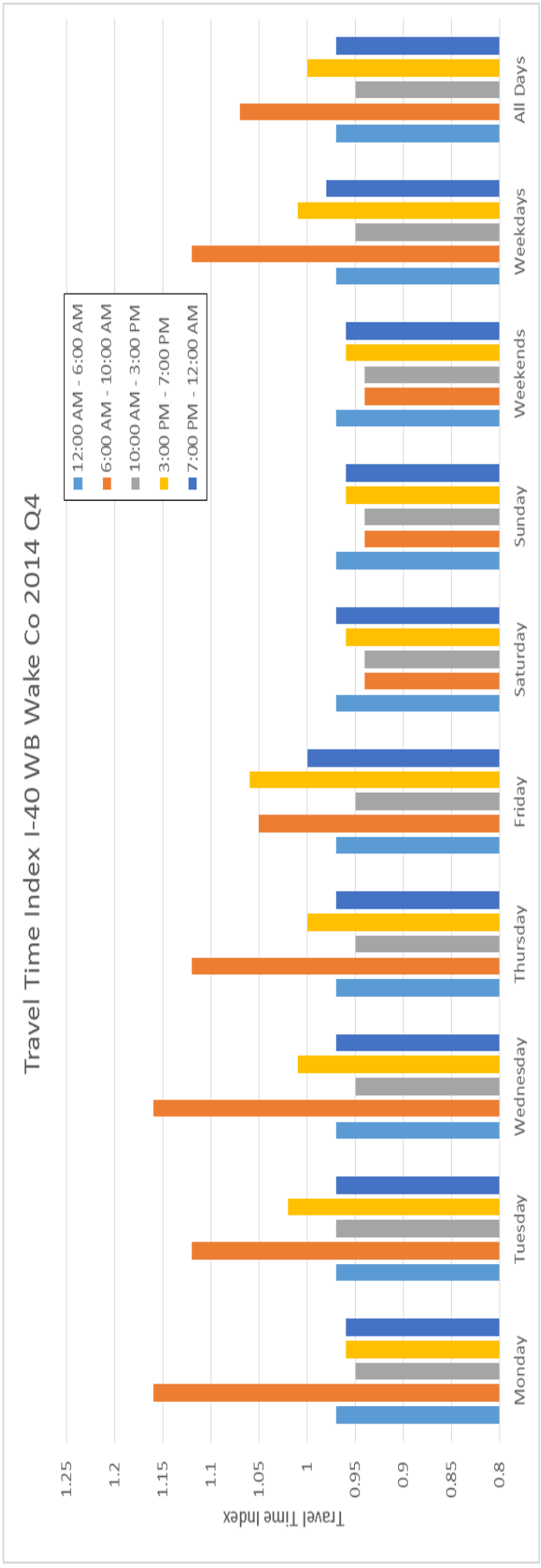
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.81	24.85	24.25	29.47	24.65
Tuesday	24.8	24.39	24.37	29.94	24.95
Wednesday	24.93	24.9	24.49	28.36	24.71
Thursday	25.09	24.77	24.18	29.35	24.81
Friday	24.93	24.26	24.1	31.47	24.9
Saturday	24.88	24.1	24	24.21	24.69
Sunday	24.64	24.28	23.73	24.1	24.5
Weekends	24.75	24.19	23.86	24.15	24.59
Weekdays	24.92	24.64	24.28	29.7	24.8
All Days	24.87	24.52	24.17	28.16	24.74

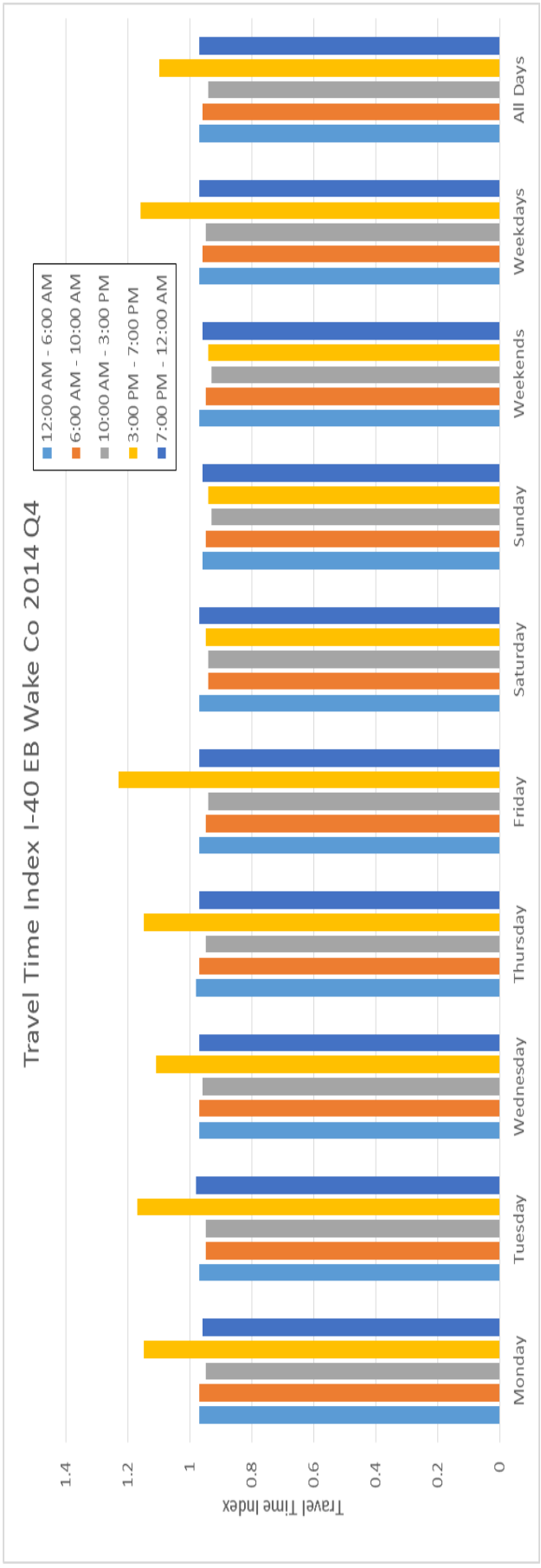
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.97	0.95	1.15	0.96
Tuesday	0.97	0.95	0.95	1.17	0.98
Wednesday	0.97	0.97	0.96	1.11	0.97
Thursday	0.98	0.97	0.95	1.15	0.97
Friday	0.97	0.95	0.94	1.23	0.97
Saturday	0.97	0.94	0.94	0.95	0.97
Sunday	0.96	0.95	0.93	0.94	0.96
Weekends	0.97	0.95	0.93	0.94	0.96
Weekdays	0.97	0.96	0.95	1.16	0.97
All Days	0.97	0.96	0.94	1.1	0.97


Travel Time I-40 WB Wake Co 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
32
29
26
23
20
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wake Co 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wake Co 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wake Co 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q1 2015:

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound January 2015 through March 2015

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.45	15.37	0	1.75	0.02
Tuesday	0.64	19.8	8.13	4.18	0.29
Wednesday	0.58	29.53	0.13	3.08	0.5
Thursday	0.95	5.51	0.27	1.59	0
Friday	0.47	7.61	0.03	4	0
Saturday	0.33	0	0	0	0
Sunday	0.24	0.1	0	0	0
Weekends	0.29	0	0	0	0
Weekdays	0.56	13.28	0.38	2.39	0
All Days	0.49	10.45	0.11	1.6	0

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.48	0	0.07	0
Tuesday	0.03	0.64	0.31	0.16	0.01
Wednesday	0.02	0.95	0.01	0.12	0.02
Thursday	0.04	0.17	0.01	0.06	0
Friday	0.02	0.28	0	0.14	0
Saturday	0.01	0	0	0	0
Sunday	0.01	0	0	0	0
Weekends	0.01	0	0	0	0
Weekdays	0.02	0.43	0.01	0.09	0
All Days	0.02	0.36	0	0.06	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	26.87	51.07	26.43	28.68	27.26
Tuesday	27.07	53.89	34.95	31.34	27.65
Wednesday	27.01	63.51	26.85	30.17	27.54
Thursday	27.38	39.5	26.97	29.22	27.03
Friday	26.9	36	26.78	32.68	26.96
Saturday	26.85	26.48	26.66	26.78	26.94
Sunday	26.72	27.01	26.6	26.89	26.81
Weekends	26.8	26.7	26.64	26.79	26.87
Weekdays	26.98	46.81	27.11	29.89	27.15
All Days	26.94	42.39	26.89	28.97	27.1

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound January 2015 through March 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.93	1	1.09	1.03
Tuesday	1.02	2.04	1.32	1.19	1.05
Wednesday	1.02	2.4	1.02	1.14	1.04
Thursday	1.04	1.49	1.02	1.11	1.02
Friday	1.02	1.36	1.01	1.24	1.02
Saturday	1.02	1	1.01	1.01	1.02
Sunday	1.01	1.02	1.01	1.02	1.01
Weekends	1.01	1.01	1.01	1.01	1.02
Weekdays	1.02	1.77	1.03	1.13	1.03
All Days	1.02	1.6	1.02	1.1	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.43	55.72	68.35	66.98	66.79
Tuesday	66.76	54.1	62.43	63.92	66.69
Wednesday	67.06	52.33	65.9	66.34	66.78
Thursday	66	60.62	67.52	66.13	67.25
Friday	67.45	62.84	66.51	65.31	67.71
Saturday	67.33	69.16	68.77	67.98	68
Sunday	67.8	68.11	69.35	68.93	68.42
Weekends	67.56	68.63	69.06	68.45	68.21
Weekdays	66.93	56.93	66.08	65.71	67.05
All Days	67.11	59.88	66.92	66.48	67.38

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	25.46	30.81	25.12	25.63	25.7
Tuesday	25.72	31.73	27.5	26.86	25.74
Wednesday	25.6	32.81	26.05	25.88	25.71
Thursday	26.01	28.32	25.43	25.96	25.53
Friday	25.45	27.32	25.81	26.29	25.35
Saturday	25.5	24.82	24.96	25.25	25.24
Sunday	25.32	25.21	24.76	24.91	25.09
Weekends	25.41	25.02	24.86	25.08	25.17
Weekdays	25.65	30.16	25.98	26.13	25.61
All Days	25.58	28.67	25.66	25.82	25.48

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.17	0.95	0.97	0.97
Tuesday	0.97	1.2	1.04	1.02	0.97
Wednesday	0.97	1.24	0.99	0.98	0.97
Thursday	0.98	1.07	0.96	0.98	0.97
Friday	0.96	1.03	0.98	0.99	0.96
Saturday	0.96	0.94	0.94	0.96	0.95
Sunday	0.96	0.95	0.94	0.94	0.95
Weekends	0.96	0.95	0.94	0.95	0.95
Weekdays	0.97	1.14	0.98	0.99	0.97
All Days	0.97	1.08	0.97	0.98	0.96

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Eastbound January 2015 through March 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.83	2.04	0	8.5	0.41
Tuesday	1.61	6.46	10.96	12.8	0.87
Wednesday	1.06	3.75	0	8.42	0.04
Thursday	1.04	1.42	0.41	15.53	0.09
Friday	0.98	8.97	0	21.44	0
Saturday	0.42	0	0	0.01	0
Sunday	0.27	0	0.17	0	0
Weekends	0.37	0	0	0	0
Weekdays	0.97	2.64	0.25	14.95	0
All Days	0.77	1.43	0.14	12.68	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.04	0.09	0	0.31	0.02
Tuesday	0.07	0.28	0.47	0.45	0.04
Wednesday	0.05	0.16	0	0.29	0
Thursday	0.05	0.06	0.02	0.51	0
Friday	0.04	0.38	0	0.61	0
Saturday	0.02	0	0	0	0
Sunday	0.01	0	0.01	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.04	0.11	0.01	0.5	0
All Days	0.03	0.06	0.01	0.45	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	27.43	28.88	26.62	40.47	27.84
Tuesday	28.23	33.67	40.01	45.45	28.4
Wednesday	27.77	30.59	26.69	41.23	27.61
Thursday	27.68	28.19	27.15	50.7	27.73
Friday	27.6	35.75	26.77	61.83	27.55
Saturday	27.19	26.92	26.8	26.93	27.23
Sunday	27	27.41	26.95	26.84	27.01
Weekends	27.11	27.06	26.85	26.84	27.12
Weekdays	27.58	29.44	27.06	49.66	27.7
All Days	27.44	28.46	26.99	45.33	27.55

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Eastbound January 2015 through March 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.09	1	1.52	1.05
Tuesday	1.06	1.27	1.5	1.71	1.07
Wednesday	1.04	1.15	1	1.55	1.04
Thursday	1.04	1.06	1.02	1.91	1.04
Friday	1.04	1.34	1.01	2.32	1.04
Saturday	1.02	1.01	1.01	1.01	1.02
Sunday	1.01	1.03	1.01	1.01	1.02
Weekends	1.02	1.02	1.01	1.01	1.02
Weekdays	1.04	1.11	1.02	1.87	1.04
All Days	1.03	1.07	1.01	1.7	1.04

Speed (mph)

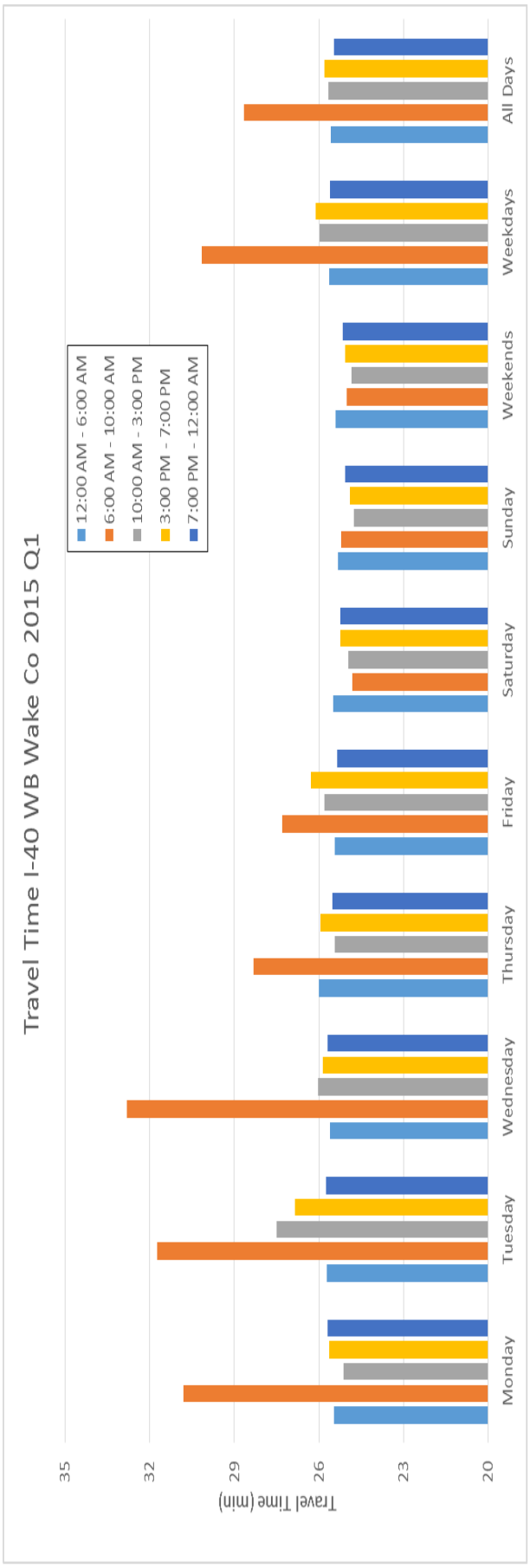
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.36	66.64	68.21	62.13	66.58
Tuesday	66.1	63.55	60.8	59.04	66.44
Wednesday	66.59	65.81	67.82	60.91	66.59
Thursday	65.74	66.88	67.74	56.54	66.53
Friday	66.62	62.95	67.98	50.67	67.23
Saturday	67.19	68.23	68.53	68.58	67.71
Sunday	67.52	67.68	68.56	68.9	67.76
Weekends	67.36	67.95	68.54	68.74	67.74
Weekdays	66.28	65.1	66.35	57.5	66.68
All Days	66.58	65.9	66.97	60.36	66.98

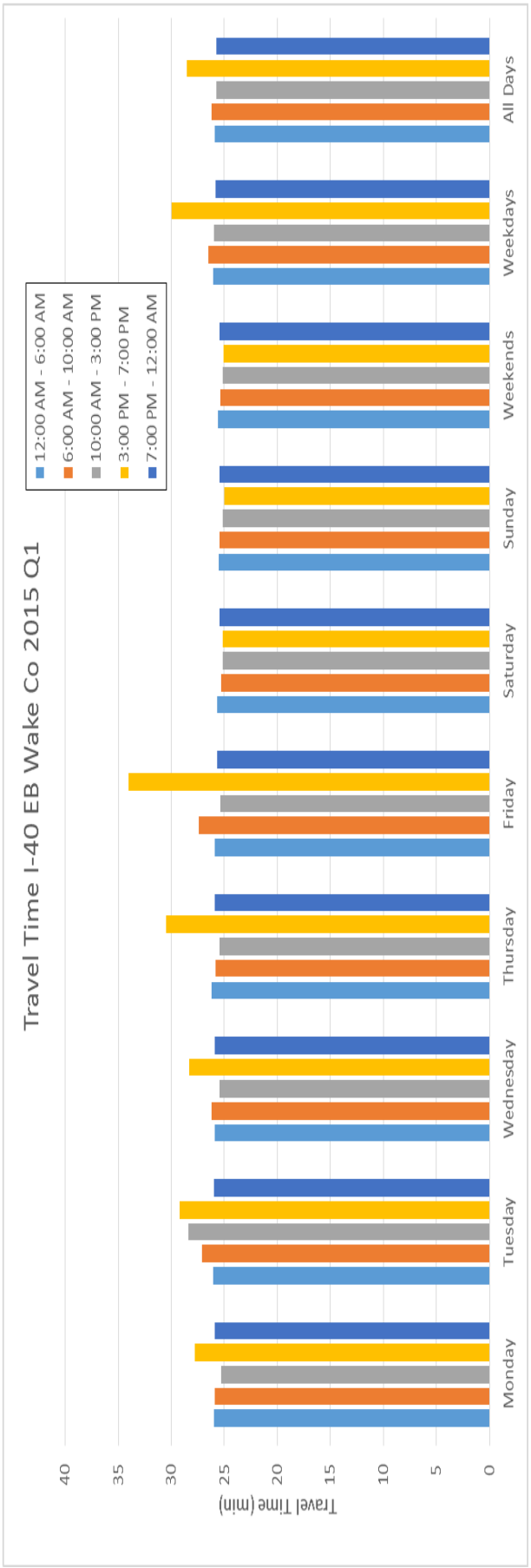
Travel time (minutes)

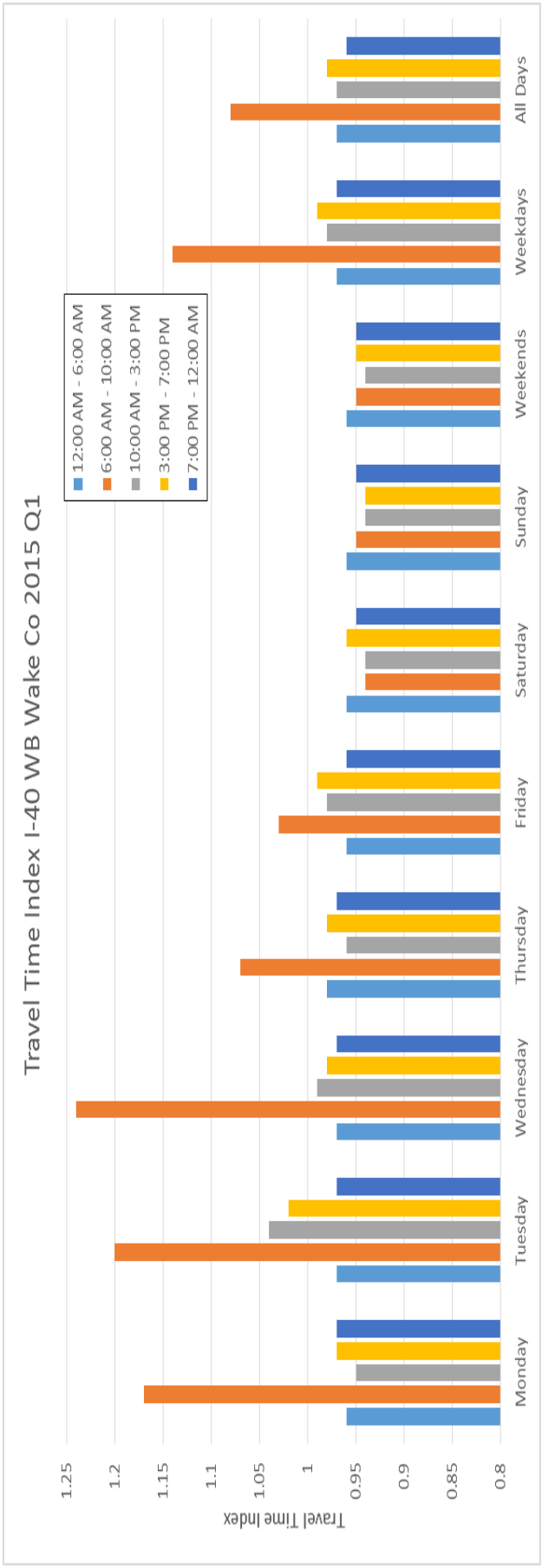
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	25.99	25.88	25.28	27.76	25.9
Tuesday	26.09	27.13	28.36	29.21	25.95
Wednesday	25.9	26.2	25.43	28.31	25.9
Thursday	26.23	25.79	25.46	30.5	25.92
Friday	25.89	27.39	25.37	34.03	25.65
Saturday	25.67	25.27	25.17	25.15	25.47
Sunday	25.54	25.48	25.15	25.03	25.45
Weekends	25.6	25.38	25.16	25.09	25.46
Weekdays	26.02	26.49	25.99	29.99	25.86
All Days	25.9	26.17	25.75	28.57	25.75

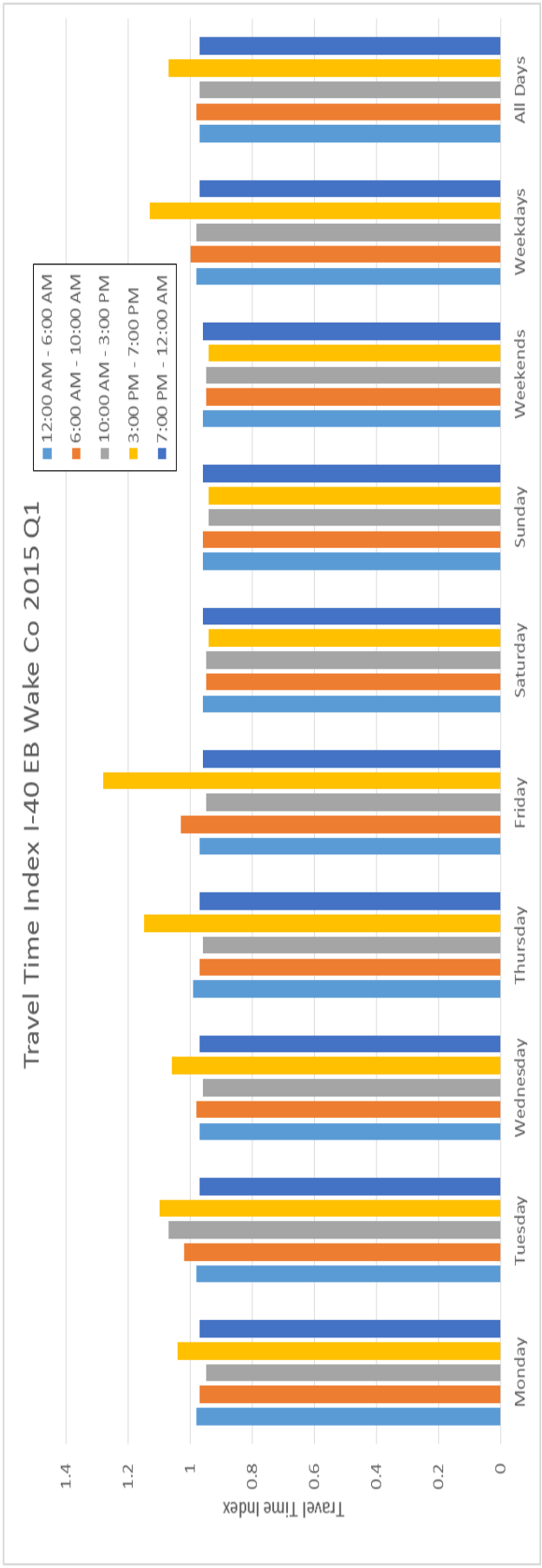
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.98	0.97	0.95	1.04	0.97
Tuesday	0.98	1.02	1.07	1.1	0.97
Wednesday	0.97	0.98	0.96	1.06	0.97
Thursday	0.99	0.97	0.96	1.15	0.97
Friday	0.97	1.03	0.95	1.28	0.96
Saturday	0.96	0.95	0.95	0.94	0.96
Sunday	0.96	0.96	0.94	0.94	0.96
Weekends	0.96	0.95	0.95	0.94	0.96
Weekdays	0.98	1	0.98	1.13	0.97
All Days	0.97	0.98	0.97	1.07	0.97


Travel Time I-40 WB Wake Co 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
32
29
26
23
20
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wake Co 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
40
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wake Co 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wake Co 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q2 2015:

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound April 2015 through June 2015

Buffer time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.86	11.13	0	4.9	0
Tuesday	1.01	8.48	0	4.49	0
Wednesday	1.05	15.9	0	9.05	0.23
Thursday	1.06	10.49	0	9.08	1.04
Friday	1.12	10.41	0	5.31	0
Saturday	1.18	0	3.61	1.29	0.14
Sunday	1.1	0	3.7	2.54	0.29
Weekends	1.17	0	3.58	2.13	0.04
Weekdays	1.02	10	0	5.65	0
All Days	1.04	6.72	0	4.47	0.05

Buffer index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.35	0	0.19	0
Tuesday	0.04	0.27	0	0.17	0
Wednesday	0.04	0.51	0	0.34	0.01
Thursday	0.04	0.33	0	0.34	0.04
Friday	0.04	0.38	0	0.19	0
Saturday	0.05	0	0.14	0.05	0.01
Sunday	0.04	0	0.14	0.1	0.01
Weekends	0.05	0	0.14	0.08	0
Weekdays	0.04	0.33	0	0.21	0
All Days	0.04	0.23	0	0.17	0

Planning time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	26.55	43.13	25.82	31.11	26.23
Tuesday	26.7	39.37	25.82	30.91	26.56
Wednesday	26.74	47.07	25.69	35.42	26.51
Thursday	26.76	42.29	25.63	35.98	27.48
Friday	26.81	38.06	25.99	33.27	26.4
Saturday	26.98	25.63	29.97	27.56	26.88
Sunday	26.87	25.91	29.77	28.91	27.02
Weekends	26.96	25.85	29.8	28.45	26.78
Weekdays	26.72	40.7	25.73	32.42	26.58
All Days	26.76	36.13	25.99	31.11	26.67

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Westbound April 2015 through June 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.68	1.01	1.21	1.02
Tuesday	1.04	1.53	1.01	1.2	1.03
Wednesday	1.04	1.83	1	1.38	1.03
Thursday	1.04	1.65	1	1.4	1.07
Friday	1.04	1.48	1.01	1.29	1.03
Saturday	1.05	1	1.17	1.07	1.05
Sunday	1.05	1.01	1.16	1.13	1.05
Weekends	1.05	1.01	1.16	1.11	1.04
Weekdays	1.04	1.58	1	1.26	1.03
All Days	1.04	1.41	1.01	1.21	1.04

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.83	59.2	68.23	64.45	67.52
Tuesday	66.38	58.89	67.89	66.17	66.59
Wednesday	66.15	55.48	67.34	63.6	66.7
Thursday	66.26	59.55	68.27	62.63	66.57
Friday	66.26	61.41	67.29	64.77	67.31
Saturday	66	69.04	66.54	68.22	66.96
Sunday	66.8	68.99	67.66	66.16	67.68
Weekends	66.4	69.01	67.09	67.17	67.32
Weekdays	66.37	58.86	67.8	64.28	66.94
All Days	66.38	61.46	67.59	65.09	67.05

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.97	28.19	24.46	25.89	24.72
Tuesday	25.14	28.34	24.58	25.22	25.06
Wednesday	25.23	30.08	24.78	26.24	25.02
Thursday	25.18	28.02	24.44	26.64	25.07
Friday	25.18	27.17	24.8	25.76	24.79
Saturday	25.28	24.17	25.08	24.46	24.92
Sunday	24.98	24.19	24.66	25.22	24.66
Weekends	25.13	24.18	24.87	24.84	24.79
Weekdays	25.14	28.35	24.61	25.96	24.93
All Days	25.14	27.15	24.69	25.64	24.89

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.1	0.95	1.01	0.96
Tuesday	0.98	1.1	0.96	0.98	0.97
Wednesday	0.98	1.17	0.96	1.02	0.97
Thursday	0.98	1.09	0.95	1.04	0.98
Friday	0.98	1.06	0.96	1	0.96
Saturday	0.98	0.94	0.98	0.95	0.97
Sunday	0.97	0.94	0.96	0.98	0.96
Weekends	0.98	0.94	0.97	0.97	0.96
Weekdays	0.98	1.1	0.96	1.01	0.97
All Days	0.98	1.06	0.96	1	0.97

	Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,				
	Eastbound April 2015 through June 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.87	0	0	18.25	0
Tuesday	3.24	0.06	0	20.96	0
Wednesday	0.87	0.1	0	17.38	0.07
Thursday	1.01	0.55	0	21.45	2.11
Friday	1.24	0	3.56	32.39	0
Saturday	0.92	0	2.73	2.14	0
Sunday	0.64	0	0	0.22	0
Weekends	0.75	0	0.23	0.57	0
Weekdays	1	0.1	0	25.76	0
All Days	0.92	0	0	22.59	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.04	0	0	0.66	0
Tuesday	0.14	0	0	0.74	0
Wednesday	0.04	0	0	0.61	0
Thursday	0.04	0.02	0	0.7	0.09
Friday	0.05	0	0.15	0.92	0
Saturday	0.04	0	0.12	0.09	0
Sunday	0.03	0	0	0.01	0
Weekends	0.03	0	0.01	0.02	0
Weekdays	0.04	0	0	0.86	0
All Days	0.04	0	0	0.8	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	24.01	23.23	23.05	45.94	23.77
Tuesday	26.4	23.34	23.14	49.23	23.73
Wednesday	24.01	23.42	23.19	46.03	24.18
Thursday	24.18	23.85	23.19	52.01	26.29
Friday	24.4	23.21	27.18	67.66	24.42
Saturday	24.26	23.27	26.45	25.64	24.13
Sunday	23.96	23.61	23.29	23.67	23.88
Weekends	24.08	23.45	23.77	24.04	23.96
Weekdays	24.16	23.43	23.22	55.85	24.23
All Days	24.13	23.33	23.3	50.79	24.11

Performance Summaries for I-40 between JOHNSTON--WAKE County Border (GARNER) (NORTH) and I-540,
Eastbound April 2015 through June 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.04	1	1	1.99	1.03
Tuesday	1.14	1.01	1	2.13	1.03
Wednesday	1.04	1.01	1	1.99	1.05
Thursday	1.05	1.03	1	2.25	1.14
Friday	1.05	1	1.18	2.93	1.06
Saturday	1.05	1.01	1.14	1.11	1.04
Sunday	1.04	1.02	1.01	1.02	1.03
Weekends	1.04	1.01	1.03	1.04	1.04
Weekdays	1.04	1.01	1	2.41	1.05
All Days	1.04	1.01	1.01	2.2	1.04

Speed (mph)

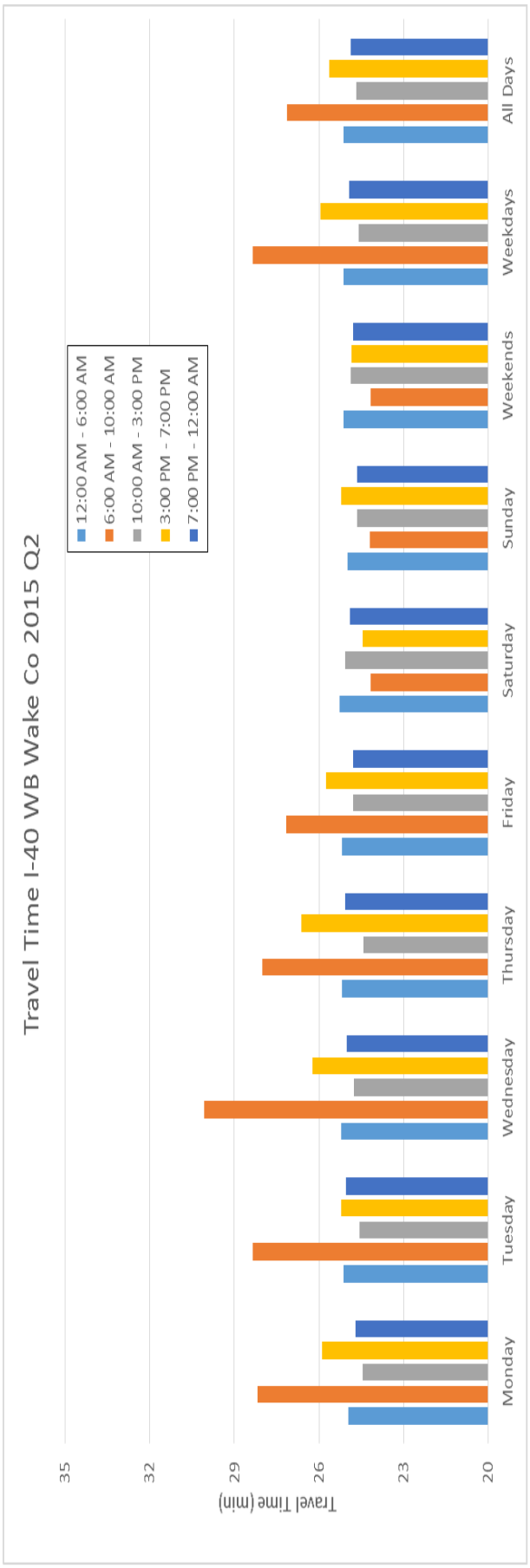
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.33	67.71	68.24	56.91	67.09
Tuesday	65.08	67.44	68.01	54.4	67.11
Wednesday	66.17	67.09	67.77	52.99	66.27
Thursday	65.72	67.56	67.33	50.03	65.52
Friday	65.55	67.76	65.78	41.57	66.33
Saturday	66.11	68.81	67.02	67.03	67.37
Sunday	66.87	67.95	68.96	67.08	67.45
Weekends	66.49	68.38	67.97	67.06	67.41
Weekdays	65.77	67.51	67.41	50.54	66.46
All Days	65.97	67.76	67.58	54.42	66.73

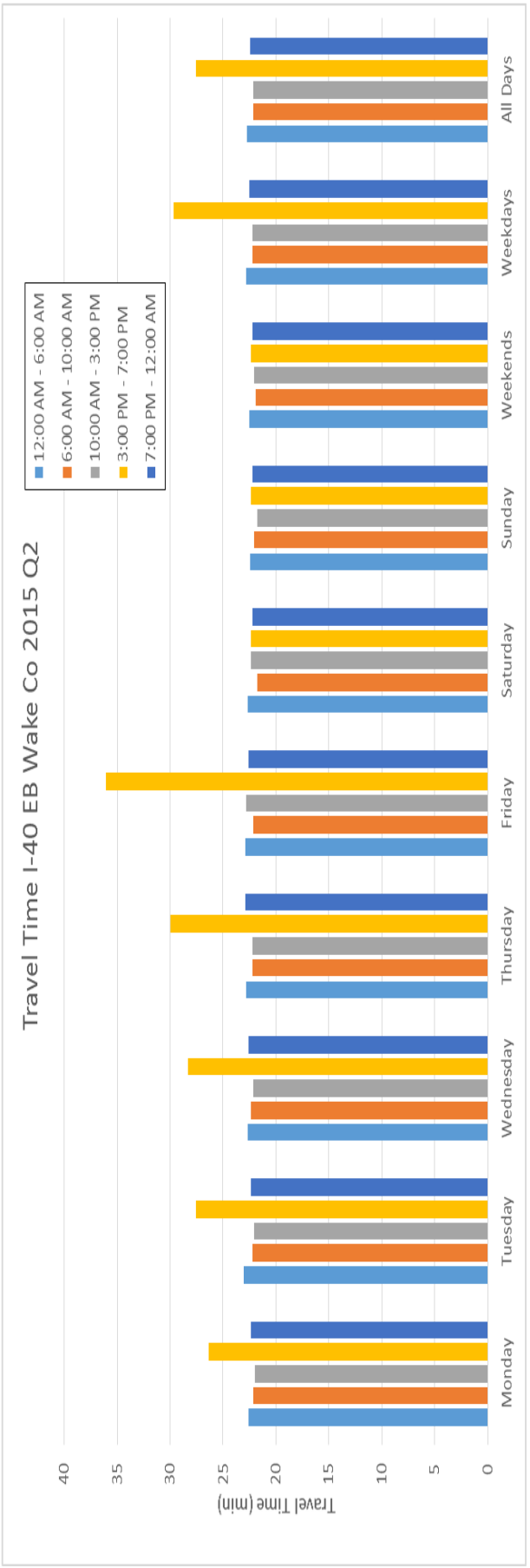
Travel time (minutes)

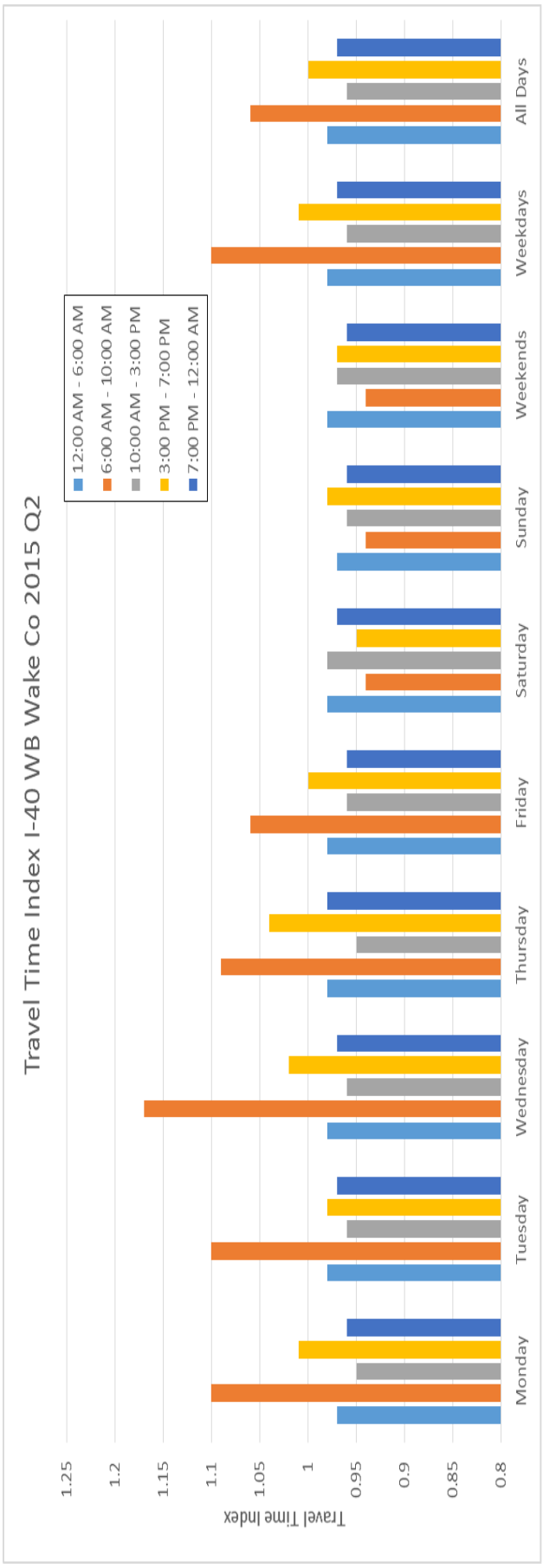
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	22.59	22.13	21.96	26.33	22.34
Tuesday	23.02	22.22	22.03	27.54	22.33
Wednesday	22.65	22.34	22.11	28.28	22.61
Thursday	22.8	22.18	22.25	29.95	22.87
Friday	22.86	22.11	22.78	36.04	22.59
Saturday	22.67	21.78	22.36	22.35	22.24
Sunday	22.41	22.05	21.73	22.34	22.21
Weekends	22.54	21.91	22.04	22.35	22.23
Weekdays	22.78	22.19	22.23	29.65	22.55
All Days	22.71	22.11	22.17	27.54	22.46

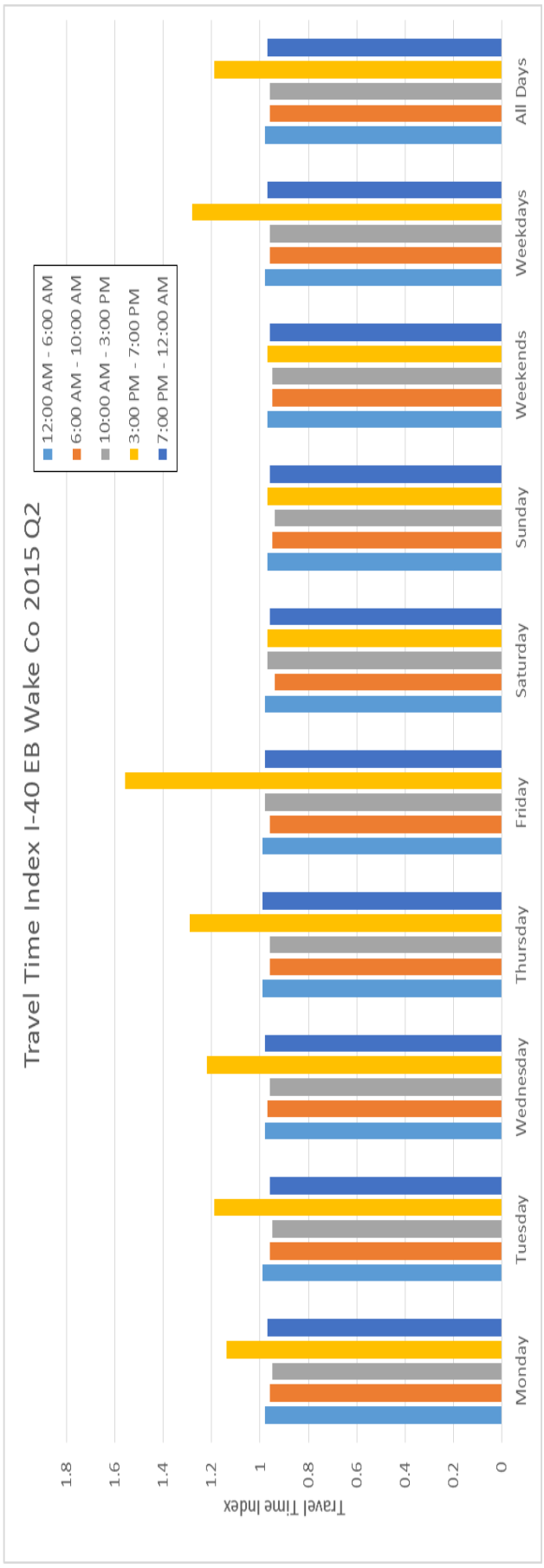
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.98	0.96	0.95	1.14	0.97
Tuesday	0.99	0.96	0.95	1.19	0.96
Wednesday	0.98	0.97	0.96	1.22	0.98
Thursday	0.99	0.96	0.96	1.29	0.99
Friday	0.99	0.96	0.98	1.56	0.98
Saturday	0.98	0.94	0.97	0.97	0.96
Sunday	0.97	0.95	0.94	0.97	0.96
Weekends	0.97	0.95	0.95	0.97	0.96
Weekdays	0.98	0.96	0.96	1.28	0.97
All Days	0.98	0.96	0.96	1.19	0.97


Travel Time I-40 WB Wake Co 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
35
32
29
26
23
20
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Wake Co 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
40
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Wake Co 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Wake Co 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

I-40, NCDOT Division 5, Q1 2014 to Q2 2015

Q1 2014:

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Westbound January 2014 through March 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.49	22.7	0	0.93	1.38
Tuesday	1.73	22.78	0	4.55	2.96
Wednesday	0.98	21.04	0.88	42.67	1.81
Thursday	1.15	11.39	0	6.59	0.15
Friday	1.09	7.07	0	11.75	0
Saturday	0.92	0	0	0	0
Sunday	0.84	0	0	0.1	0
Weekends	0.84	0	0	0	0
Weekdays	1.01	14.68	0	7.96	0.58
All Days	1	10.84	0	5.19	0.26
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.51	0	0.02	0.04
Tuesday	0.05	0.53	0	0.12	0.08
Wednesday	0.03	0.49	0.02	1.1	0.05
Thursday	0.03	0.26	0	0.17	0
Friday	0.03	0.18	0	0.27	0
Saturday	0.02	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.03	0.34	0	0.2	0.01
All Days	0.03	0.26	0	0.13	0.01
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	39.27	69.13	38.05	40.21	41.13
Tuesday	40.52	68.19	38.67	44.19	42.81
Wednesday	39.76	69.65	39.74	82.25	41.27
Thursday	39.95	57.7	38.2	46.97	39.78
Friday	39.88	47.62	38.68	56.25	39.76
Saturday	39.84	38.62	38.32	38.6	39.98
Sunday	39.72	39.08	38.66	40.87	39.51
Weekends	39.74	39.06	38.56	40.15	39.78
Weekdays	39.8	60.06	38.35	48.47	40.39
All Days	39.82	54.72	38.36	45.54	40.12

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Westbound January 2014 through March 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.79	0.99	1.04	1.07
Tuesday	1.05	1.77	1	1.15	1.11
Wednesday	1.03	1.81	1.03	2.13	1.07
Thursday	1.04	1.5	0.99	1.22	1.03
Friday	1.03	1.24	1	1.46	1.03
Saturday	1.03	1	0.99	1	1.04
Sunday	1.03	1.01	1	1.06	1.02
Weekends	1.03	1.01	1	1.04	1.03
Weekdays	1.03	1.56	0.99	1.26	1.05
All Days	1.03	1.42	1	1.18	1.04

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.3	58.8	69.19	68.12	67.11
Tuesday	66.61	56.86	66.41	67.07	66.15
Wednesday	66.59	58.28	65.09	59.8	65.84
Thursday	66.41	61.19	68.88	65.89	67.64
Friday	66.89	65.65	68.89	62.86	67.6
Saturday	66.66	69.44	69.77	69.51	67.91
Sunday	66.46	68.63	69.8	67.7	67.63
Weekends	66.56	69.04	69.79	68.59	67.77
Weekdays	66.76	60.06	67.67	64.56	66.87
All Days	66.7	62.41	68.27	65.68	67.13

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	37.22	42.6	36.21	36.77	37.33
Tuesday	37.61	44.05	37.72	37.35	37.86
Wednesday	37.62	42.98	38.48	41.89	38.05
Thursday	37.72	40.94	36.37	38.02	37.04
Friday	37.45	38.16	36.36	39.85	37.05
Saturday	37.58	36.07	35.9	36.04	36.89
Sunday	37.69	36.5	35.89	37	37.04
Weekends	37.63	36.28	35.89	36.52	36.96
Weekdays	37.52	41.71	37.01	38.8	37.46
All Days	37.55	40.14	36.69	38.14	37.31

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.1	0.94	0.95	0.97
Tuesday	0.97	1.14	0.98	0.97	0.98
Wednesday	0.98	1.11	1	1.09	0.99
Thursday	0.98	1.06	0.94	0.99	0.96
Friday	0.97	0.99	0.94	1.03	0.96
Saturday	0.97	0.94	0.93	0.94	0.96
Sunday	0.98	0.95	0.93	0.96	0.96
Weekends	0.98	0.94	0.93	0.95	0.96
Weekdays	0.97	1.08	0.96	1.01	0.97
All Days	0.97	1.04	0.95	0.99	0.97

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound January 2014 through March 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.54	7.15	0	13.71	3.22
Tuesday	2.26	2.87	0	18.34	4.52
Wednesday	2.27	1.51	2.03	53.98	0.59
Thursday	1.13	4.88	0	18.86	0
Friday	1.11	1.95	0	32.11	0
Saturday	0.95	0	0	0	0.04
Sunday	0.69	0	0	0	0
Weekends	0.86	0	0	0	0
Weekdays	1.33	3.46	0	25.62	0.45
All Days	1.18	1.6	0	18.13	0.1
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.2	0	0.34	0.09
Tuesday	0.06	0.08	0	0.45	0.13
Wednesday	0.06	0.04	0.06	1.31	0.02
Thursday	0.03	0.14	0	0.43	0
Friday	0.03	0.06	0	0.66	0
Saturday	0.03	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.04	0.1	0	0.6	0.01
All Days	0.03	0.04	0	0.45	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	40.15	45.96	38	58.23	43.4
Tuesday	41.88	41.71	37.85	63.39	45.03
Wednesday	41.89	40.28	40.83	99.18	41.39
Thursday	40.77	43.51	38.15	66.77	39.84
Friday	40.74	40.79	38.66	85.46	40.82
Saturday	40.77	39.34	38.19	38.26	40.92
Sunday	40.48	40.12	39.6	38.63	39.93
Weekends	40.66	39.93	38.55	38.45	40.27
Weekdays	40.96	42.24	38.18	72.97	41.31
All Days	40.86	41	38.26	63.34	40.93

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Eastbound January 2014 through March 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.04	1.19	0.99	1.51	1.13
Tuesday	1.09	1.08	0.98	1.64	1.17
Wednesday	1.09	1.04	1.06	2.57	1.07
Thursday	1.06	1.13	0.99	1.73	1.03
Friday	1.06	1.06	1	2.22	1.06
Saturday	1.06	1.02	0.99	0.99	1.06
Sunday	1.05	1.04	1.03	1	1.04
Weekends	1.05	1.04	1	1	1.04
Weekdays	1.06	1.1	0.99	1.89	1.07
All Days	1.06	1.06	0.99	1.64	1.06

Speed (mph)

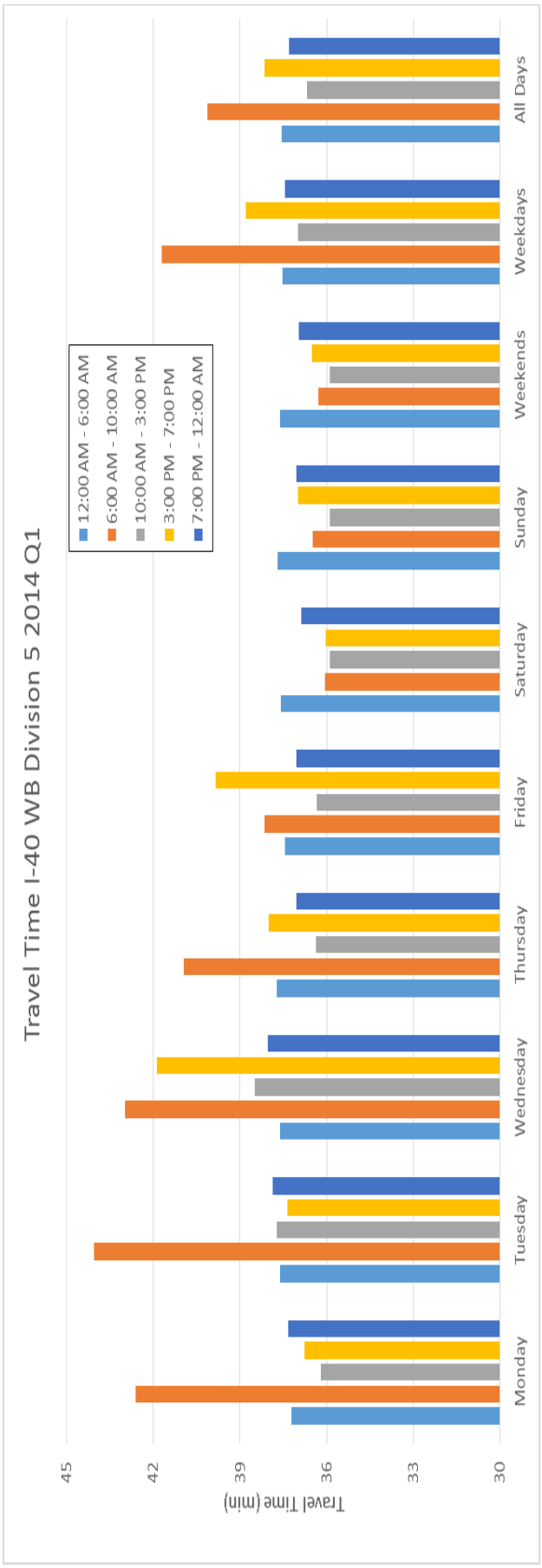
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.11	66.64	69.21	62.38	66.61
Tuesday	66.11	67.35	69.05	61.11	66.05
Wednesday	65.67	67.18	60.6	51.94	66.26
Thursday	66.2	67.1	69.16	59.73	67.59
Friday	66.4	67.86	68.74	52.73	67.33
Saturday	66.23	69.2	69.75	69.82	67.5
Sunday	66.59	67.68	69.56	69.48	68.52
Weekends	66.4	68.43	69.66	69.65	68
Weekdays	66.3	67.23	67.15	57.15	66.78
All Days	66.33	67.57	67.85	60.3	67.13

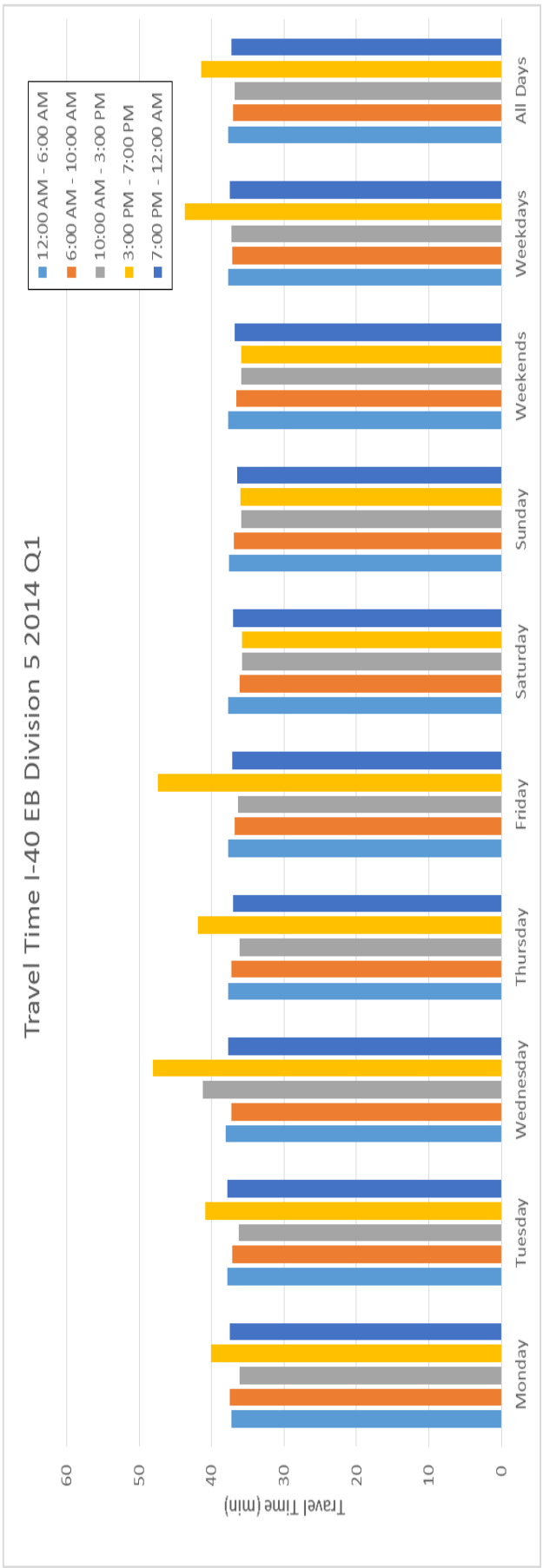
Travel time (minutes)

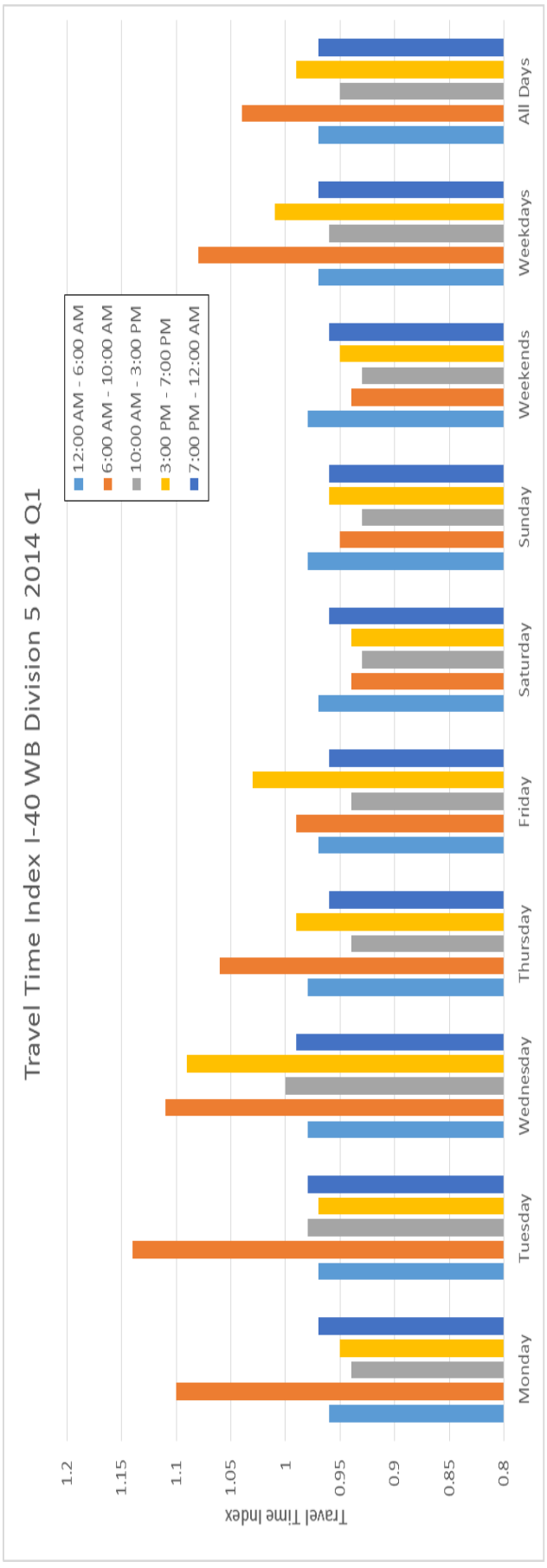
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	37.27	37.53	36.14	40.09	37.55
Tuesday	37.83	37.14	36.22	40.93	37.87
Wednesday	38.09	37.23	41.27	48.16	37.75
Thursday	37.78	37.28	36.16	41.88	37.01
Friday	37.67	36.86	36.39	47.43	37.15
Saturday	37.77	36.15	35.86	35.82	37.06
Sunday	37.56	36.96	35.96	36	36.51
Weekends	37.67	36.55	35.91	35.91	36.78
Weekdays	37.73	37.21	37.25	43.76	37.46
All Days	37.71	37.02	36.86	41.48	37.26

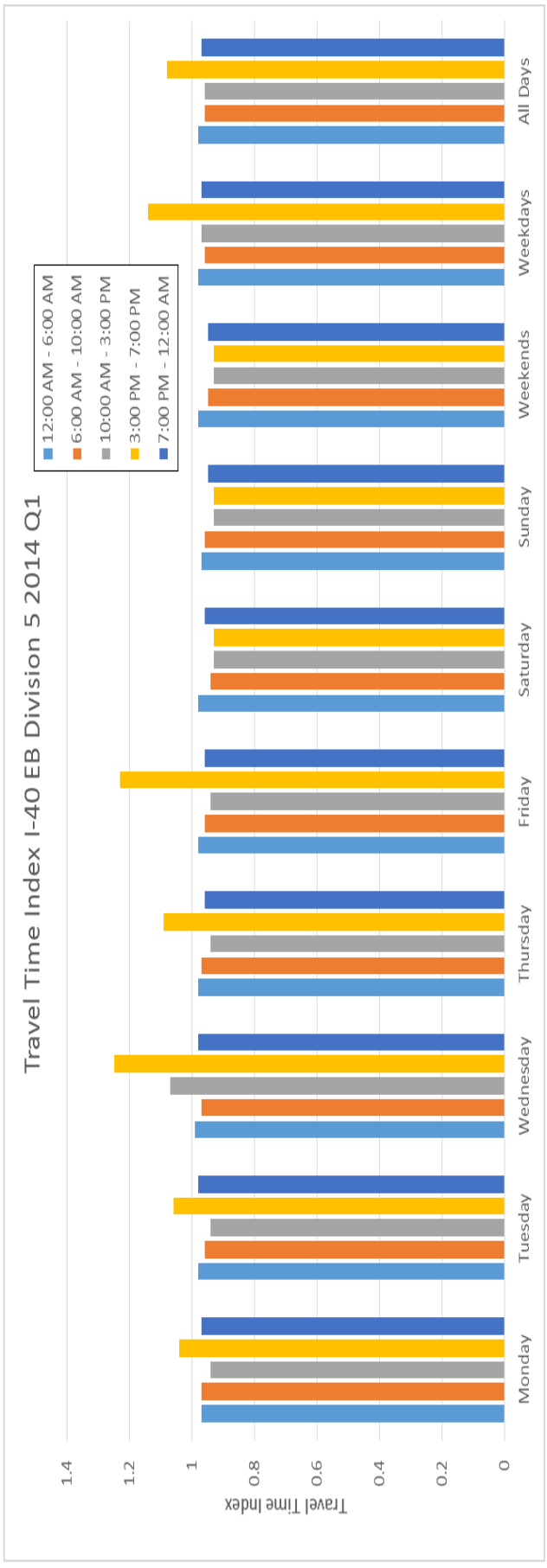
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.97	0.94	1.04	0.97
Tuesday	0.98	0.96	0.94	1.06	0.98
Wednesday	0.99	0.97	1.07	1.25	0.98
Thursday	0.98	0.97	0.94	1.09	0.96
Friday	0.98	0.96	0.94	1.23	0.96
Saturday	0.98	0.94	0.93	0.93	0.96
Sunday	0.97	0.96	0.93	0.93	0.95
Weekends	0.98	0.95	0.93	0.93	0.95
Weekdays	0.98	0.96	0.97	1.14	0.97
All Days	0.98	0.96	0.96	1.08	0.97


Travel Time I-40 WB Division 5 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
45
42
39
36
33
30
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Division 5 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
60
50
40
30
20
10
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Division 5 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Division 5 2014 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q2 2014:

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Westbound April 2014 through June 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.44	14.13	0	2.53	0
Tuesday	0.5	23.76	0	15.73	0
Wednesday	0.43	13.81	0	13.28	0.03
Thursday	0.54	11.4	0	15.89	0
Friday	1.43	5.67	0	19.04	0.37
Saturday	0.9	0	0	0	0.05
Sunday	1.3	0	0	2.1	0.03
Weekends	0.84	0	0	0.2	0
Weekdays	0.61	13.63	0	13.11	0
All Days	0.71	10.59	0	9.18	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.34	0	0.07	0
Tuesday	0.01	0.58	0	0.42	0
Wednesday	0.01	0.34	0	0.35	0
Thursday	0.01	0.27	0	0.41	0
Friday	0.04	0.15	0	0.46	0.01
Saturday	0.02	0	0	0	0
Sunday	0.04	0	0	0.06	0
Weekends	0.02	0	0	0.01	0
Weekdays	0.02	0.33	0	0.34	0
All Days	0.02	0.27	0	0.24	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	38.14	58.63	36.83	42.14	38.18
Tuesday	38.22	67.57	36.65	54.21	38.38
Wednesday	38.14	57.21	36.83	51.73	38.33
Thursday	38.26	55.76	37.41	55.08	38.44
Friday	39.15	44.59	37.34	62.49	39.59
Saturday	38.74	36.85	37.45	36.81	38.97
Sunday	39.11	37.92	37.37	42.93	38.74
Weekends	38.66	37.66	37.41	40.26	38.79
Weekdays	38.32	56.86	36.88	52.42	38.48
All Days	38.45	52.72	36.94	49.38	38.54

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Westbound April 2014 through June 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.56	0.98	1.12	1.02
Tuesday	1.02	1.8	0.98	1.45	1.02
Wednesday	1.02	1.53	0.98	1.38	1.02
Thursday	1.02	1.49	1	1.47	1.03
Friday	1.04	1.19	1	1.67	1.06
Saturday	1.03	0.98	1	0.98	1.04
Sunday	1.04	1.01	1	1.15	1.03
Weekends	1.03	1	1	1.07	1.03
Weekdays	1.02	1.52	0.98	1.4	1.03
All Days	1.03	1.41	0.99	1.32	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.42	61.59	69.41	68.13	68.32
Tuesday	67.43	58.42	69.41	63.14	67.97
Wednesday	67.42	61.15	69.31	64.42	68.05
Thursday	67.5	62.67	68.52	63.09	68.2
Friday	67.05	66.46	68.45	59.78	66.93
Saturday	66.76	70.71	69.63	69.75	68.15
Sunday	66.56	69.43	69.65	67.99	68.32
Weekends	66.66	70.06	69.64	68.86	68.23
Weekdays	67.36	61.95	69.02	63.6	67.89
All Days	67.16	64.08	69.2	65.03	67.99

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.12	39.54	35.08	35.74	35.64
Tuesday	36.11	41.68	35.09	38.57	35.83
Wednesday	36.12	39.82	35.13	37.8	35.79
Thursday	36.08	38.86	35.54	38.6	35.7
Friday	36.32	36.64	35.58	40.74	36.38
Saturday	36.48	34.44	34.97	34.92	35.73
Sunday	36.59	35.07	34.96	35.82	35.64
Weekends	36.53	34.76	34.97	35.37	35.69
Weekdays	36.15	39.31	35.28	38.29	35.87
All Days	36.26	38	35.19	37.45	35.82

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.05	0.94	0.95	0.95
Tuesday	0.96	1.11	0.94	1.03	0.96
Wednesday	0.96	1.06	0.94	1.01	0.95
Thursday	0.96	1.04	0.95	1.03	0.95
Friday	0.97	0.98	0.95	1.09	0.97
Saturday	0.97	0.92	0.93	0.93	0.95
Sunday	0.98	0.94	0.93	0.96	0.95
Weekends	0.97	0.93	0.93	0.94	0.95
Weekdays	0.96	1.05	0.94	1.02	0.96
All Days	0.97	1.01	0.94	1	0.96

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound April 2014 through June 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.58	0.45	0	11.96	0
Tuesday	0.52	10.9	0	21.22	0
Wednesday	0.58	4.41	0	19.91	0.95
Thursday	0.5	0	0	49.74	0.54
Friday	1.54	0	0	36.14	0
Saturday	0.83	0	0	0	0
Sunday	0.69	0	0	0	0
Weekends	0.75	0	0	0	0
Weekdays	0.64	0.39	0	32.52	0
All Days	0.67	0	0	26.64	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.01	0	0.31	0
Tuesday	0.02	0.32	0	0.54	0
Wednesday	0.02	0.13	0	0.49	0.03
Thursday	0.01	0	0	1.18	0.02
Friday	0.05	0	0	0.77	0
Saturday	0.02	0	0	0	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0	0
Weekdays	0.02	0.01	0	0.78	0
All Days	0.02	0	0	0.67	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	39.15	38.25	36.82	54.97	38.92
Tuesday	39.11	48.5	36.69	65.5	39.01
Wednesday	39.16	42.13	36.9	64.33	40.67
Thursday	39.1	37.33	37.53	96.91	40.16
Friday	40.14	37.1	37.13	88.59	40.24
Saturday	39.57	37.49	37.84	37	39.57
Sunday	39.43	39.01	37.31	37.22	39.1
Weekends	39.5	38.92	37.37	37.12	39.3
Weekdays	39.22	38.07	36.99	78.84	39.31
All Days	39.31	37.75	37.03	70.75	39.35

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G
Eastbound April 2014 through June 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.04	1.02	0.98	1.47	1.04
Tuesday	1.04	1.29	0.98	1.75	1.04
Wednesday	1.04	1.12	0.98	1.71	1.08
Thursday	1.04	0.99	1	2.58	1.07
Friday	1.07	0.99	0.99	2.36	1.07
Saturday	1.05	1	1.01	0.99	1.05
Sunday	1.05	1.04	0.99	0.99	1.04
Weekends	1.05	1.04	1	0.99	1.05
Weekdays	1.05	1.01	0.99	2.1	1.05
All Days	1.05	1.01	0.99	1.89	1.05

Speed (mph)

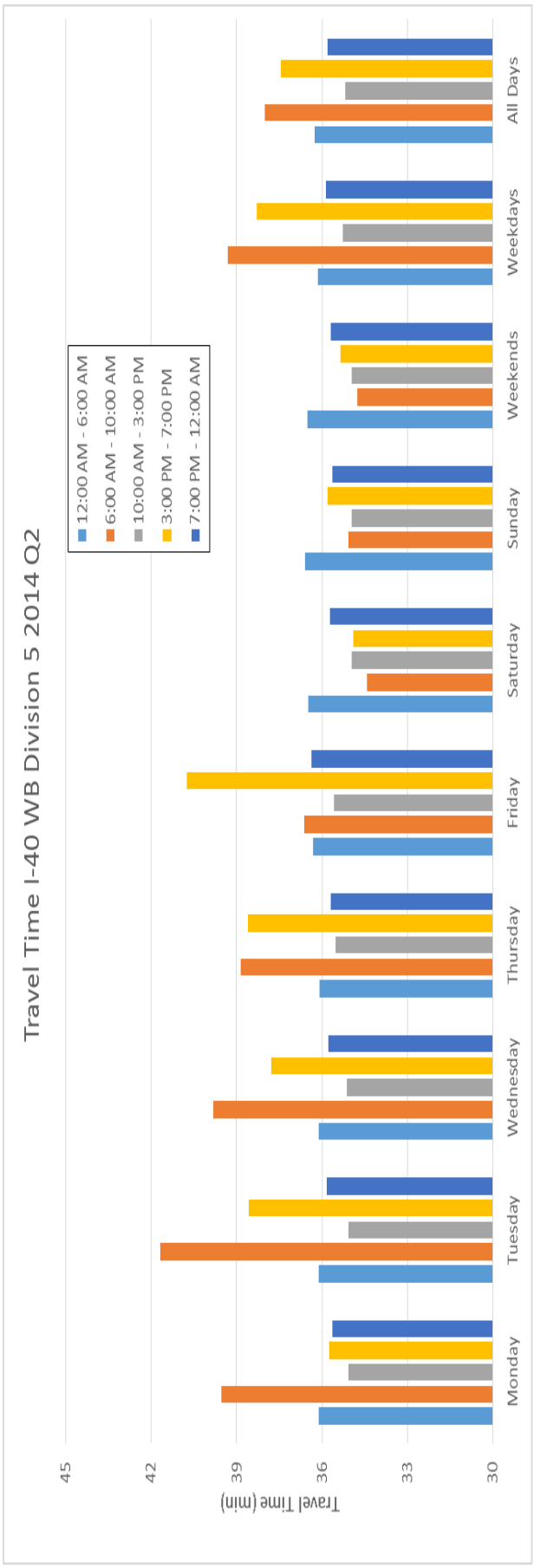
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.08	68.79	69.39	61.75	68.48
Tuesday	66.84	62.61	68.77	59.74	68.34
Wednesday	67.06	66.89	69.17	58.64	68.31
Thursday	67.18	68.39	68.15	49.13	65.31
Friday	66.72	67.2	68.76	49.41	67.92
Saturday	66.87	69.85	69.31	70	68.32
Sunday	66.39	68.66	70.06	69.45	68.5
Weekends	66.63	69.25	69.68	69.72	68.41
Weekdays	66.98	66.69	68.85	55.2	67.65
All Days	66.88	67.4	69.09	58.72	67.86

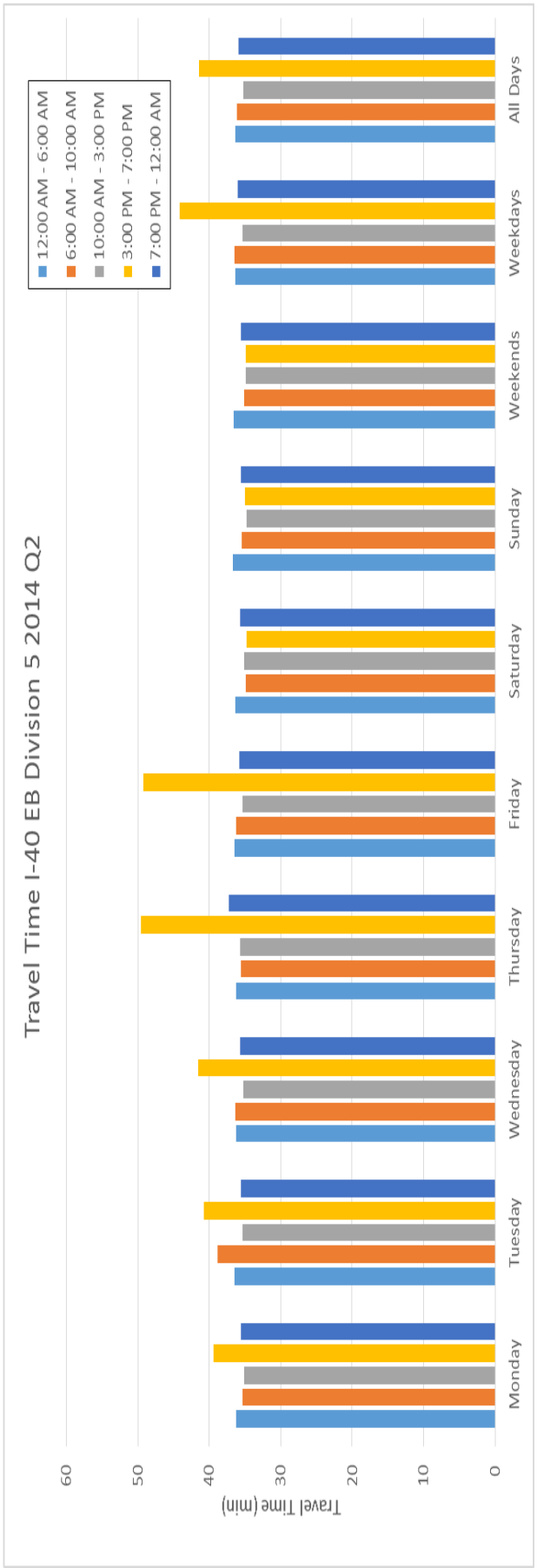
Travel time (minutes)

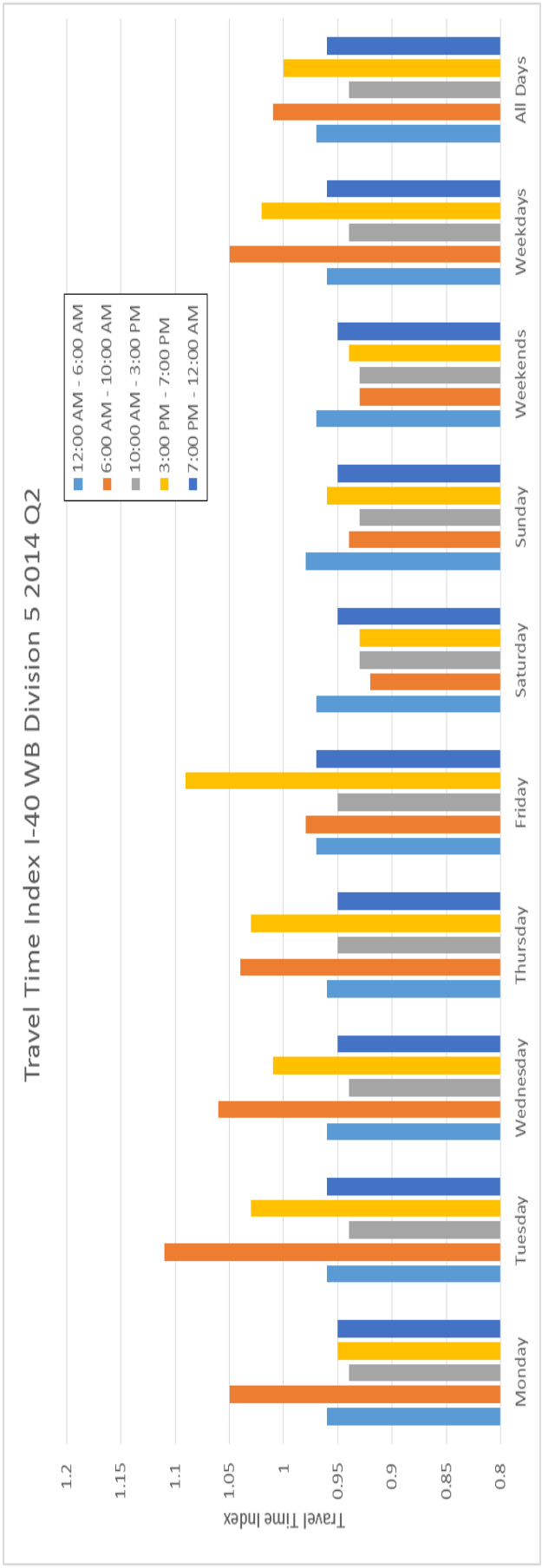
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.3	35.4	35.09	39.43	35.56
Tuesday	36.43	38.89	35.41	40.75	35.63
Wednesday	36.31	36.4	35.2	41.52	35.64
Thursday	36.25	35.6	35.73	49.56	37.28
Friday	36.49	36.23	35.41	49.28	35.85
Saturday	36.41	34.86	35.13	34.79	35.64
Sunday	36.68	35.46	34.75	35.06	35.54
Weekends	36.54	35.16	34.94	34.92	35.59
Weekdays	36.35	36.51	35.37	44.11	35.99
All Days	36.41	36.12	35.24	41.47	35.88

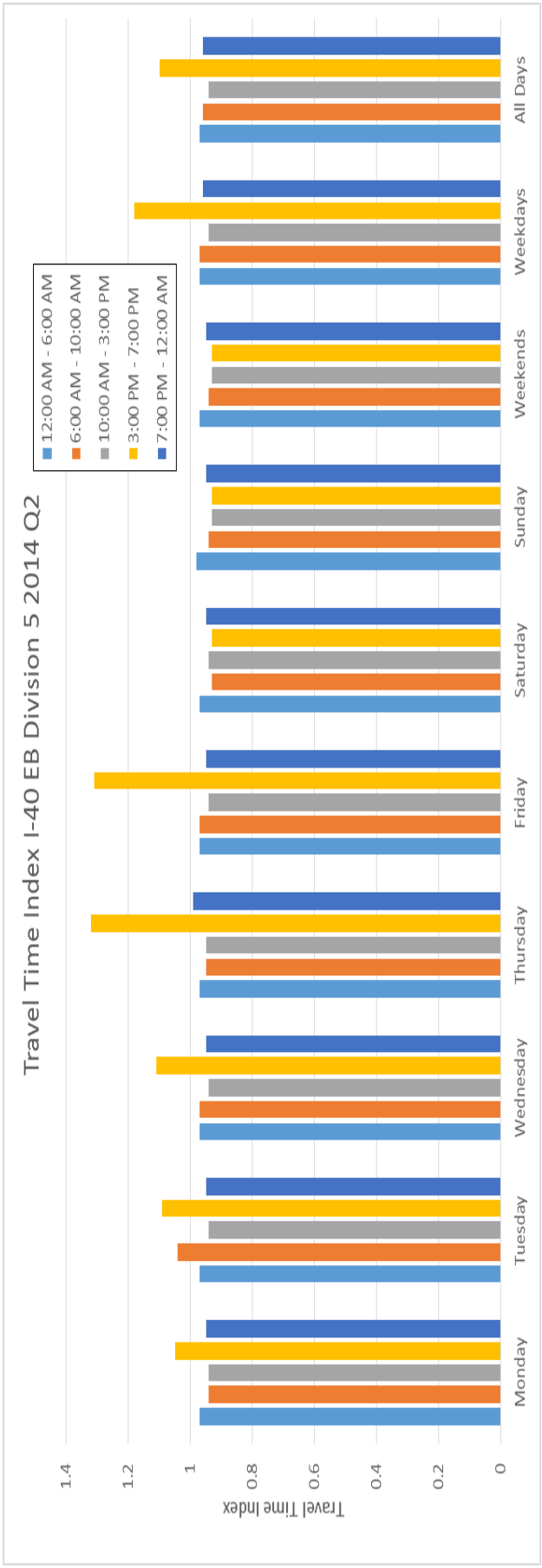
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.94	0.94	1.05	0.95
Tuesday	0.97	1.04	0.94	1.09	0.95
Wednesday	0.97	0.97	0.94	1.11	0.95
Thursday	0.97	0.95	0.95	1.32	0.99
Friday	0.97	0.97	0.94	1.31	0.95
Saturday	0.97	0.93	0.94	0.93	0.95
Sunday	0.98	0.94	0.93	0.93	0.95
Weekends	0.97	0.94	0.93	0.93	0.95
Weekdays	0.97	0.97	0.94	1.18	0.96
All Days	0.97	0.96	0.94	1.1	0.96


Travel Time I-40 WB Division 5 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
45
42
39
36
33
30
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Division 5 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
60
50
40
30
20
10
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Division 5 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Division 5 2014 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q3 2014:

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Westbound July 2014 through September 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.81	23.32	0	2.21	0
Tuesday	0.63	16.03	0	4.88	0.29
Wednesday	0.64	19.1	0	9.91	0
Thursday	0.75	17.86	0.47	8.92	0.39
Friday	1	4.42	0	21.35	0
Saturday	1.14	0	0.65	3.37	0.48
Sunday	1.73	0	0	0.04	0.39
Weekends	1.14	0	0.38	0.64	0.41
Weekdays	0.85	14.41	0	10.45	0.08
All Days	0.91	11.04	0	7.53	0.19
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.56	0	0.06	0
Tuesday	0.02	0.39	0	0.13	0.01
Wednesday	0.02	0.46	0	0.26	0
Thursday	0.02	0.43	0.01	0.23	0.01
Friday	0.03	0.12	0	0.52	0
Saturday	0.03	0	0.02	0.09	0.01
Sunday	0.05	0	0	0	0.01
Weekends	0.03	0	0.01	0.02	0.01
Weekdays	0.02	0.35	0	0.27	0
All Days	0.02	0.28	0	0.2	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	38.32	67.8	37.25	41.67	38.36
Tuesday	38.34	59.68	36.64	43.36	38.73
Wednesday	38.35	62.85	37.04	48.37	38.02
Thursday	38.25	61.93	38.18	48.12	38.7
Friday	38.55	43.44	36.93	65.33	38.64
Saturday	38.98	37.11	41.15	43.55	39.2
Sunday	39.53	37.98	39.55	40.18	39.07
Weekends	38.96	37.73	40.53	40.73	39.04
Weekdays	38.47	57.64	37	49.8	38.53
All Days	38.66	53.17	37.38	47.92	38.69

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G
Westbound July 2014 through September 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.81	0.99	1.11	1.02
Tuesday	1.02	1.59	0.98	1.16	1.03
Wednesday	1.02	1.68	0.99	1.29	1.01
Thursday	1.02	1.65	1.02	1.28	1.03
Friday	1.03	1.16	0.99	1.74	1.03
Saturday	1.04	0.99	1.1	1.16	1.05
Sunday	1.05	1.01	1.06	1.07	1.04
Weekends	1.04	1.01	1.08	1.09	1.04
Weekdays	1.03	1.54	0.99	1.33	1.03
All Days	1.03	1.42	1	1.28	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.11	59.39	68.83	67.75	67.93
Tuesday	67.45	61.03	69.41	66.61	67.71
Wednesday	67.49	60.27	68.84	64.21	68.2
Thursday	67.57	60.11	67.32	65.36	67.92
Friday	67.57	65.81	69.11	59.52	68.09
Saturday	67.08	70.26	68.13	68.17	67.93
Sunday	66.41	68.93	69.22	68.25	67.22
Weekends	66.73	69.58	68.67	68.21	67.58
Weekdays	67.44	61.24	68.71	64.63	67.96
All Days	67.24	63.37	68.7	65.61	67.85

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.29	41.01	35.38	35.94	35.85
Tuesday	36.1	39.9	35.08	36.56	35.96
Wednesday	36.08	40.4	35.37	37.92	35.71
Thursday	36.04	40.51	36.17	37.26	35.85
Friday	36.04	37	35.24	40.91	35.77
Saturday	36.3	34.66	35.75	35.72	35.85
Sunday	36.67	35.33	35.18	35.68	36.22
Weekends	36.49	35	35.46	35.7	36.03
Weekdays	36.11	39.76	35.44	37.68	35.83
All Days	36.22	38.43	35.45	37.12	35.89

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.09	0.94	0.96	0.96
Tuesday	0.96	1.06	0.94	0.97	0.96
Wednesday	0.96	1.08	0.94	1.01	0.95
Thursday	0.96	1.08	0.96	0.99	0.96
Friday	0.96	0.99	0.94	1.09	0.95
Saturday	0.97	0.93	0.95	0.95	0.96
Sunday	0.98	0.94	0.94	0.95	0.97
Weekends	0.97	0.93	0.95	0.95	0.96
Weekdays	0.96	1.06	0.95	1	0.96
All Days	0.97	1.02	0.95	0.99	0.96

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound July 2014 through September 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.6	6.33	0	16.08	0
Tuesday	0.74	2.81	0	17.91	0.38
Wednesday	0.81	1.02	0	43.31	0
Thursday	0.79	0.25	0	23.18	0.55
Friday	2.14	0	0	41.39	0
Saturday	0.89	0	0.38	1.52	0.19
Sunday	1.03	0	0	0	0
Weekends	0.96	0	0	0	0.01
Weekdays	0.89	1.76	0	29.3	0.02
All Days	0.93	0.66	0	23.95	0.02
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.18	0	0.41	0
Tuesday	0.02	0.08	0	0.45	0.01
Wednesday	0.02	0.03	0	1.08	0
Thursday	0.02	0.01	0	0.55	0.02
Friday	0.06	0	0	0.88	0
Saturday	0.03	0	0.01	0.04	0.01
Sunday	0.03	0	0	0	0
Weekends	0.03	0	0	0	0
Weekdays	0.03	0.05	0	0.7	0
All Days	0.03	0.02	0	0.6	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	39.04	44.12	37.21	59.98	38.19
Tuesday	39.32	40.4	36.69	61.77	39.07
Wednesday	39.39	38.79	36.94	90.49	39.38
Thursday	39.3	37.87	36.9	70.44	39.23
Friday	40.31	37.2	37.24	93.41	39.56
Saturday	39.64	37.68	39.57	39.9	38.97
Sunday	39.77	38.17	37.73	37.39	38.32
Weekends	39.7	38	38.46	37.9	38.65
Weekdays	39.46	39.48	36.98	75.8	38.93
All Days	39.56	38.65	37.27	68.23	38.86

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Eastbound July 2014 through September 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.04	1.18	0.99	1.6	1.02
Tuesday	1.05	1.08	0.98	1.65	1.04
Wednesday	1.05	1.03	0.98	2.41	1.05
Thursday	1.05	1.01	0.98	1.88	1.05
Friday	1.07	0.99	0.99	2.49	1.05
Saturday	1.06	1	1.05	1.06	1.04
Sunday	1.06	1.02	1.01	1	1.02
Weekends	1.06	1.01	1.03	1.01	1.03
Weekdays	1.05	1.05	0.99	2.02	1.04
All Days	1.05	1.03	0.99	1.82	1.04

Speed (mph)

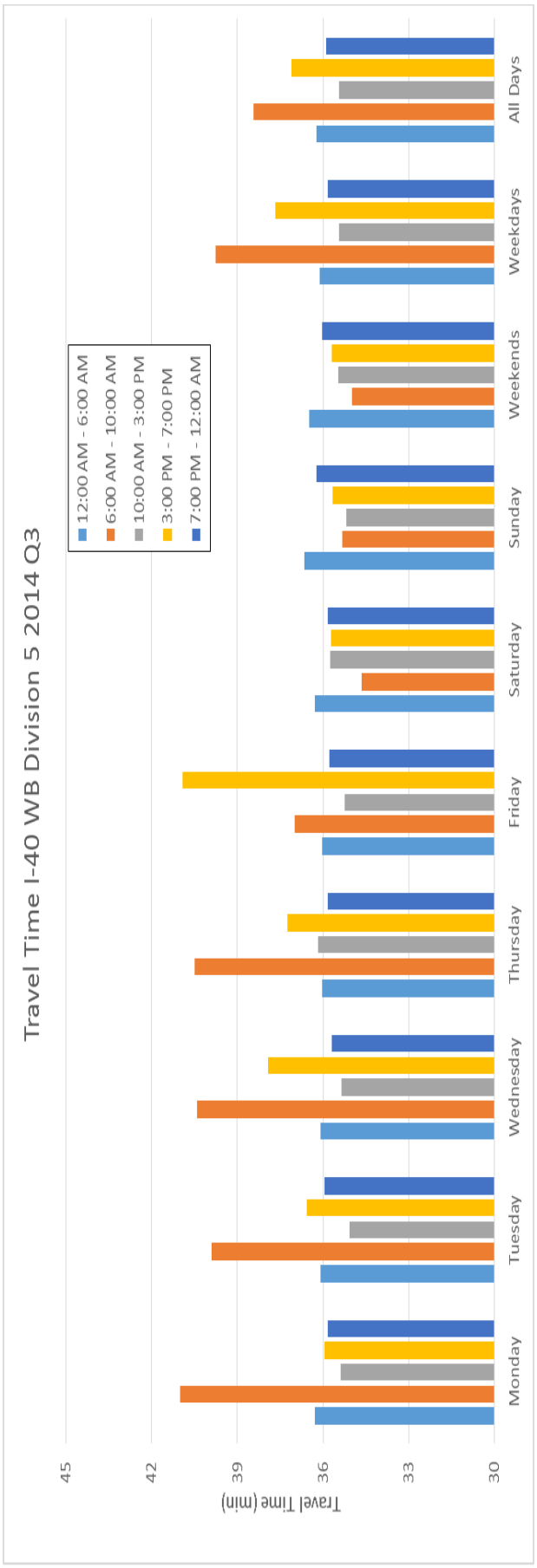
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.04	66.22	69.03	61.87	68.13
Tuesday	67.14	67.72	69.38	59.59	67.63
Wednesday	67.18	68.48	69.15	53.16	67.62
Thursday	67.22	67.88	68.82	57.13	67.61
Friday	66.85	69.1	68.78	51.17	67.58
Saturday	66.65	69.49	68.78	67.08	67.71
Sunday	66.49	68.59	69.64	69.58	68.39
Weekends	66.57	69.03	69.21	68.3	68.04
Weekdays	67.08	67.87	69.04	56.39	67.71
All Days	66.94	68.19	69.09	59.33	67.81

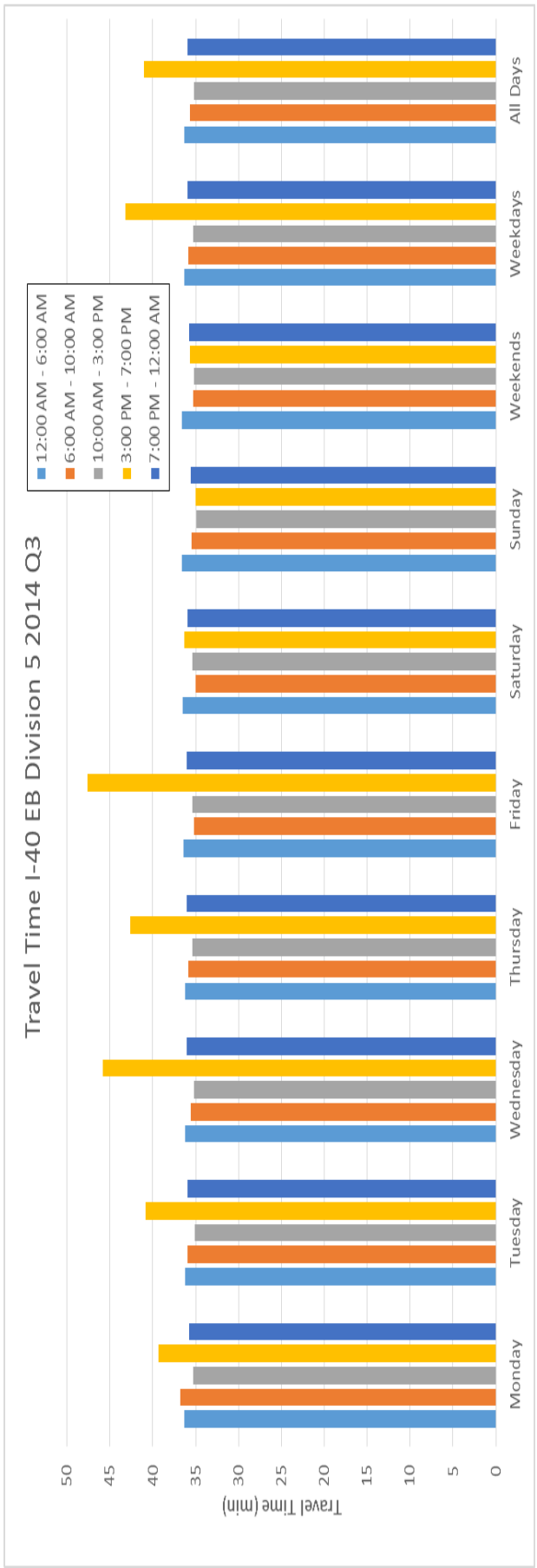
Travel time (minutes)

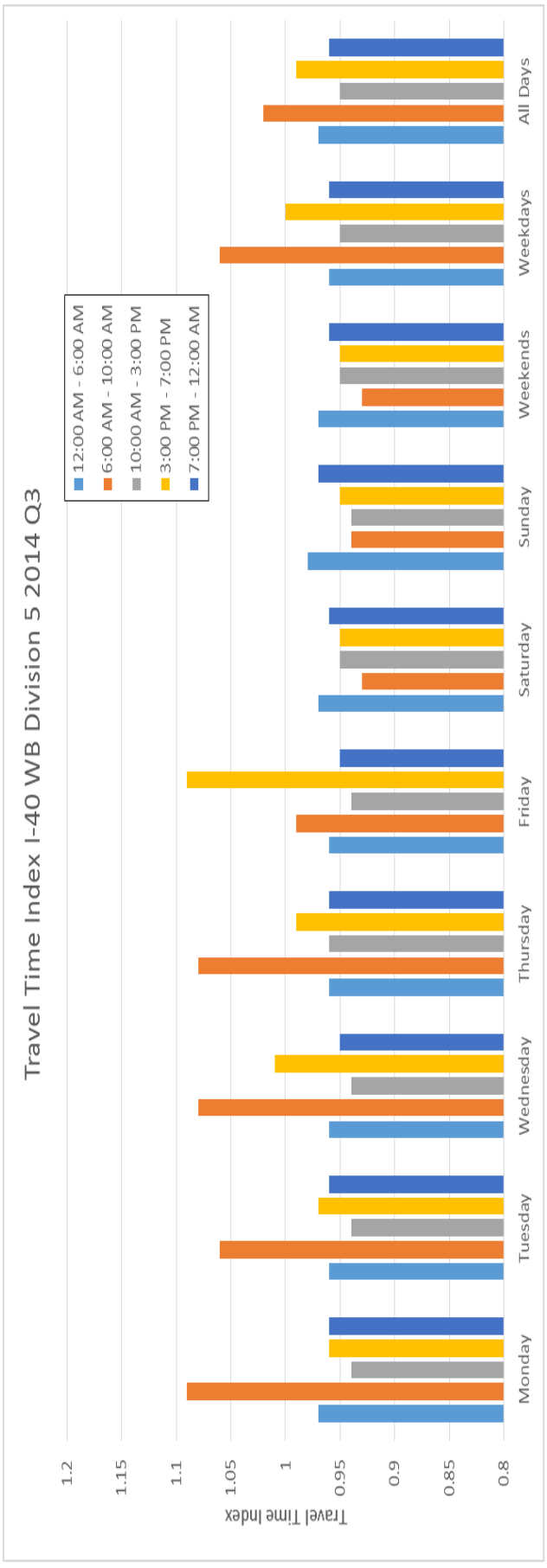
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.32	36.77	35.27	39.36	35.74
Tuesday	36.27	35.95	35.09	40.86	36
Wednesday	36.24	35.55	35.21	45.81	36.01
Thursday	36.22	35.87	35.38	42.62	36.01
Friday	36.42	35.24	35.4	47.58	36.03
Saturday	36.53	35.04	35.4	36.3	35.96
Sunday	36.62	35.5	34.96	35	35.6
Weekends	36.58	35.27	35.18	35.65	35.78
Weekdays	36.3	35.88	35.27	43.18	35.96
All Days	36.37	35.71	35.24	41.04	35.91

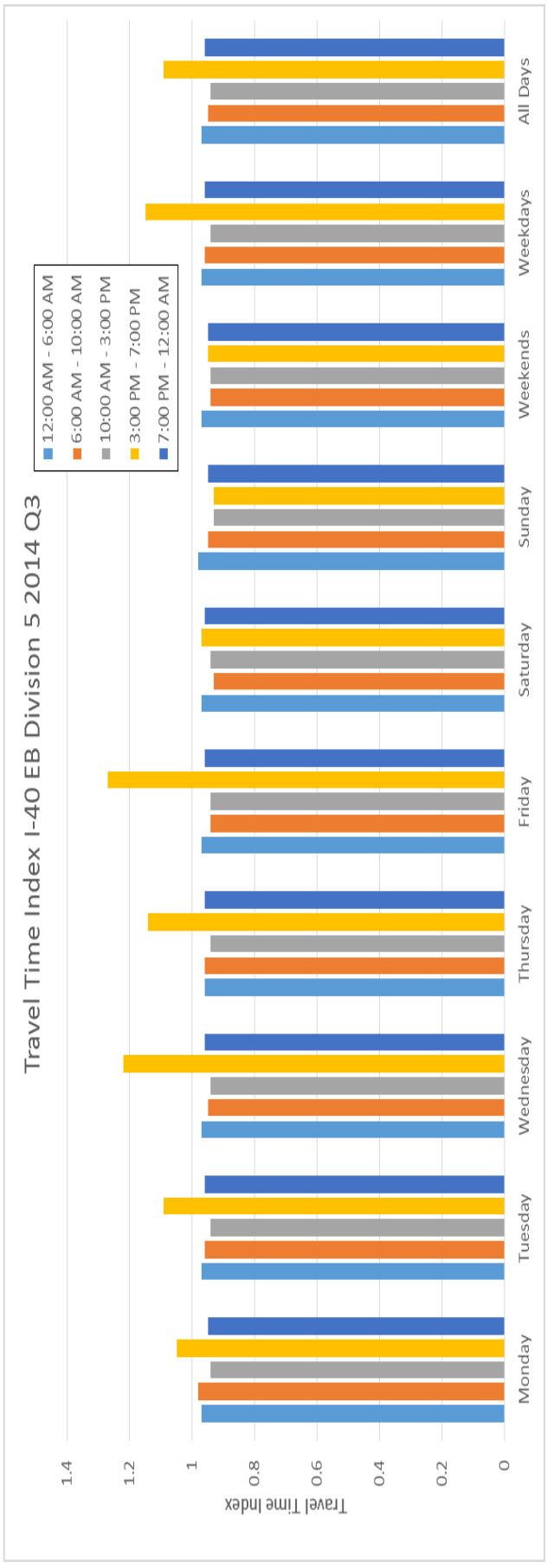
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.98	0.94	1.05	0.95
Tuesday	0.97	0.96	0.94	1.09	0.96
Wednesday	0.97	0.95	0.94	1.22	0.96
Thursday	0.96	0.96	0.94	1.14	0.96
Friday	0.97	0.94	0.94	1.27	0.96
Saturday	0.97	0.93	0.94	0.97	0.96
Sunday	0.98	0.95	0.93	0.93	0.95
Weekends	0.97	0.94	0.94	0.95	0.95
Weekdays	0.97	0.96	0.94	1.15	0.96
All Days	0.97	0.95	0.94	1.09	0.96


Travel Time I-40 WB Division 5 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
45
42
39
36
33
30
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Division 5 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
50
45
40
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Division 5 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Division 5 2014 Q3
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q4 2014:

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Westbound October 2014 through December 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.94	15.14	0	3.93	0.04
Tuesday	1.01	15.19	0.37	24.56	0.48
Wednesday	1.19	18.57	4.55	17.66	0.48
Thursday	1.01	11.52	4.12	14.16	0.39
Friday	1.09	10.6	1.13	30.16	2.12
Saturday	1.11	0	0	0.77	0.19
Sunday	0.95	0	0	1.28	0.24
Weekends	0.96	0	0	0.88	0.16
Weekdays	1.03	14.1	0.12	19.67	0.29
All Days	1	11.37	0	13.56	0.22
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.36	0	0.11	0
Tuesday	0.03	0.37	0.01	0.65	0.01
Wednesday	0.03	0.45	0.12	0.47	0.01
Thursday	0.03	0.28	0.11	0.37	0.01
Friday	0.03	0.28	0.03	0.73	0.06
Saturday	0.03	0	0	0.02	0
Sunday	0.03	0	0	0.03	0.01
Weekends	0.03	0	0	0.02	0
Weekdays	0.03	0.35	0	0.51	0.01
All Days	0.03	0.29	0	0.35	0.01
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	38.41	59.95	37.65	42.1	38.46
Tuesday	38.5	59.51	38.13	63.06	38.92
Wednesday	38.7	62.3	42.32	56.12	38.55
Thursday	38.5	55.45	41.86	53.37	38.68
Friday	38.58	49.98	38.94	72.33	41.12
Saturday	38.73	37.86	38.16	38.92	38.88
Sunday	38.53	38.1	37.55	41.11	38.74
Weekends	38.57	37.98	37.64	40.1	38.76
Weekdays	38.53	57.45	37.89	58.97	38.72
All Days	38.53	53.62	37.77	52.56	38.71

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Westbound October 2014 through December 2014

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.6	1	1.12	1.03
Tuesday	1.03	1.59	1.02	1.68	1.04
Wednesday	1.03	1.66	1.13	1.5	1.03
Thursday	1.03	1.48	1.12	1.42	1.03
Friday	1.03	1.33	1.04	1.93	1.1
Saturday	1.03	1.01	1.02	1.04	1.04
Sunday	1.03	1.02	1	1.1	1.03
Weekends	1.03	1.01	1	1.07	1.03
Weekdays	1.03	1.53	1.01	1.57	1.03
All Days	1.03	1.43	1.01	1.4	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.48	59.59	68.8	66.25	67.52
Tuesday	67.32	60.84	67.76	60.77	66.41
Wednesday	66.91	59.22	67.26	61.45	67.25
Thursday	67.01	60.91	67.73	63.04	67.34
Friday	67.19	63.9	68.3	56.79	65.02
Saturday	67.14	69.43	67.88	67.5	67.43
Sunday	67.47	69.12	69.65	68.36	67.91
Weekends	67.31	69.27	68.78	67.94	67.67
Weekdays	67.18	60.82	67.96	61.5	66.7
All Days	67.22	62.93	68.18	63.16	66.97

Travel time (minutes)

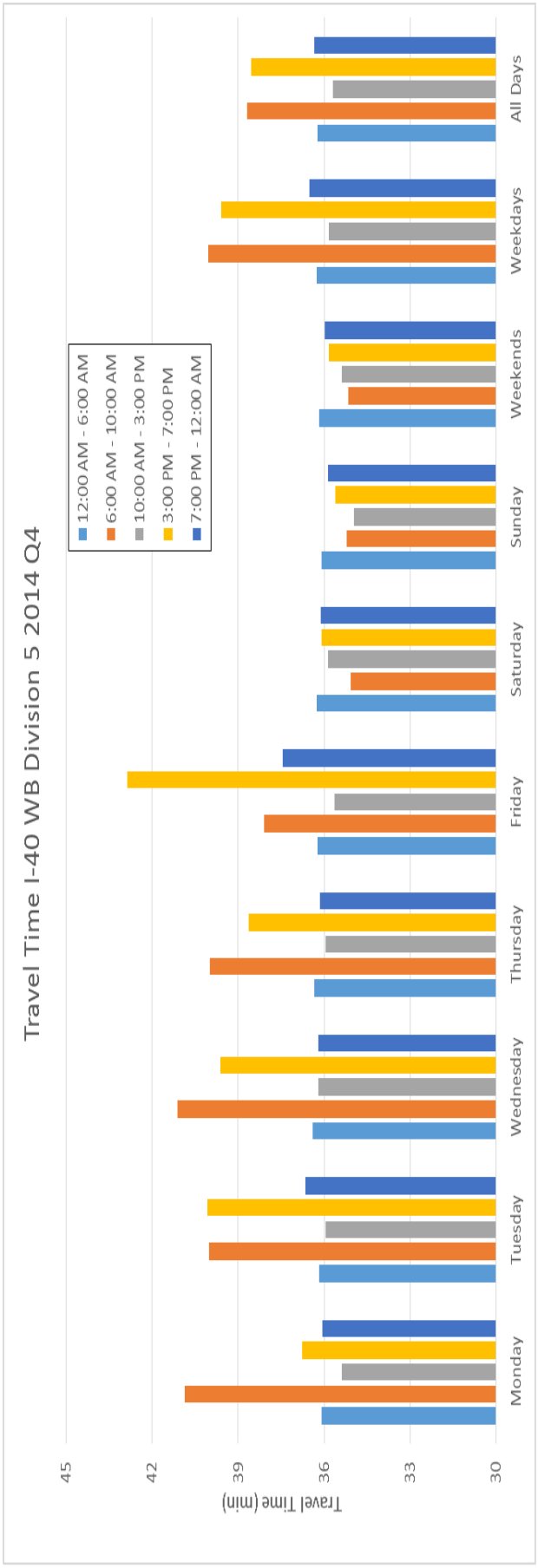
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.09	40.86	35.39	36.76	36.06
Tuesday	36.17	40.03	35.94	40.07	36.67
Wednesday	36.4	41.12	36.21	39.63	36.21
Thursday	36.34	39.98	35.95	38.63	36.16
Friday	36.24	38.11	35.65	42.88	37.45
Saturday	36.27	35.07	35.87	36.08	36.11
Sunday	36.09	35.23	34.96	35.62	35.86
Weekends	36.18	35.16	35.4	35.84	35.99
Weekdays	36.25	40.04	35.83	39.59	36.51
All Days	36.23	38.7	35.71	38.56	36.36

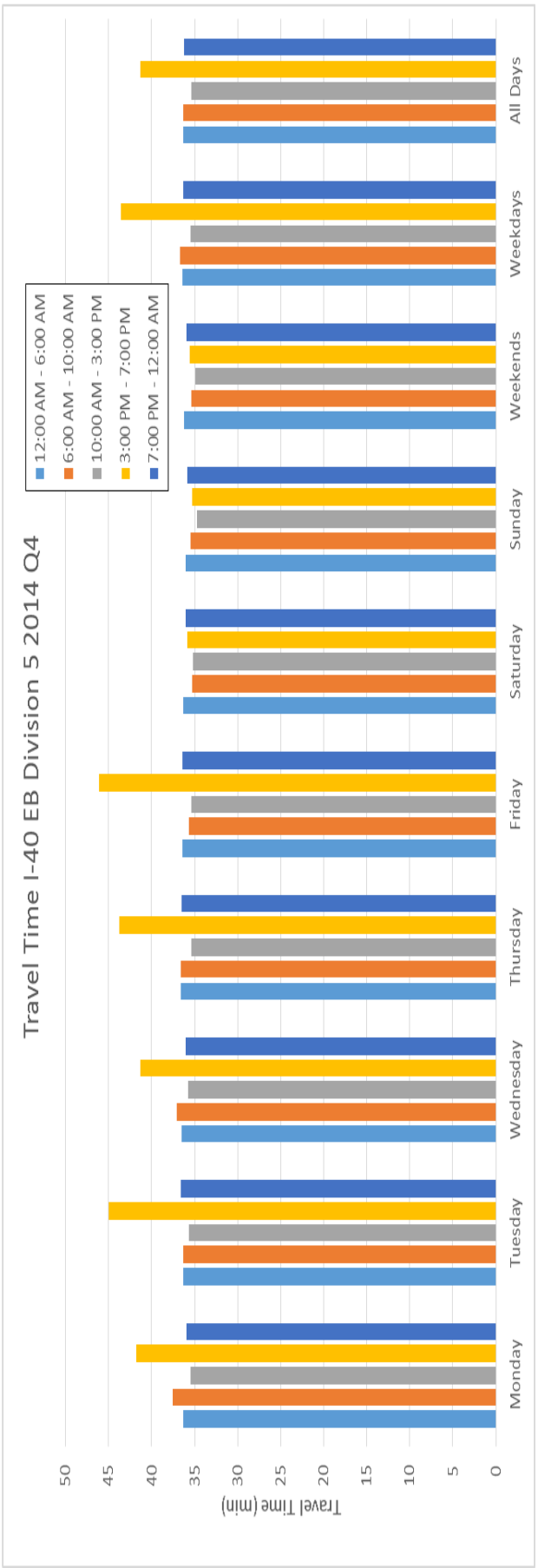
Travel time index

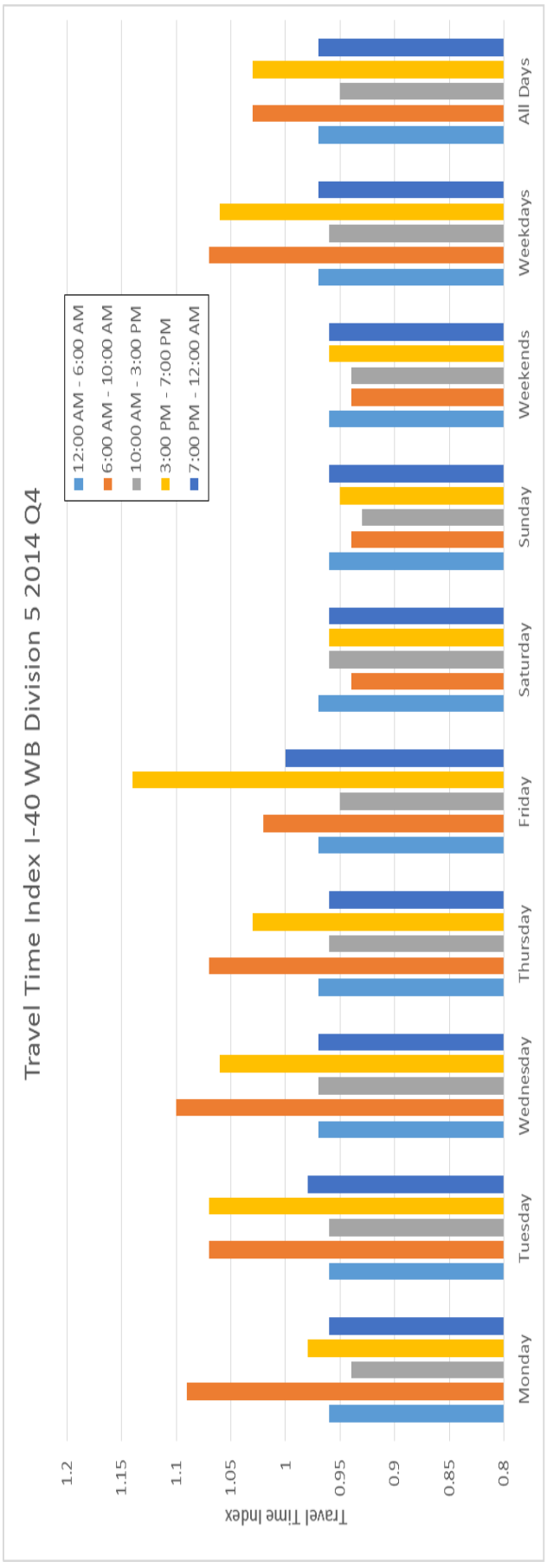
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.09	0.94	0.98	0.96
Tuesday	0.96	1.07	0.96	1.07	0.98
Wednesday	0.97	1.1	0.97	1.06	0.97
Thursday	0.97	1.07	0.96	1.03	0.96
Friday	0.97	1.02	0.95	1.14	1
Saturday	0.97	0.94	0.96	0.96	0.96
Sunday	0.96	0.94	0.93	0.95	0.96
Weekends	0.96	0.94	0.94	0.96	0.96
Weekdays	0.97	1.07	0.96	1.06	0.97
All Days	0.97	1.03	0.95	1.03	0.97

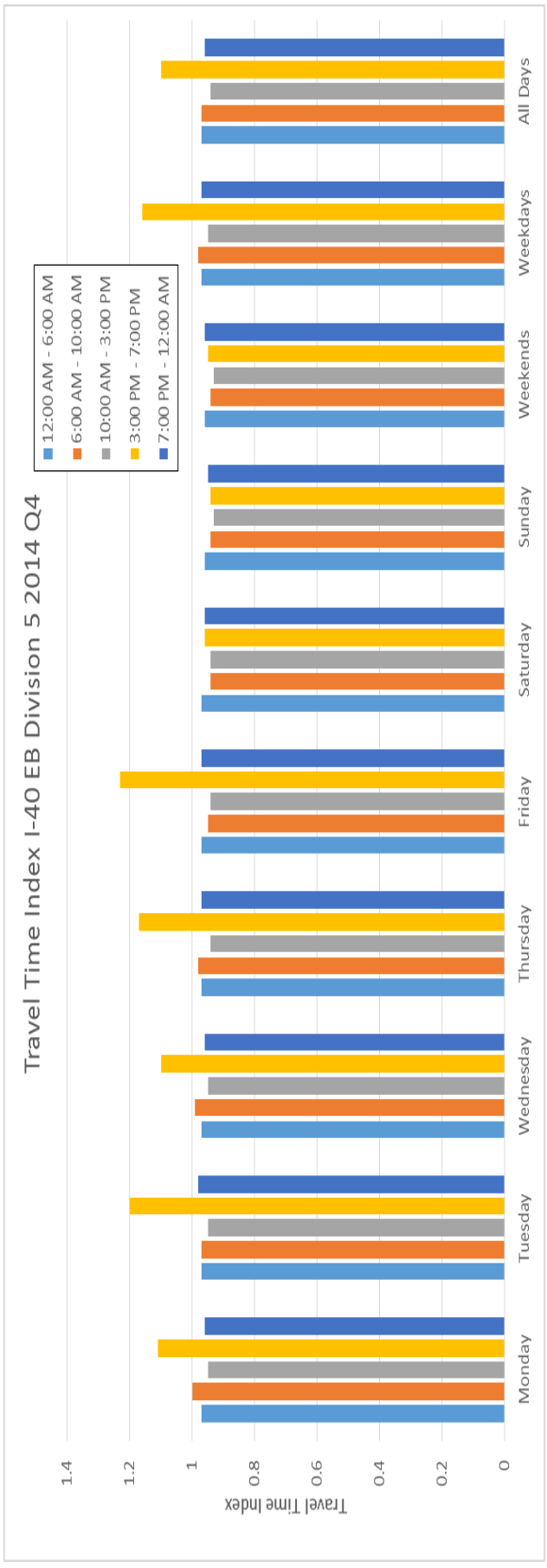
	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound October 2014 through December 2014				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.92	9.25	0.01	22.7	0.07
Tuesday	0.87	3.65	0.21	40.25	0.71
Wednesday	1.08	8.52	0	20.25	0
Thursday	1.37	5.96	0	26.55	0.44
Friday	1.23	0.9	0	27.7	0.62
Saturday	1.16	0	0	2.08	0.02
Sunday	0.91	0	0	0.24	0.07
Weekends	0.97	0	0	0.51	0.02
Weekdays	1.01	5.62	0	27.37	0.14
All Days	0.99	3.83	0	22.51	0.12
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.27	0	0.58	0
Tuesday	0.03	0.11	0.01	1.02	0.02
Wednesday	0.03	0.25	0	0.5	0
Thursday	0.04	0.17	0	0.63	0.01
Friday	0.04	0.03	0	0.59	0.02
Saturday	0.03	0	0	0.06	0
Sunday	0.03	0	0	0.01	0
Weekends	0.03	0	0	0.01	0
Weekdays	0.03	0.16	0	0.66	0
All Days	0.03	0.11	0	0.57	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	38.5	47.09	37.65	66.73	38.48
Tuesday	38.46	41.33	37.84	85.19	39.14
Wednesday	38.71	46.39	37.87	65.28	38.61
Thursday	38.98	43.63	37.6	73.54	39.01
Friday	38.83	38.73	37.44	80.17	40.42
Saturday	38.86	37.88	37.69	40.15	38.79
Sunday	38.61	38.17	37.46	38.15	38.56
Weekends	38.67	38.12	37.56	38.53	38.65
Weekdays	38.6	43.39	37.63	74.11	38.89
All Days	38.62	41.82	37.65	67	38.85

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound October 2014 through December 2014				
	Planning time index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.26	1	1.78	1.03
Tuesday	1.02	1.1	1.01	2.27	1.04
Wednesday	1.03	1.24	1.01	1.74	1.03
Thursday	1.04	1.16	1	1.96	1.04
Friday	1.03	1.03	1	2.14	1.08
Saturday	1.04	1.01	1	1.07	1.03
Sunday	1.03	1.02	1	1.02	1.03
Weekends	1.03	1.02	1	1.03	1.03
Weekdays	1.03	1.16	1	1.98	1.04
All Days	1.03	1.11	1	1.79	1.04
	Speed (mph)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.03	64.87	68.63	58.24	67.63
Tuesday	67.06	67.02	68.28	54.13	66.44
Wednesday	66.75	65.59	68.17	58.99	67.49
Thursday	66.53	66.49	68.81	55.69	66.75
Friday	66.87	68.28	68.8	52.81	66.93
Saturday	67.01	69.05	69.16	67.84	67.58
Sunday	67.53	68.69	70.11	69.05	67.94
Weekends	67.28	68.86	69.65	68.46	67.76
Weekdays	66.85	66.42	68.53	55.92	67.05
All Days	66.97	67.07	68.83	58.91	67.25
	Travel time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.32	37.54	35.48	41.81	36
Tuesday	36.31	36.33	35.66	44.98	36.65
Wednesday	36.48	37.12	35.72	41.28	36.08
Thursday	36.6	36.62	35.39	43.72	36.48
Friday	36.41	35.66	35.39	46.11	36.38
Saturday	36.34	35.26	35.21	35.89	36.03
Sunday	36.06	35.44	34.73	35.26	35.84
Weekends	36.19	35.36	34.96	35.57	35.93
Weekdays	36.42	36.66	35.53	43.54	36.32
All Days	36.36	36.3	35.37	41.33	36.21
	Travel time index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1	0.95	1.11	0.96
Tuesday	0.97	0.97	0.95	1.2	0.98
Wednesday	0.97	0.99	0.95	1.1	0.96
Thursday	0.97	0.98	0.94	1.17	0.97
Friday	0.97	0.95	0.94	1.23	0.97
Saturday	0.97	0.94	0.94	0.96	0.96
Sunday	0.96	0.94	0.93	0.94	0.95
Weekends	0.96	0.94	0.93	0.95	0.96
Weekdays	0.97	0.98	0.95	1.16	0.97
All Days	0.97	0.97	0.94	1.1	0.96


Travel Time I-40 WB Division 5 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
45
42
39
36
33
30
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Division 5 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
50
45
40
35
30
25
20
15
10
5
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Division 5 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Division 5 2014 Q4
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q1 2015:

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Westbound January 2015 through March 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.51	16.77	0	14.35	0.17
Tuesday	0.7	22.84	9.22	6.31	0.25
Wednesday	0.67	30.01	0	6.99	0.55
Thursday	1.13	6.15	0.28	6.8	0
Friday	0.52	7.61	0	19.27	0
Saturday	0.31	3.69	0	0	0
Sunday	0.21	0	0	0	0
Weekends	0.26	0	0	0	0
Weekdays	0.67	14.1	0.35	9.92	0
All Days	0.55	10.96	0.08	7.27	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.01	0.38	0	0.37	0
Tuesday	0.02	0.53	0.24	0.16	0.01
Wednesday	0.02	0.69	0	0.18	0.01
Thursday	0.03	0.14	0.01	0.17	0
Friday	0.01	0.19	0	0.45	0
Saturday	0.01	0.1	0	0	0
Sunday	0.01	0	0	0	0
Weekends	0.01	0	0	0	0
Weekdays	0.02	0.33	0.01	0.25	0
All Days	0.01	0.26	0	0.18	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	39.05	64.63	38.44	53.62	39.69
Tuesday	39.26	69.1	48.2	45.95	39.87
Wednesday	39.23	76.16	38.85	46.59	39.81
Thursday	39.68	52.3	39.12	47.19	39.26
Friday	39.07	48.14	38.82	62.8	39.25
Saturday	38.98	42.77	38.78	38.97	39.17
Sunday	38.85	39.18	38.71	38.96	39.03
Weekends	38.92	38.9	38.76	38.97	39.09
Weekdays	39.21	59.79	39.23	50.4	39.43
All Days	39.13	55.09	39.02	47.41	39.36

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Westbound January 2015 through March 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.01	1.68	1	1.39	1.03
Tuesday	1.02	1.79	1.25	1.19	1.03
Wednesday	1.02	1.98	1.01	1.21	1.03
Thursday	1.03	1.36	1.01	1.22	1.02
Friday	1.01	1.25	1.01	1.63	1.02
Saturday	1.01	1.11	1.01	1.01	1.02
Sunday	1.01	1.02	1	1.01	1.01
Weekends	1.01	1.01	1.01	1.01	1.01
Weekdays	1.02	1.55	1.02	1.31	1.02
All Days	1.02	1.43	1.01	1.23	1.02

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.71	58.88	68.63	61.74	66.58
Tuesday	67.09	57.26	63.85	64.56	67.12
Wednesday	67.29	56.41	66.94	65.74	67.06
Thursday	65.98	62.74	68	65.21	67.23
Friday	67.68	64.69	67.28	59.67	67.51
Saturday	67.59	68.1	68.39	68.42	68.27
Sunday	68.07	68.43	69.52	69.25	68.63
Weekends	67.83	68.26	68.95	68.83	68.45
Weekdays	67.15	59.89	66.9	63.26	67.1
All Days	67.34	62.09	67.48	64.78	67.49

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.99	42.54	36.5	40.57	37.62
Tuesday	37.34	43.75	39.23	38.8	37.32
Wednesday	37.23	44.4	37.42	38.1	37.35
Thursday	37.96	39.92	36.84	38.42	37.26
Friday	37.01	38.72	37.23	41.98	37.1
Saturday	37.06	36.79	36.63	36.61	36.69
Sunday	36.8	36.61	36.03	36.17	36.5
Weekends	36.93	36.7	36.33	36.39	36.6
Weekdays	37.31	41.83	37.44	39.6	37.33
All Days	37.2	40.35	37.12	38.67	37.12

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	1.1	0.95	1.05	0.98
Tuesday	0.97	1.14	1.02	1.01	0.97
Wednesday	0.97	1.15	0.97	0.99	0.97
Thursday	0.98	1.04	0.96	1	0.97
Friday	0.96	1	0.97	1.09	0.96
Saturday	0.96	0.95	0.95	0.95	0.95
Sunday	0.95	0.95	0.94	0.94	0.95
Weekends	0.96	0.95	0.94	0.94	0.95
Weekdays	0.97	1.08	0.97	1.03	0.97
All Days	0.96	1.05	0.96	1	0.96

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound January 2015 through March 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.85	6.18	0	12.48	0.54
Tuesday	1.68	12.05	12.5	21.68	0.89
Wednesday	1.11	7.33	0	13.03	0.07
Thursday	1.23	4.09	0.46	24.17	0.14
Friday	1	13.23	0	33.87	0
Saturday	0.45	0	0	0	0
Sunday	0.27	0	0.05	0	0
Weekends	0.37	0	0	0	0
Weekdays	1.02	6.53	0.28	22.7	0.03
All Days	0.81	3.75	0.13	18.49	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.02	0.17	0	0.31	0.02
Tuesday	0.05	0.34	0.35	0.53	0.02
Wednesday	0.03	0.21	0	0.32	0
Thursday	0.04	0.12	0.01	0.56	0
Friday	0.03	0.37	0	0.7	0
Saturday	0.01	0	0	0	0
Sunday	0.01	0	0	0	0
Weekends	0.01	0	0	0	0
Weekdays	0.03	0.18	0.01	0.53	0
All Days	0.02	0.11	0	0.45	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	39.4	45.13	38.5	56.67	40.02
Tuesday	40.25	51.31	53.53	66.76	40.5
Wednesday	39.77	46.3	38.52	58.5	39.82
Thursday	39.81	42.86	39.18	72.17	39.82
Friday	39.58	52.12	38.65	87.33	39.65
Saturday	39.16	38.76	38.72	38.79	39.27
Sunday	38.96	39.38	38.87	38.7	38.94
Weekends	39.08	38.98	38.77	38.71	39.1
Weekdays	39.59	45.41	39.08	70.05	39.83
All Days	39.44	42.84	38.98	63.62	39.6

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Eastbound January 2015 through March 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.02	1.17	1	1.47	1.04
Tuesday	1.04	1.33	1.39	1.73	1.05
Wednesday	1.03	1.2	1	1.52	1.03
Thursday	1.03	1.11	1.02	1.87	1.03
Friday	1.03	1.35	1	2.26	1.03
Saturday	1.02	1.01	1	1.01	1.02
Sunday	1.01	1.02	1.01	1	1.01
Weekends	1.01	1.01	1.01	1	1.01
Weekdays	1.03	1.18	1.01	1.82	1.03
All Days	1.02	1.11	1.01	1.65	1.03

Speed (mph)

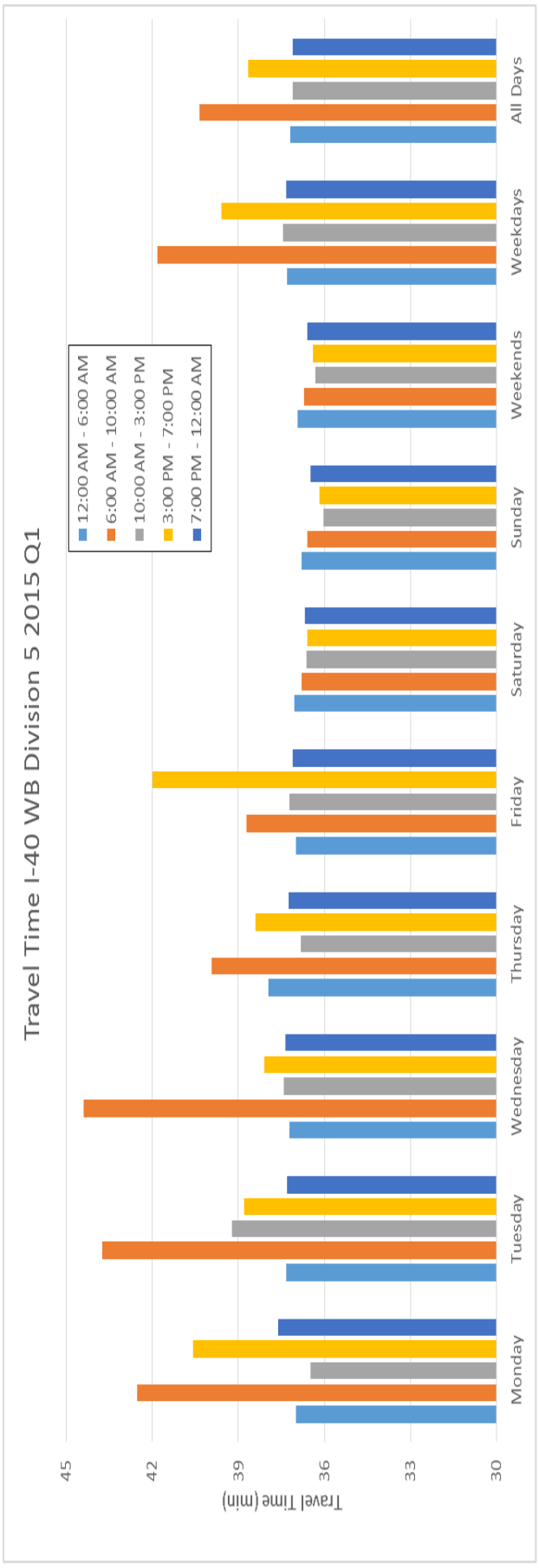
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.82	66.08	68.42	62.83	66.94
Tuesday	66.51	63.1	62.57	58.99	66.87
Wednesday	66.93	65.67	68.24	61.32	66.74
Thursday	65.89	66.62	67.98	57.02	67.03
Friday	66.99	63.54	68.3	51.72	67.63
Saturday	67.43	68.71	68.9	68.86	68.12
Sunday	67.85	68.21	69.01	68.78	68.18
Weekends	67.64	68.46	68.96	68.82	68.15
Weekdays	66.62	64.95	67	58.06	67.05
All Days	66.91	65.93	67.56	60.81	67.36

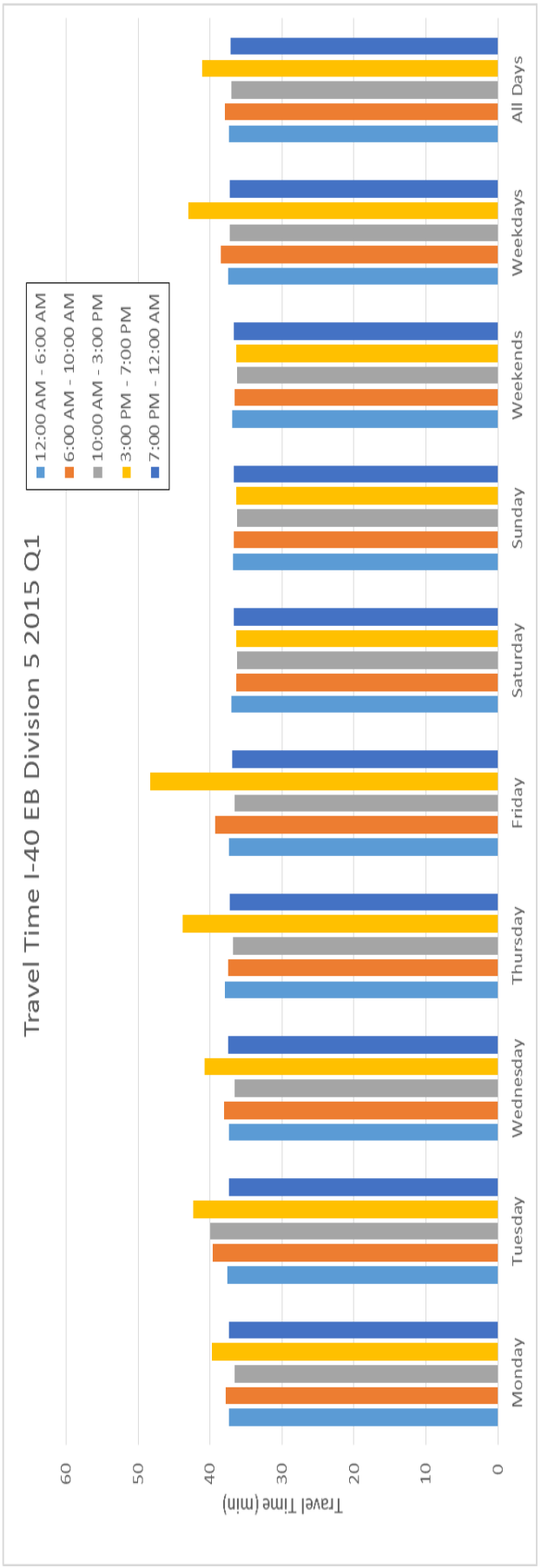
Travel time (minutes)

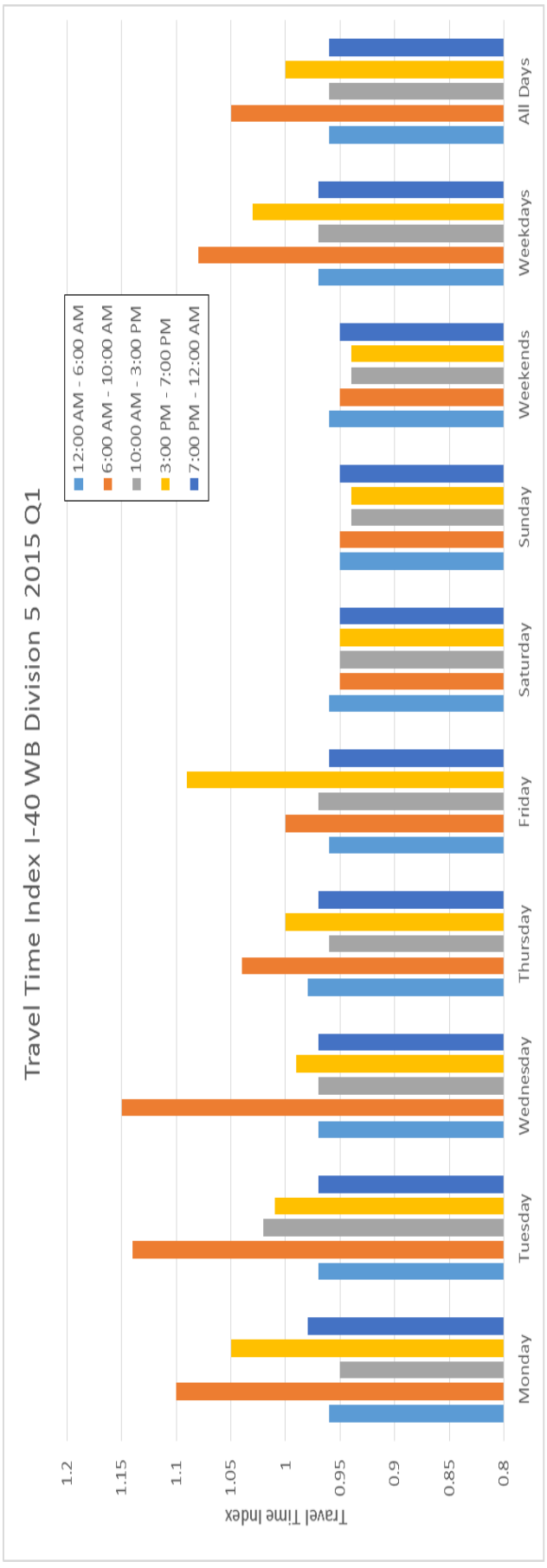
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	37.43	37.85	36.56	39.81	37.37
Tuesday	37.61	39.64	39.97	42.4	37.41
Wednesday	37.37	38.09	36.65	40.79	37.48
Thursday	37.96	37.55	36.8	43.87	37.32
Friday	37.34	39.36	36.62	48.36	36.98
Saturday	37.1	36.4	36.3	36.32	36.72
Sunday	36.86	36.67	36.24	36.36	36.69
Weekends	36.98	36.54	36.27	36.34	36.7
Weekdays	37.54	38.51	37.33	43.08	37.31
All Days	37.38	37.94	37.03	41.13	37.13

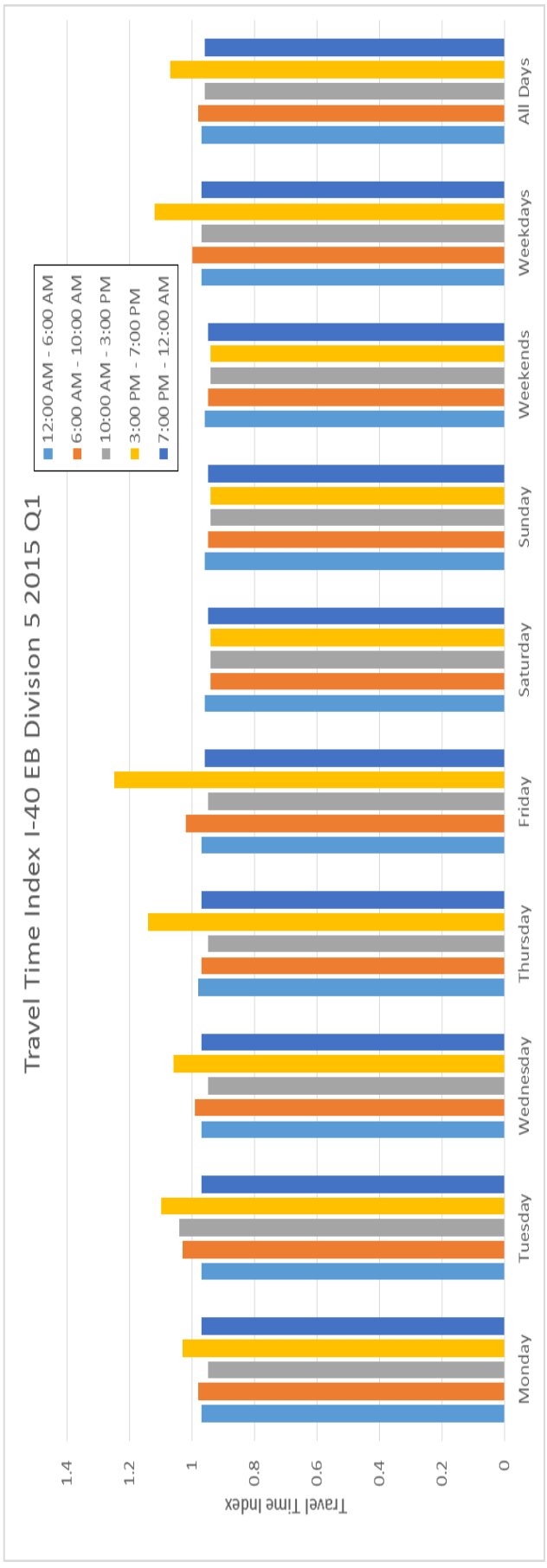
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.98	0.95	1.03	0.97
Tuesday	0.97	1.03	1.04	1.1	0.97
Wednesday	0.97	0.99	0.95	1.06	0.97
Thursday	0.98	0.97	0.95	1.14	0.97
Friday	0.97	1.02	0.95	1.25	0.96
Saturday	0.96	0.94	0.94	0.94	0.95
Sunday	0.96	0.95	0.94	0.94	0.95
Weekends	0.96	0.95	0.94	0.94	0.95
Weekdays	0.97	1	0.97	1.12	0.97
All Days	0.97	0.98	0.96	1.07	0.96


Travel Time I-40 WB Division 5 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
45
42
39
36
33
30
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Division 5 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
60
50
40
30
20
10
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Division 5 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Division 5 2015 Q1
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days

Q2 2015:

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Westbound April 2015 through June 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.96	11.15	0	8.11	0
Tuesday	1.11	9.24	0	12.95	0
Wednesday	1.16	17.06	0	18.01	0.09
Thursday	1.18	12.04	0	20.03	1.25
Friday	1.17	10.26	1.76	25.92	0
Saturday	1.35	0	4.94	1.84	0.06
Sunday	1.27	0	3.5	2.35	0.35
Weekends	1.36	0	4.08	2.13	0.05
Weekdays	1.12	10.71	0	16.91	0
All Days	1.15	7.03	0	13.08	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.25	0	0.21	0
Tuesday	0.03	0.21	0	0.33	0
Wednesday	0.03	0.39	0	0.46	0
Thursday	0.03	0.27	0	0.51	0.03
Friday	0.03	0.26	0.05	0.61	0
Saturday	0.04	0	0.13	0.05	0
Sunday	0.03	0	0.09	0.06	0.01
Weekends	0.04	0	0.11	0.06	0
Weekdays	0.03	0.25	0	0.43	0
All Days	0.03	0.17	0	0.33	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	38.78	55.31	37.66	46.66	38.28
Tuesday	38.93	52.3	37.72	51.85	38.67
Wednesday	38.98	60.4	37.55	56.89	38.59
Thursday	39.01	56	37.55	59.7	39.91
Friday	38.99	50.06	39.97	68.72	38.46
Saturday	39.29	37.53	43.53	40.34	39.13
Sunday	39.19	37.99	41.77	40.91	39.29
Weekends	39.29	37.88	42.5	40.67	39.05
Weekdays	38.94	53.57	37.64	56.66	38.69
All Days	39	48.63	37.95	52.49	38.81

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G

Westbound April 2015 through June 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.46	1	1.23	1.01
Tuesday	1.03	1.38	1	1.37	1.02
Wednesday	1.03	1.6	0.99	1.5	1.02
Thursday	1.03	1.48	0.99	1.58	1.06
Friday	1.03	1.32	1.06	1.82	1.02
Saturday	1.04	0.99	1.15	1.07	1.03
Sunday	1.04	1	1.1	1.08	1.04
Weekends	1.04	1	1.12	1.08	1.03
Weekdays	1.03	1.42	1	1.5	1.02
All Days	1.03	1.29	1	1.39	1.03

Speed (mph)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	67.24	62.14	68.72	64.97	67.95
Tuesday	66.94	61.27	68.38	63.94	67.18
Wednesday	66.71	59.03	68.07	62.11	67.2
Thursday	66.78	61.93	68.64	60.42	67.02
Friday	66.9	63.71	67.34	58.05	67.86
Saturday	66.58	69.53	66.89	68.27	67.56
Sunday	67.22	69.29	68.48	67.51	68.15
Weekends	66.9	69.41	67.67	67.89	67.86
Weekdays	66.91	61.59	68.23	61.78	67.44
All Days	66.91	63.66	68.06	63.43	67.56

Travel time (minutes)

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.54	39.54	35.75	37.82	36.16
Tuesday	36.7	40.1	35.93	38.43	36.57
Wednesday	36.83	41.62	36.09	39.56	36.56
Thursday	36.79	39.67	35.79	40.66	36.66
Friday	36.73	38.57	36.48	42.32	36.21
Saturday	36.9	35.33	36.73	35.99	36.36
Sunday	36.55	35.46	35.88	36.39	36.05
Weekends	36.72	35.4	36.31	36.19	36.21
Weekdays	36.72	39.89	36.01	39.77	36.43
All Days	36.72	38.59	36.1	38.73	36.37

Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	1.05	0.95	1	0.96
Tuesday	0.97	1.06	0.95	1.02	0.97
Wednesday	0.97	1.1	0.95	1.05	0.97
Thursday	0.97	1.05	0.95	1.07	0.97
Friday	0.97	1.02	0.96	1.12	0.96
Saturday	0.98	0.93	0.97	0.95	0.96
Sunday	0.97	0.94	0.95	0.96	0.95
Weekends	0.97	0.94	0.96	0.96	0.96
Weekdays	0.97	1.05	0.95	1.05	0.96
All Days	0.97	1.02	0.95	1.02	0.96

	Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G				
	Eastbound April 2015 through June 2015				
	Buffer time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.92	2.38	0	25.85	0
Tuesday	3.22	1.29	0	42.18	0
Wednesday	0.85	1.48	0	39.75	0
Thursday	1.05	9.2	0	41.44	3.05
Friday	1.25	0	3.35	43.97	0
Saturday	0.94	0	2.5	1.96	0
Sunday	0.68	0	0	0.14	0
Weekends	0.79	0	0	0.42	0
Weekdays	1.02	1.61	0	43.38	0
All Days	0.94	0.57	0	37.45	0
	Buffer index				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.03	0.07	0	0.65	0
Tuesday	0.09	0.04	0	1.04	0
Wednesday	0.02	0.04	0	0.96	0
Thursday	0.03	0.26	0	0.96	0.08
Friday	0.04	0	0.09	0.91	0
Saturday	0.03	0	0.07	0.05	0
Sunday	0.02	0	0	0	0
Weekends	0.02	0	0	0.01	0
Weekdays	0.03	0.05	0	1.02	0
All Days	0.03	0.02	0	0.92	0
	Planning time (minutes)				
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	36.02	37.86	34.71	65.75	35.71
Tuesday	38.33	36.62	34.83	82.87	35.74
Wednesday	35.95	36.93	34.92	81.08	36.19
Thursday	36.17	44.51	35.15	84.82	39.27
Friday	36.36	35.06	38.96	92.32	36.38
Saturday	36.24	35.03	38.21	37.56	36.19
Sunday	35.96	35.42	35.09	35.65	35.86
Weekends	36.07	35.22	35.55	35.98	35.97
Weekdays	36.12	37.02	34.96	86.11	36.3
All Days	36.1	36.2	35.07	78.13	36.16

Performance Summaries for I-40 between US-15/US-501/Exit 270 and JOHNSTON--WAKE County Border (G
Eastbound April 2015 through June 2015

Planning time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	1.03	1.08	0.99	1.87	1.02
Tuesday	1.09	1.04	0.99	2.36	1.02
Wednesday	1.02	1.05	1	2.31	1.03
Thursday	1.03	1.27	1	2.42	1.12
Friday	1.04	1	1.11	2.63	1.04
Saturday	1.03	1	1.09	1.07	1.03
Sunday	1.02	1.01	1	1.02	1.02
Weekends	1.03	1	1.01	1.03	1.03
Weekdays	1.03	1.06	1	2.45	1.03
All Days	1.03	1.03	1	2.23	1.03

Speed (mph)

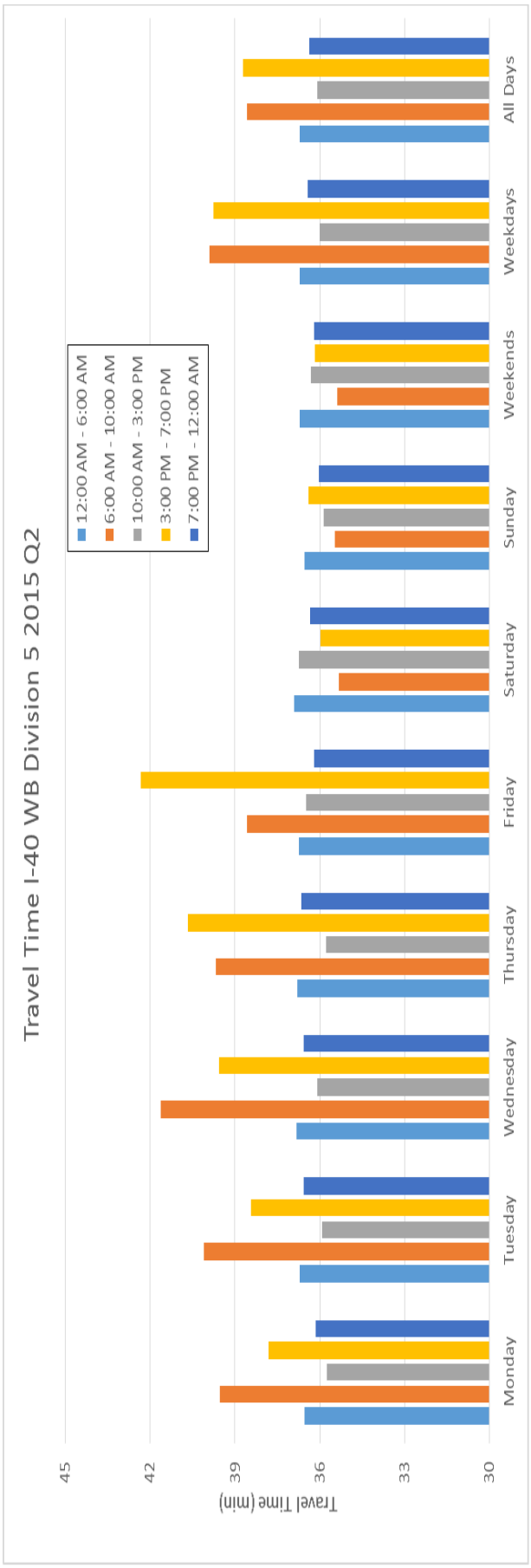
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	66.92	66.94	68.3	58.08	67.71
Tuesday	66.07	67.56	68.54	52.9	67.07
Wednesday	66.79	67.02	68.34	50.24	67.03
Thursday	66.38	64.58	67.02	49.04	65.71
Friday	66.29	68.28	67.05	44.82	67.29
Saturday	66.8	69.24	67.75	67.84	67.95
Sunday	67.48	68.68	69.41	67.97	67.97
Weekends	67.14	68.96	68.56	67.9	67.96
Weekdays	66.49	66.85	67.84	50.63	66.95
All Days	66.67	67.44	68.05	54.65	67.24

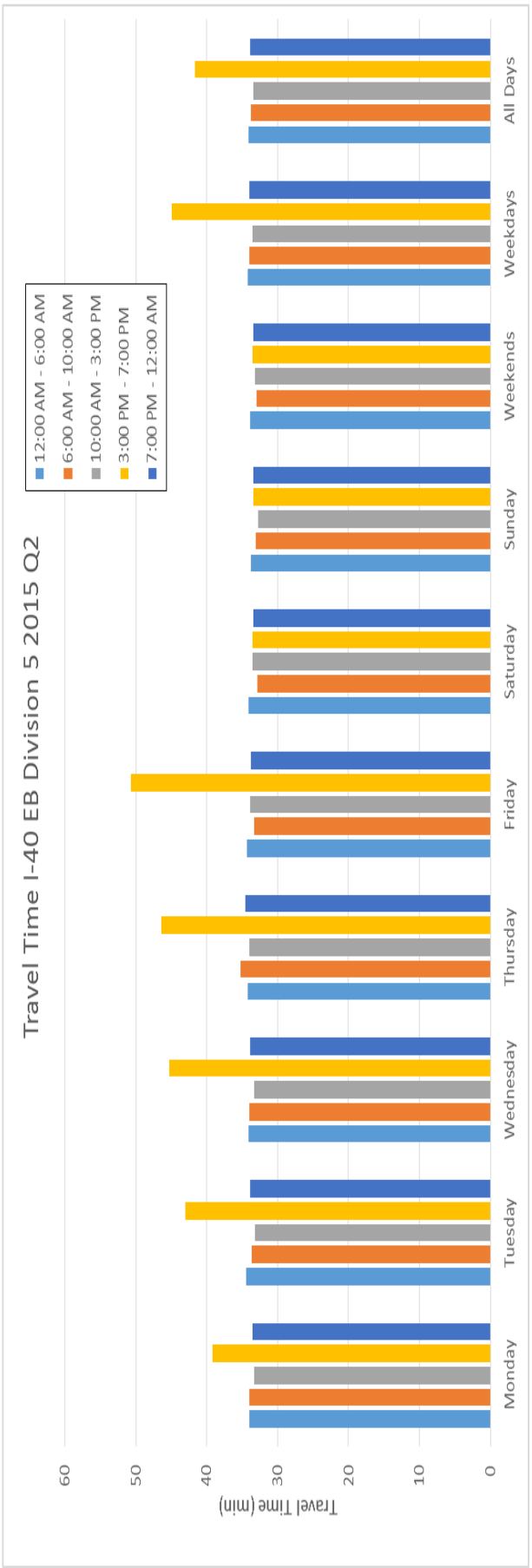
Travel time (minutes)

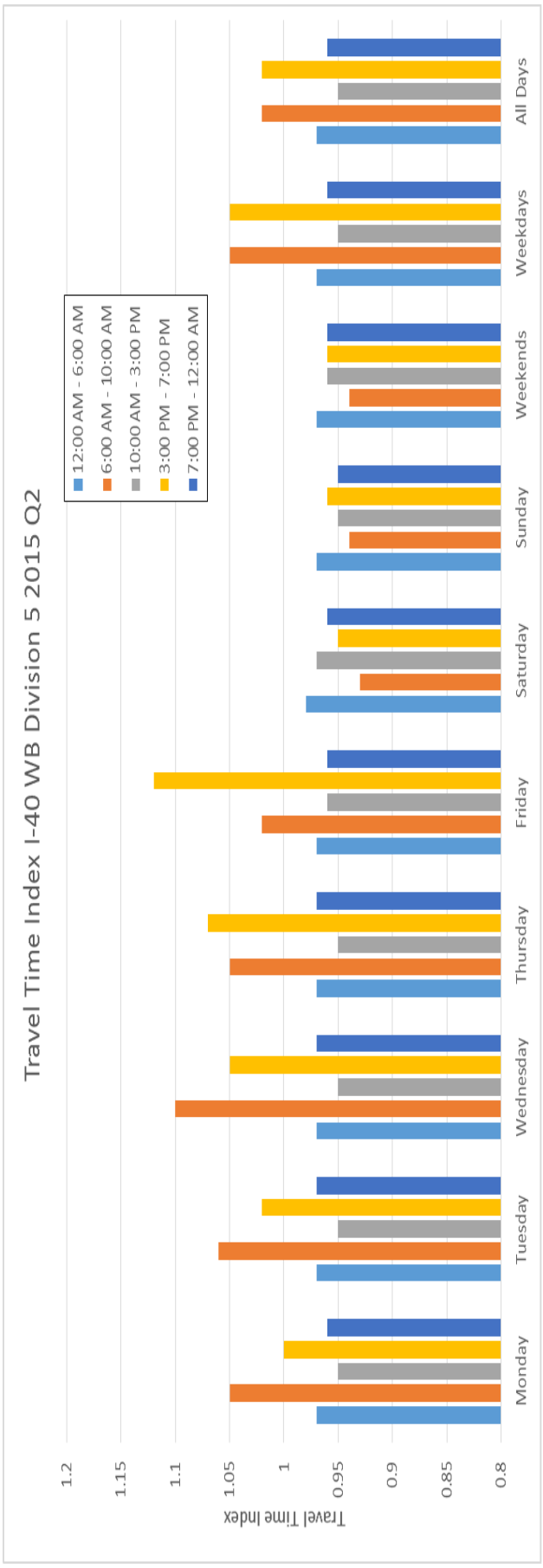
	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	34	33.99	33.31	39.17	33.6
Tuesday	34.44	33.68	33.19	43.01	33.93
Wednesday	34.06	33.95	33.29	45.29	33.94
Thursday	34.28	35.23	33.95	46.4	34.62
Friday	34.32	33.32	33.93	50.76	33.81
Saturday	34.06	32.86	33.58	33.54	33.48
Sunday	33.72	33.13	32.78	33.48	33.47
Weekends	33.89	32.99	33.18	33.51	33.48
Weekdays	34.22	34.04	33.54	44.94	33.98
All Days	34.13	33.74	33.44	41.63	33.84

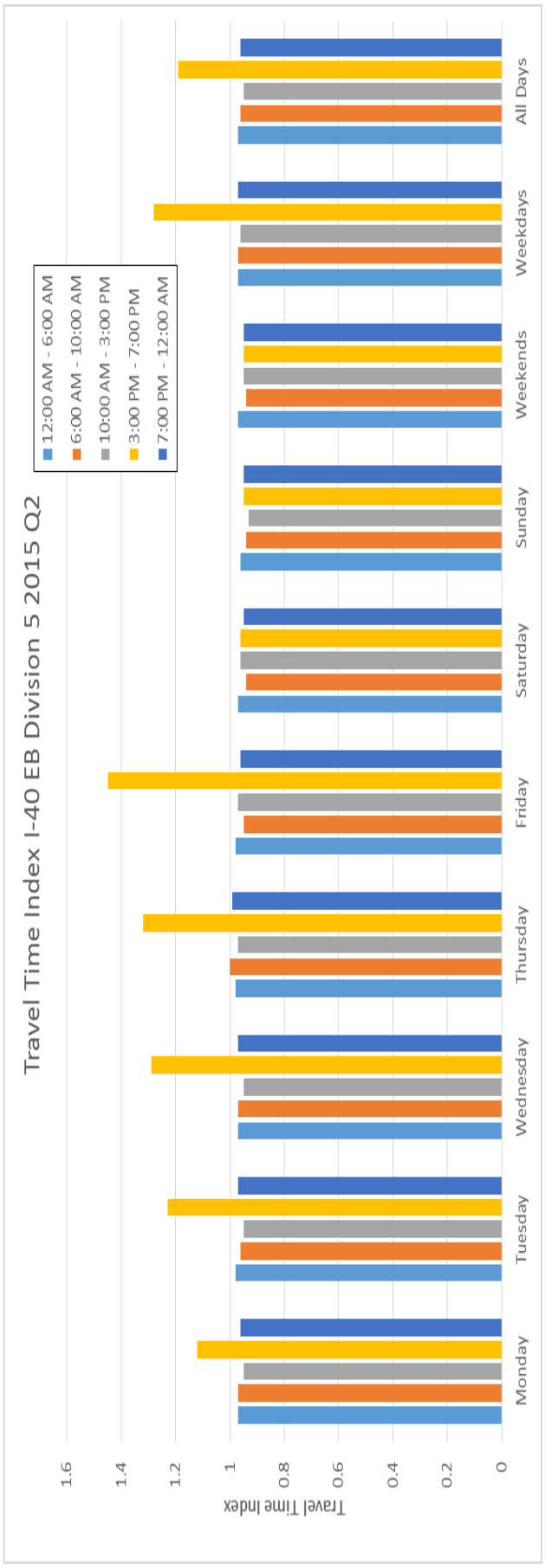
Travel time index

	12:00 AM - 6:00 AM	6:00 AM - 10:00 AM	10:00 AM - 3:00 PM	3:00 PM - 7:00 PM	7:00 PM - 12:00 AM
Monday	0.97	0.97	0.95	1.12	0.96
Tuesday	0.98	0.96	0.95	1.23	0.97
Wednesday	0.97	0.97	0.95	1.29	0.97
Thursday	0.98	1	0.97	1.32	0.99
Friday	0.98	0.95	0.97	1.45	0.96
Saturday	0.97	0.94	0.96	0.96	0.95
Sunday	0.96	0.94	0.93	0.95	0.95
Weekends	0.97	0.94	0.95	0.95	0.95
Weekdays	0.97	0.97	0.96	1.28	0.97
All Days	0.97	0.96	0.95	1.19	0.96


Travel Time I-40 WB Division 5 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
45
42
39
36
33
30
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time I-40 EB Division 5 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time (min)
60
50
40
30
20
10
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 WB Division 5 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days


Travel Time Index I-40 EB Division 5 2015 Q2
12:00 AM - 6:00 AM
6:00 AM - 10:00 AM
10:00 AM - 3:00 PM
3:00 PM - 7:00 PM
7:00 PM - 12:00 AM
Travel Time Index
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Weekends
Weekdays
All Days